Isle of Man
Government

Department of Agriculture, Fisheries and Forestry

ISLE OF MAN

ECOLOGICAL HABITAT SURVEY

Phase 1
1991 - 1994
Final Report
May 1995

ISLE OF MAN HABITAT SURVEY

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ECOLOGICAL HABITAT SURVEY

PHASE 1 FINAL REPORT

SUMMARY

1. The report presents the results of the Ecological Habitat Survey of the Isle of Man, carried out between 1991 and 1993. The main Island only has been studied. The Calf of Man, owned by the Manx National Trust, has not been considered or included in the results.

2. The survey used the methodology of Phase 1 ecological surveys developed by the (then) Nature Conservancy Council in the United Kingdom. Every field and distinguishable parcel of land has been assigned to one of some 90 habitat types and recorded on 1:10 560 maps using standard colour codes with further information, such as dominant species, appended in code.

3. In addition, target notes are prepared for individual areas of particular interest (over 2000 in this survey), in all cases recording the plant species present, and noting any other wildlife of interest, such as birds and butterflies.

4. These procedures permit the calculation of the total area of each habitat type present in the Isle of Man. The report discusses each habitat type in turn, listing the typical species found and describing its distribution, relationship with other habitats and value for nature conservation.

5. Semi-natural habitats (excluding intertidal areas), cover 16,438.90 hectares, or 29% of the Isle of Man. Almost 59% is agricultural (arable, improved and poor semi-improved grasslands) and slightly over 6% is covered by plantations, mainly of coniferous species. The remaining 6% is largely built-up land and amenity grasslands, including parks, golf-courses, playing fields and so on.

6. Over a third of the Island's semi-natural vegetation is heathland, occurring principally on the uplands. Heather dominated heathland is an internationally rare habitat, being restricted to northwest Europe, and hence the heath on the Isle of Man is of outstanding nature conservation importance. It is often closely associated with acid grassland, the next most common habitat type, covering 7% of the Island. Other habitat types occupying over 1000 hectares are dense bracken (3.5% of the Island), marshy grassland (nearly 2%) and scrub (also nearly 2%).

7. There are a number of habitats of considerable ecological value where each contributes 1% or less of the total area. Semi-improved and unimproved neutral grassland are scattered throughout the Island, covering just over 1%. Other habitats covering less than 1% of the total include broadleaved woodland; coastal and dune heath and grasslands (with which are associated dune slacks, open dune, dune scrub and lichen/bryophyte heath); and the various types of bogs and mires.

8. Mires are wetlands occurring on deep peat (more than 0.5 metres) with many sub-types, depending on water chemistry, hydrology and plant species composition. The total area of mires, which are subdivided into important ecological types such as blanket bog, raised bog, flush and valley and basin mires, is just over 1% of the Island.

9. The report is supported by the maps, descriptions of each map sheet and the target notes. These are all held by the Department of Agriculture, Fisheries and Forestry (DAFF) although copies of the target notes will be lodged with the Biological Records Centre at the Manx Museum.

10. All the information collected will be of assistance in the formulation and implementation of Government policy on the countryside, for land use, planning and nature conservation purposes.

11. All Government departments will have access to the Phase 1 survey database and should incorporate the results within their policies and decision-making. Indeed the information is already being used in assessing planning applications and preparing environmental impact assessments for large developments.

12. Identification of all those sites which require protection and management for the benefit of wildlife is an objective of the DAFF and this is presently being carried forward by a more detailed survey (Phase 2) of sites of potential value.

1. INTRODUCTION

1.1 The Isle of Man

1.1.1 Introduction

The Isle of Man lies in the Irish Sea, about 29km from Scotland and roughly equidistant between Ireland and England, between latitudes of 54° 4' N and 54° 22' N, and longitudes of 4° 20' W and 4° 50' W (Cullen & Jennings, 1986).

The Island is 51 km in length and 21 km wide at its widest point, covering an area of about 500 km² (Robinson & McCarroll, 1990). Almost half its population is situated in Douglas and Onchan, with other major settlements at Ramsey, Peel, Castletown, Port Erin, Port St. Mary, Laxey and Kirk Michael. The remainder of the population is scattered through the Island in small villages and isolated farms and dwellings, representing a population density of approximately 1 per 3 hectares (Census, 1991).

The varied geology and landscape of the Island, coupled with its insular status and location, provide an extremely wide range of habitats for such a small area, many of which are of national or even international importance. These range from the central slate hills to wooded glens; from the dry lichen heath of the Ayres to the wetland Curraghs; and from dunes to rocky coastal cliffs. (Robinson and McCarroll, 1990).

1.1.2 Relief and geology

In general the Island consists of a central mass of hills with flatter areas to the north and south. The axis of the hills is roughly northeast-southwest in three distinct bands. The northern hills are the highest, and include the Island's only "true" mountain, Snaefell (619m). These are separated from the southern hills (which peak at South Barrule, 483m) by the narrow central valley. The southernmost band of hills, known as the Mull Hills, are the lowest, and extend to the southernmost tip of the Island, reappearing offshore at the Calf of Man, an islet of 249.3 hectares (Allen, 1984).

The hills are largely composed of Cambrian Manx slate, interspersed with Glacial Drift, which becomes more dominant to the east of the Island, with a band of Agneash grit running northeast-southwest through it.

Soils in the hills are in general indicative of the altitude rather than the geology.

North of the hills the land becomes dramatically flat, largely the result of glaciation, with some hills of terminal moraine clustered around Bride, at the extreme north of the Island. The geology in this area is nearly all of glacial origin: predominantly boulder drift and sand and gravel platforms, with scattered areas of sand and gravel mounds notably around Orrisdale and south of Bride. Around Kirk Michael, in the Milntown area, and in a large area between Ballaugh and Killane, Late-Glacial flood gravels are present. Extending along the north coast from Sartfield to the Point of Ayre, broken by the raised beach between Rue Point and the Point of Ayre, is an area of blown sand, broadening to the east to cover the area inland as far as Lough Cranstal. There is also a large area of alluvium in a broad strip between Ballaugh Curragh and Ramsey at the foot of the hills, and extending along the Lhen Trench, possibly connected with the former Glacial Lake Andreas. Soils throughout this area accurately reflect the geology except in the area of the Ballaugh Curragh where lowland peat soils have developed.

South of the southern hills the land is undulating and composed largely of Glacial boulder drift. The geology becomes more complex along the southern coast where the only limestone in the Island occurs, with some sand and gravel platforms. Here, Glacial till soils give rise to a mosaic of soils reflecting the geology.

Mull Hill and the Calf of Man, are composed, like the northern and southern hills, of Cambrian Manx slates, again interspersed with some boulder drift; here soils are largely of an upland nature.

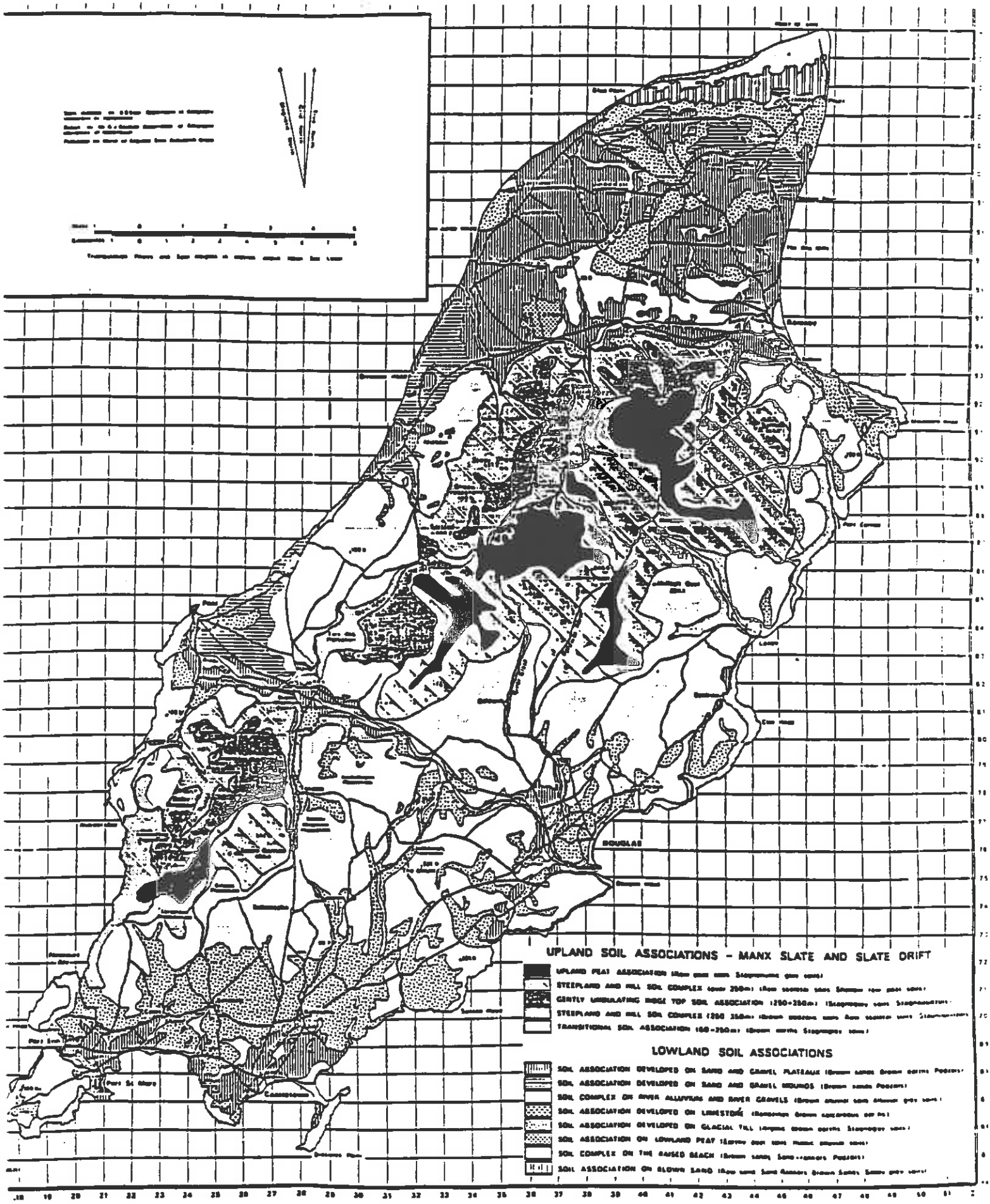
Outcrops of granite occur at The Dhoon, Slieau Ruy and Granite Mountain.

The soils of the Island are illustrated in Figure 1.

1.1.3 Climate

The Isle of Man enjoys an "Atlantic" climate with usually mild winters and cool summers and a comparatively high rainfall. The sea modifies temperatures and the Gulf Stream current raises winter sea temperatures so that

FIGURE 1 SOILS OF THE ISLE OF MAN



they are higher than those of adjacent coasts.

The lowest mean temperature, 5.3°C, occurs in January, with the highest temperatures in July and August (mean 14.5°C).

The quantity of rainfall varies significantly from area to area, the hills receiving more than twice that of the driest areas, notably around Castletown and Port Erin, and the east being generally wetter than the west. Mean annual precipitation is 866mm.

Another feature of the climate are the frequent strong winds, mainly westerlies. These often carry high levels of salt which must influence the flora of the west coast (Allen, 1984).

The Island enjoys an average of 1548 hours of sunshine per year and is said to be the sunniest place, for its latitude, in the world (pers. comm. Met. Office). Statistics supplied by the Meteorological Office.

1.1.4 Development of the flora

The native flora of the Isle of Man is thought to have developed from that which colonised the area at the end of the last Ice Age. During glaciation sea-level was lowered to the extent that the British Isles and Europe became linked by dry land, effectively becoming one land mass. Following the retreat of the ice sheet, roughly 15 000 years ago, sea levels rose once more and the Island became separated first from Ireland and later (about 9000 years ago) from England, Scotland and North Wales (Allen, 1984).

A sudden rise in temperature, approximately 13 000 years ago (McCarroll, Garrad & Dackombe, 1990), brought about a rapid increase in the colonisation of the post-glacial grassland by herbaceous species, the most light-demanding of which, such as the still-present purple milk-vetch (*Astragalus danicus*)* and field mouse-ear (*Cerastium arvense*), were driven to marginal situations by the subsequent growth of forest. This was first dominated by birch, later giving rise to Scots pine and ultimately broadleaved woodland: oak, hazel, wych elm and alder (Allen, 1984).

Mesolithic colonists, arriving possibly before the Island was wholly cut off from the mainland, may have carried out some deforestation to facilitate easier hunting (Allen, 1984). From Neolithic times wood was used for charcoal and construction purposes (McCarroll, Garrad & Dackombe, 1990), and forest was cleared for agricultural purposes (Garrad, 1972). By the eleventh century natural forestation must have been much diminished but was still fairly extensive. There is some dispute as to when the remainder was cleared but by the early sixteenth century, most of the forest had disappeared. The majority of the present broadleaved woodland, including the glens, dates from the late eighteenth century. There are isolated groups of oak trees which are thought to have descended from primeval stock, such as those along the east coast between Traie ny Halsall and Clay Head; at Glen Maye; on the side of the Santan gorge and at Lag ny Killey (Garrad, 1972).

The Island has a large number of habitats present in a very small area and has a wide geographical range of species present. Many of the Island's species are Atlantic in character, such as spring squill (*Scilla verna*), western gorse (*Ulex gallii*) and wall pennywort (*Umbilicus rupestris*). In addition the Island contains many northern species including most of its upland species, bottle sedge (*Carex rostrata*), common butterwort (*Pinguicula vulgaris*) and wood horsetail (*Equisetum sylvaticum*); and there are many "Germanic" species more characteristic of south and east Britain, growing especially in the warmer, drier north and south ends of Man. These include species such as autumn lady's-tresses (*Spiranthes spiralis*), pyramidal orchid (*Anacamptis pyramidalis*), bird's-foot clover (*Trifolium ornithopodioides*) and calamint (*Clinopodium ascendens*) (Allen, 1984). The climate allows many exotic species to thrive in Man which are less hardy in other parts of Britain, such as fuchsias, hedge-veronica (*Hebe* spp.) and *Escallonia* (Garrad, 1972).

1.1.5 Influences on the landscape: Industrial and agricultural history

Traditionally the Isle of Man was a community of subsistence farmers and fishermen. From Norse times the arable constituent (mainly below 180m) was divided into "treens", subdivided into "quarterlands" of around 90 acres, farmed as units. These lacked internal enclosures and fields were enclosed only from the sixteenth century, originally by hedges of turf, earth and stones, later by fences and walls. From the time of the first divisions unenclosed land was used as common ground and all could use it to graze stock or dig turf (Garrad, 1972). It became a common practice to construct buildings in the uplands at the margins of farmland (typically between 160

* Nomenclature of plants follows Stace, 1991

and 300m), for use by shepherds, milking cows on summer pasture, and for making cheese for winter use. Many of these sites are still farmed and are characterised by the name "Eary" meaning "summer pasture" (Garrad, 1972; Freke, 1990).

There are also shielings - the sites of ancient settlements - higher in the hills, on moorlands above about 300m. The shielings at Block Eary, in the hills above Sulby Glen, date from the twelfth century. There are over 200 other shieling sites on the Island (Garrad, 1972; Freke, 1990).

By the late eighteenth century many boundaries were straightened to facilitate the construction of dry stone walls. At about this time European gorse (*Ulex europaeus*) was in common use as a winter feed for horses and cattle and was extensively planted as seed and cuttings, with hawthorn, on sod hedges. By this time crops grown included barley, rye, oats, wheat and potatoes, depending on location. During the eighteenth and nineteenth centuries flax was widely grown and the linen exported. With the advent of crop rotations, clover (both red and white), and ryegrass seed were imported, probably introducing a number of weeds to the Island (Garrad, 1972).

In the Isle of Man, stock has been reared since Celtic times. At one time the Island had its own unique breeds of pigs, sheep, cattle and ponies, descended from the original livestock, but these, though hardy, had their shortcomings and have now disappeared through improvement, with the exception of the Loaghtan sheep (Garrad, 1972). This breed, once facing extinction, is now preserved as a rare breed through the Loaghtan Sheep Society, with Manx National Heritage having some large flocks, notably at Cregneish and the Calf of Man. On the latter the reintroduction of sheep grazing has been of benefit to the chough (Bullock & del-Novo, 1983).

Modern agriculture consists of, in general, low-intensity, mixed farming. The climate favours grass production and thus cattle and sheep farming is an important part of most Manx farms. Most farmers also grow some cereal, barley being most widely grown in recent years. Oats were formerly by far the most important crop but have declined rapidly since the last war, while wheat occupies only about 5% of the cereal acreage. In recent years silage production has become important, while the total area of hay meadows has declined. Some upland improvement has been carried out (Davies, 1990).

In addition to the agriculture and fishing industries, the Island was comparatively rich in natural resources, especially mineral ores but also small areas of limestone and "black marble". These resources, coupled with plentiful supplies of fresh water and timber, allowed manufacturing and extractive industries to develop. Although it lacked coal, full use was made of other power sources: wind, water and peat were all used widely (Robinson, 1990).

Records of mineral mining in the Island date from the thirteenth century but it did not reach its peak until the 1800s. The mines at Foxdale were the most important in the British Isles for lead extraction during the 1870s and 1880s (Robinson, 1990). Laxey was an equally important source of zinc. At this time 99% of the Island's production was from ten mines: three in Laxey, five in Foxdale and two in the south of the Island. These produced, in addition to lead and zinc, significant quantities of iron, copper and silver, and between them employed over 1000 men. Other mines, such as those at Maughold and Glen Maye, were less successful, and even the best were in decline by the turn of the century. This may have been due to the fall in lead and zinc prices occasioned by foreign competition, or perhaps merely exhaustion of the mines.

In addition to mining, quarrying was important in the nineteenth century. Although Manx slate is not ideal for building purposes its use was preferable to the expense of importing alternatives and it was quarried at Douglas Head, Glen Mooar, South Barrule and Glen Rushen. Limestone is still quarried in the Castletown area but formerly there were five quarries worked for building and agricultural purposes. The same area was also a source of Poyllvaaish "black marble" (black limestone) extracted in quantity for ornamental purposes from the sixteenth to the nineteenth centuries. Red sandstone was also quarried for decorative and structural use from Creg Malin, Peel, largely in the late 1800s.

In conjunction with the mining and quarrying industries several subsidiary industries developed. Lime-burning was carried out by both individual farmers and commercial companies, to make it suitable for agricultural use (there are disused lime kilns scattered throughout the Island). Other industries included smelting and brick-making (Robinson, 1990).

The textile industry has long been a part of the Island's economy, from the time when wool was spun and woven by farmers, fishermen and smallholders to supplement their incomes. During the seventeenth and eighteenth centuries flax was widely grown and processed locally. The woollen industry increased markedly during the latter half of the nineteenth century, coinciding with the lifting of export restrictions of woollen goods and the

development of power-driven looms. Only one of the sixteen mills established at this time is still in operation, at Laxey.

Industries also developed in connection with the farming and fishing tradition of the Isle of Man. In connection with agriculture, mills and tanneries were established, the former most abundant. There were 32 corn mills by 1511 and 51 by 1870, mainly water-powered, hence situated along streams. However, in competition with more efficient mainland mills, this industry declined during the latter part of the nineteenth century and now only one, Laxey Glen Mills, remains. The fishing industry stimulated ship-building, and to a lesser extent, rope- and net-making and the production of sailcloth. The former was at its height from 1840-1890 (when there were five shipyards in Douglas, two in Ramsey and four in each of Peel and Castletown), but subsequently greatly declined (Robinson, 1990).

It can be seen that much of the Island's industry slumped around the turn of the last century, but it was at this time that tourism was at its height, centred around Douglas and Ramsey but also important in Peel, Port Erin and Port St. Mary (Robinson, 1990).

Up to World War 2, there was an increase in industries involving processing and manufacturing to produce finished goods. These included those connected with the tourist industry, such as rock and mineral-water making; and others such as brewing, and the manufacture of cheese, bacon, kippers, paper, paint and clothing, the latter employing mainly women (Robinson, 1990).

Post-war, tourism began to decline, although it has remained one of the more important aspects of the Manx economy. However, the largest sector of the economy is now the financial sector. Through political and financial stability and comparatively low taxes, the Island now enjoys an international reputation as an offshore business centre. In connection with this the property market (catering for both new residents and more affluent sections of the existing community), and hence the building industry, have been stimulated. In particular the Douglas area has greatly expanded in recent years and elsewhere extensive building developments are being carried out. Manufacturing industries have remained important although the emphasis has switched to engineering, relying on the importation of raw materials and component parts and often involving large international companies, although there are many smaller local firms in operation (Robinson, 1990).

1.1.6 Ownership

Most of the land in the Island is privately owned but a significant proportion is Government property. In particular, the Department of Agriculture, Fisheries and Forestry, owns much of the hill-land, and the plantations and glens. The Water Authority owns substantial areas, principally the catchment areas of the reservoirs. Most other government departments also own small areas of land.

2. THE SURVEY

2.1 The aims and purpose of Phase 1 habitat survey

The Phase 1 survey technique originated in the 1970's and was initially used in south-east Scotland and later in Cumbria and West Yorkshire. English Nature (formerly the Nature Conservancy Council) has played a pivotal role in devising and implementing standardised methods of biological survey and this has resulted in the production of a handbook (England Field Unit, 1990). It is important that a standardised system is used and that surveys are conducted to a consistent level of detail and accuracy so that the results from one survey may be compared with those of another and maps and statistical data may be readily interpreted. It would be of great benefit to nature conservation and to development planning if all authorities had a comprehensive Phase 1 survey database.

For these reasons, the English Nature Phase 1 survey format has been followed for the Island survey.

The aim of Phase 1 survey is to produce a relatively rapid record of the semi-natural vegetation and wildlife habitat over large areas. The methodology may be used for specific habitats, for example, woodlands, but is more frequently used to record the vegetation present at a county or district level.

The habitat classification is based predominantly on vegetation as it is a static feature and generally easy to observe, identify and record over large areas. Information is augmented by reference to topographic and substrate features. The mobility, fugitive behaviour and small size of most animals means they are much more difficult to observe and record in the field, such that comprehensive, large-scale faunal surveys are not practical. However, in this survey butterfly observations were recorded.

In Phase 1 survey every parcel of land in the entire survey area is assigned a habitat type and mapped on to Ordnance Survey maps at a scale of 1:10,560 (1:10,000 is the usual scale but this was not available for the Island), in terms of some 90 specified habitat types using standard colour codes, (see EFU, 1990). Figure 2 illustrates the habitats used in the survey. Appendix 1 outlines the species codes used in the survey. Much of the mapping can be achieved from public rights of way and using binoculars at relatively short ranges. Aerial photographs may prove useful in some areas as an adjunct to ground survey. The black and white photographs for the Island were found to be of little value due to an inappropriate scale (1:27 000), date (1984) and poor clarity of habitat. This survey, therefore, relies entirely upon ground work.

Colour and dominant species-codes on final maps allows rapid visual assessment of the extent and distribution of habitat types and land use. Target symbols (⊙) in red ink on the map refer to a six figure grid reference with a descriptive "target note" giving a brief description of particular areas of interest. Target notes are an essential part of the Phase 1 survey.

Habitat areas are measured on the final maps and statistics produced on the extent and distribution of each habitat type. The target notes and statistics can be held on computer. The result of a Phase I survey is a set of maps, target notes, statistics and a report.

Nature conservation entails the conservation of plants and animals through the active management of natural and semi-natural habitats to maintain the interest. To be conducted effectively, knowledge of the nature, location, extent and distribution of these habitats is required. Phase 1 survey provides this information. It should be appreciated that sites of relatively limited conservation interest in themselves may be of strategic importance to nature conservation as wildlife corridors or "stepping stones".

Phase 1 survey provides:

- a basis for determining sites warranting Phase 2 survey.
- knowledge of sites which should be considered for protection as nature reserves, local trust wildlife sites etc.
- a baseline for monitoring changes in the countryside.
- help in the production and evaluation of Environmental Impact Assessments.
- aid in the development of a countryside strategy.

Phase 1 survey information can be very useful to planners providing vital information for the formulation of policy i.e. development and local plans or individual planning applications. Such data can save time and money by providing knowledge that will enable planners and developers to avoid the controversy sometimes involved with environmental issues and to respond quickly.

FIGURE 2. Phase 1 habitat classification

A. Woodland and scrub

1. Semi-natural broadleaved woodland
2. Broadleaved plantation
3. Coniferous plantation
4. Mixed plantation
5. Dense/continuous scrub
6. Scattered scrub
7. Scattered broadleaved trees
8. Scattered conifers
9. Recently-felled woodland

B. Grassland and marsh

1. Acid grassland
2. Semi-improved acid grassland
3. Neutral grassland
4. Semi-improved neutral grassland
5. Improved grassland
6. Marshy grassland
7. Poor semi-improved grassland

C. Tall herb and fern

1. Continuous bracken
2. Scattered bracken
3. Tall ruderal
4. Non-ruderal

D. Heathland

1. Dry dwarf shrub heath
2. Wet dwarf shrub heath
3. Dry heath/acid grassland mosaic
4. Wet heath/acid grassland mosaic

E. Mire

1. Blanket bog
2. Raised bog
3 Wet modified bog
4. Dry modified bog
5. Acid/neutral flush
6. Valley mire
7. Basin mire
8. Bare peat

F. Swamp, Marginal and Inundation

1. Swamp
2. Marginal vegetation
3. Inundation vegetation

G. Open water

1. Standing water
2. Running water

H. Coastland

1. Saltmarsh
2. Scattered saltmarsh
3. Shingle/gravel above high-tide mark
4. Boulders/rocks above high-tide mark
5. Strandline vegetation
6. Open dune
7. Dune grassland
8. Dune heath
9. Dune slack
10. Dune scrub
11. Maritime hard cliff
12. Maritime soft cliff
13. Crevice/ledge vegetation
14. Coastal grassland
15. Coastal heathland

I. Rock exposure and waste

1. Quarry
2. Spoil
3. Refuse Tip

J. Miscellaneous

1. Arable
2. Amenity grassland
3. Intact hedge
4. Defunct hedge
5. Hedge with trees
6. Wall
7. Ditch
8. Boundary removed
9. Fence
10. Earthbank
11. Sodhedge
12. Bare ground
13. Sea wall
14. Buildings

Subsequent study on the vegetation may include repeated Phase 1 survey to reveal changes in the habitat extent and distribution or a more detailed Phase 2 or Phase 3 survey.

Identification of all those sites which require protection and wildlife management is an objective of the Isle of Man Department of Agriculture, Fisheries and Forestry (DAFF), and Phase 1 is the first step towards achieving this task. All Government departments will have access to the Phase 1 survey database and should incorporate the results within their policies and decision-making.

2.2 The Manx Phase 1 habitat survey

The Isle of Man was surveyed between 1991 and 1993 by two surveyors employed by the DAFF, based at the Department of Highways, Ports and Properties (DHPP) office at Glen Duff. All subsequent cartographic work, typing of target notes and analysis of data has been undertaken by the surveyors. In May and June of 1991 the central valley was surveyed at both Phase 1 and 2 as part of the Environmental Impact Assessment for the IRIS (Integration and Recycling of the Island's Sewage) Project. From July to December the government-owned hill-land was surveyed. In 1992 the land of the northern plain from The Barony in Maughold to Kirk Michael was surveyed and the remainder of the Island completed in 1993 (see Figure 3).

Due to the high cost of original ("top copy") maps, full scale photocopies were taken. Two copies were made of each map, one for use in the field and one (the "fair copy") onto which the survey could be copied from the field maps. Notes were taken in the field and formed "target notes".

Target notes should enable others to make a preliminary assessment of the nature conservation value of a given site and a comparison between one site and another. Target notes will probably form the chief basis of site selection for conservation planning and further survey. The aim of a target note is to create a succinct picture of the nature conservation interest of a site in the context of its habitat type(s) and management.

Target notes should include: the habitat(s) present and the dominant species; other species of note; a description of the habitat structure, topography and substrate; a description of the plant communities present; details of any noteworthy animal associations; note of any known rare species of plant or animal; notes on past, present or proposed management practices; ownership details; details of any form of site protection; notes on damaging activities recent or present; and whether the site warrants further survey. Target notes are recorded with a six figure grid reference referring to the relevant map, a date (month and year) and the surveyors initials.

Target notes are typed in numerical order of their grid reference on A4 sheets with the notes for each 1km square starting on a fresh sheet, identified by the four figure grid reference for the square. Field copies were mapped using the system of colour and species codes outlined previously.

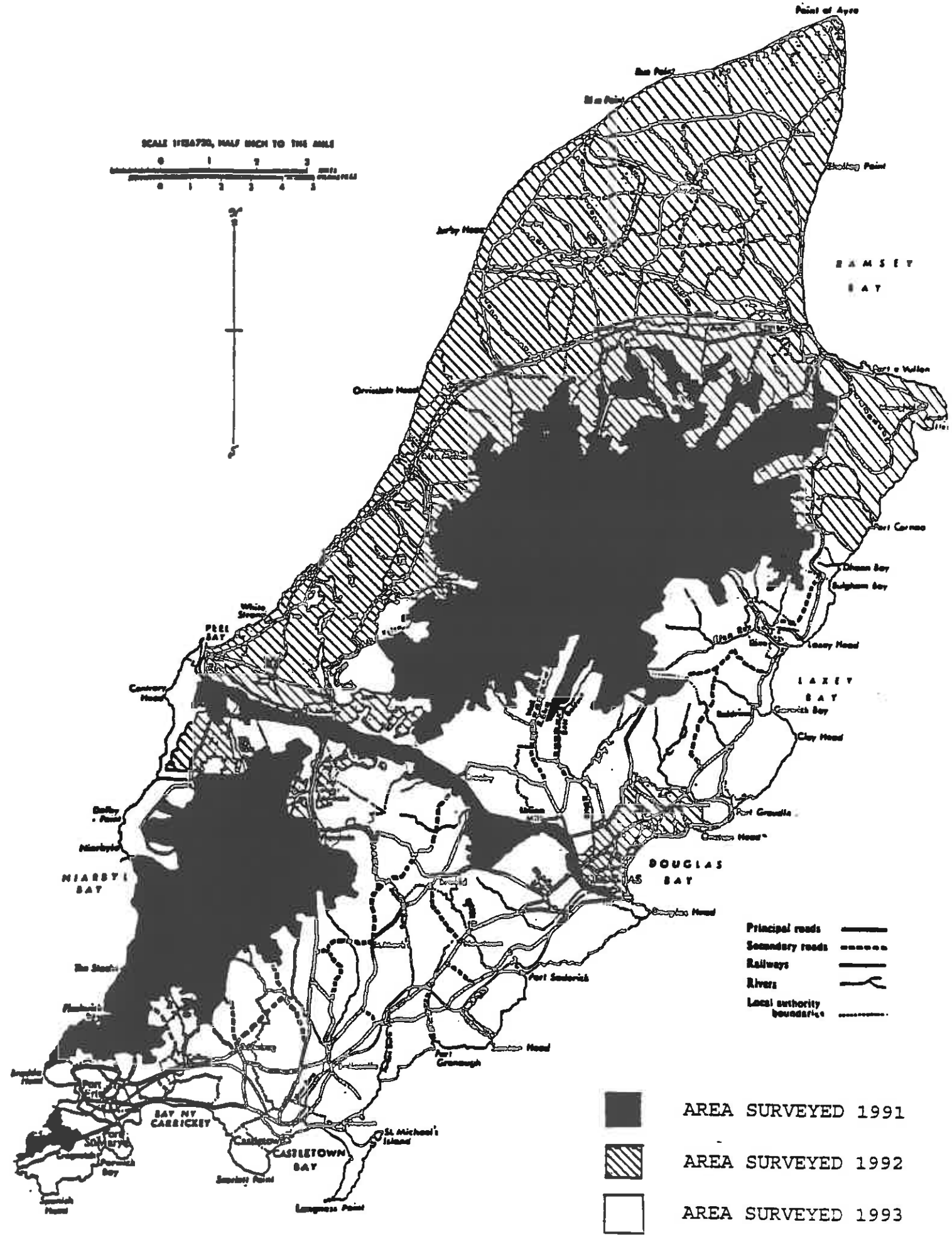
Due to the scale of the maps, areas less than 0.25 ha are difficult to map accurately though an attempt has been made to do so. Where the site is difficult to map or is of ecological or landscape interest a target note is written. Target notes can also describe features or situations not evident from the map. Large sites may have more than one target note reflecting variations.

Many habitat types will be under-represented due to the small size of many of the sites, for example, flush, swamp, tall ruderal vegetation, open water and coastal grassland and heathland. It is difficult to map accurately the shape and exact boundaries of habitat types when on the same level in the hills and the surveyors usually tried to map the land from a suitable vantage point, for example, from above or on the opposite side of the valley. However, this has limitations as not all habitats are distinct at a distance. The lack of physical boundaries i.e. walls, sodhedges and hedges or points of reference such as buildings and valleys increases the difficulty of producing exact habitat boundaries especially when there has been some past interference from man, for example, peat digging, producing transitional habitat types.

All this is exacerbated by the fact that the maps are a flat representation of the land taking no account of angle of slope which distorts mapping and results in a misrepresentation of habitats on steep slopes and vertical exposures such as maritime cliff, coastal vegetation and quarries. However, errors in most cases are likely to be less than 5% (EFU, 1990). Having mapped the boundaries the surveyors walked over as much of the area as possible (working as a pair for reasons of safety).

Field maps were copied onto "fair copies" during the winter months of the survey. Target notes were written-up throughout the survey season whenever weather conditions precluded field work. This was to ensure details were still fresh in the surveyor's mind and was an insurance against the notebooks being lost in the field. The copied

FIGURE 3 PHASE 1 SURVEY COVERAGE



maps have been checked several times with the originals and a number of sites revisited to check on certain details. Target symbols have been positioned and grid references and notes checked.

Sheet descriptions have been written for each map sheet which includes a short description of the geology, soils, relief, distribution of semi-natural habitats and any sites of importance.

2.3 Analysis of the habitat data

The completed "fair copy" maps show the extent and distribution of semi-natural vegetation and other land use across each 1:10,560 (25km²) map sheet. The relative abundance of each habitat unit is ascertained by hand measurement, using a transparent Romer dot grid overlay. This divides a 1km map square into 100- hectare squares. Each of these squares has 25 equally spaced dots, representing 0.04 ha. Area measurement is calculated by counting the total number of 0.04 ha dots falling onto each habitat parcel. Multiplying the number of dots by 0.04 gives the area of the habitat in hectares. The minimum mappable area is approximately 0.12 ha for solid colour and 0.25 ha for hatching.

Ideally "top copy" maps should be used to avoid having to compensate for the image stretch produced by photocopying but lack of time prevented completion of these maps and "fair" copies were used. If a habitat unit crossed the grid line boundary of a 1km square only the area of the unit within the square being measured is recorded and a grid reference is added to the recording sheet. This indicates that a particular habitat continues and that these areas need to be added together to illustrate the true extent of the habitat unit.

To simplify measuring habitat areas English Nature combines some categories but a finer level of detail was considered necessary for this survey. The categories used are outlined in Table 1. The measurements produced can be compared with those of English Nature.

Each map was measured systematically starting with the grid square in the bottom left-hand corner of the map and working up the grid column to the top and then starting at the bottom of the next grid column along. The information for each 1km grid square was recorded on specifically designed forms (see Appendix 2).

The information has been used to produce statistics of the total amount of semi-natural habitat remaining and of the total area of each habitat type, expressed as a percentage of the survey area. This is shown in Table 1.

It is not considered practical to calculate the area of hedges, stone walls and sodhedges, the width of which is over-represented by the map. This also applies to ditches, streams and rivers, but these are covered in the report.

Although the maps and accompanying data have "been produced with the intention of indicating and classifying the occurrence of semi-natural habitats, it is not to be regarded as a definitive representation of the conservation value or interest of any piece of land. In particular the absence of any symbol such as colour code or target note should not be taken as denoting a lack of conservation value" (EFU, 1990).

Maps should not be used as the sole basis of assessing the likely effects of a specific land use change proposal because:

- the maps are not 100% accurate,
- important animal communities will not be indicated,
- major habitat changes may have occurred since mapping,
- very small habitats will not have been mapped,
- sites are only visited once and thus some communities may have been missed due to seasonal effects,
- complete species lists are not provided and rarities may be missed.

In addition, all mapped habitats are not of equal conservation value and even if a habitat is widespread it may still be threatened. The great majority of a habitat type may be seriously damaged, leaving only small patches in good condition. Quite large tracts of habitat may only be remnants of more extensive cover and may themselves be disappearing or changing rapidly. The maps give no indication of the rates of change of habitat. A monitoring programme is necessary to determine the rate and extent of such change.

3. RESULTS

The overall results of the survey are presented in Table 1, which shows the total area in hectares of each habitat type on the Island. An analysis of the major habitat classes on the Island is shown in Table 2 and Figure 4.

Semi-natural habitats total 16,438.90 ha, representing 29% of the land area of the Island. Agricultural land, which includes arable, improved and poor semi-improved grassland, farm tracks and often roads, and hedges and ditches, makes up 33,149.32 ha, 58.66% of the Island. Plantation woodlands, predominantly coniferous, cover 3459.87 ha, 6.12% of the Island, while built-up land, including farmyards and often roads, occupies 2233.96 ha, almost 4% of the Island.

The semi-natural vegetation of the Island is analysed in broad habitat categories in Table 3, with Figure 5 illustrating diagrammatically their relative proportions.

The dominant form of semi-natural habitat is heathland, which covers 10.54% of the Island and makes up 36.23% of the semi-natural vegetation. This is closely followed by grasslands, both unimproved and semi-improved, which represent 10.44% of the Island, 35.87% of the semi-natural total. However 53.47% of this grassland is unimproved acidic and only 0.19% was classified as unimproved neutral grassland. The third largest habitat type on the Island is dense bracken which occupies 1975.12 ha, 12.01% of the semi-natural total. Semi-natural woodlands cover only 1189.88 ha (2.11%) of the Island but most (1022.80 ha) of this is dense scrub, while conifer plantations cover 3.74%, with a further 1.06% of the Island newly planted conifers over heathland. Mires, which include blanket bog, modified bogs, valley mire, acidic flush and raised bog cover only 1.18% of the total land area and make-up 4.07% of the semi-natural total. Measurable coastal habitats cover 1.02% of the Island, 3.50% of the semi-natural total. Open water and swamp vegetation cover a mere 0.22% of the Island, 0.78% of the semi-natural total.

TABLE 1 TOTAL AREA OF HABITAT TYPES ON THE ISLE OF MAN

HABITAT	TOTAL AREA ha	LARGEST AREA ha	SMALLEST AREA ha	MEAN SIZE ha	% OF ISLAND	% SEMI-NAT.HAB
Broadleaved woodland	167.08	9.00	0.12	0.57	0.30	1.02
Dense Scrub	1022.80	75.80	0.12	0.96	1.81	6.22
Total	1189.88					
Unimproved Acid Grassland	3152.88	2654.60	0.12	35.03	5.58	19.18
Semi-improved " "	1002.72	110.20	0.12	4.36	1.77	6.10
Unimproved Neutral G'land	11.08	8.24	0.32	2.77	0.02	0.07
Semi-improved " "	633.96	107.36	0.12	2.20	1.12	3.86
Marshy Grassland	1096.16	31.88	0.12	1.43	1.94	6.67
Total	5896.80					
Dense Bracken	1975.12	189.20	0.12	2.35	3.50	12.01
Tall Ruderal	48.80	2.88	0.12	0.40	0.09	0.30
Total	2023.92					
Dry Dwarf Shrub Heath	5645.72	2143.34	0.12	26.88	9.99	34.34
Wet Dwarf Shrub Heath	309.94	20.68	0.12	2.18	0.55	1.89
Total	5955.66					
Flush	455.24	34.04	0.12	1.64	0.81	2.77
Blanket Bog	105.72	15.48	0.20	3.92	0.19	0.64
Raised Bog	0.36	0.36	0.36	0.36	0.0006	0.002
Dry Modified Bog	67.36	47.04	0.64	8.42	0.12	0.41
Wet Modified Bog	26.08	12.68	0.12	1.37	0.05	0.16
Valley Mire	14.56	7.00	0.16	1.82	0.03	0.09
Total	669.32					
Standing Water	103.08	26.64	0.12	0.73	0.18	0.63
Swamp	19.00	2.20	0.12	0.51	0.03	0.12
Inundation Vegetation	5.56	4.04	1.52	2.78	0.0098	0.03
Total	127.64					
Coastal Grassland	55.84	4.32	0.12	0.80	0.10	0.34
Coastal Heathland	11.44	5.76	0.16	0.82	0.02	0.07
Dune Grassland	101.20	38.60	0.16	4.22	0.18	0.62
Dune Heathland	311.08	286.84	0.20	25.92	0.55	1.89
Dune Scrub	1.40	0.44	0.16	0.28	0.003	0.009
Dune Slack	7.28	3.48	0.12	0.81	0.01	0.04
Open Dune	74.92	35.24	0.12	4.99	0.13	0.46
Bare Sand	2.68	1.12	0.16	0.45	0.005	0.02
Lichen/Bryophyte Heath	3.12	3.12	3.12	3.12	0.006	0.02
Saltmarsh	6.72	3.44	0.16	0.84	0.01	0.04
Total	575.68					
TOTAL SEMI-NAT. HABITAT	16438.9					

TABLE 1 cont'd. TOTAL AREA OF HABITAT TYPES ON THE ISLE OF MAN

HABITAT	TOTAL AREA ha	LARGEST AREA ha	SMALLEST AREA ha	MEAN SIZE ha	% OF ISLAND
Conifer Plantation	2,112.03	168.68	0.12	6.95	3.74
- PCW over DDSH	543.24	94.68	0.80	45.27	0.96
- PCW over DH/AG	40.84	40.84	40.84	40.84	0.07
- PCW over WDSH	19.24	19.24	19.24	19.24	0.03
Broadleaved Plantation	618.24	13.88	0.12	1.02	1.09
- PBW over DDSH	10.36	3.36	0.40	1.30	0.02
Mixed Plantation	111.84	9.96	0.12	0.88	0.20
- PMW over DDSH	4.08	2.72	1.36	2.04	0.007
Total	**3,459.87**				
Improved / Arable	30,445.00	-	-	-	53.88
Poor Semi-improved	2,704.32	106.24	0.12	2.40	4.79
Total	**33,149.32**				
Amenity Grassland	1,011.32	65.00	0.12	1.25	1.79
Ephem./Short Perennial	7.84	4.20	0.16	0.78	0.01
Quarry. Refuse & Spoil	136.60	57.16	0.12	2.10	0.24
Built-up	2,233.96	849.96	0.12	3.09	3.95
Bare Ground	60.00	9.88	0.12	1.30	0.11
Introduced Shrub	7.16	2.48	0.12	0.42	0.01
Unsurveyed	3.68	3.68	3.68	3.68	0.0065
TOTAL	**40,069.75**				
TOTAL ISLAND AREA	**56,508.65**				

KEY

PCW	Planted Conifer Woodland
PBW	Planted Broadleaved Woodland
PMW	Planted Mixed Woodland
DDSH	Dry Dwarf Shrub Heath
DH/AG	Dry Heath/Acid Grassland Mosaic
WDSH	Wet Dwarf Shrub Heath
Ephem.	Ephemeral

FIGURE 4 RELATIVE PROPORTIONS OF MAJOR HABITAT CLASSES IN THE ISLE OF MAN

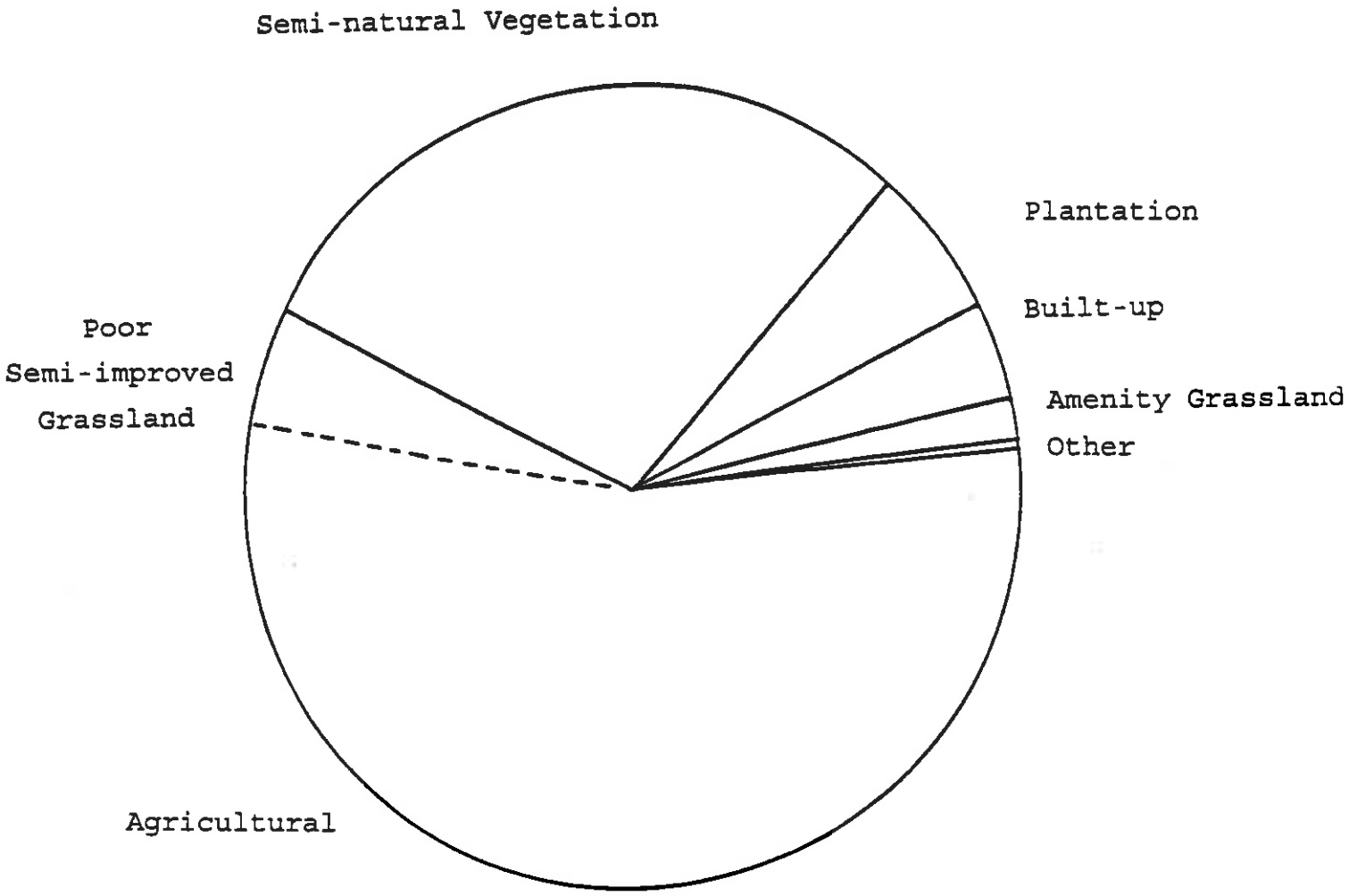


TABLE 2 ANALYSIS OF MAJOR HABITAT CLASSES IN THE ISLE OF MAN

LAND USE	TOTAL AREA hectares	% OF ISLAND
Semi-natural	16,438.90	29.09
Plantation	3,459.87	6.12
Agricultural	33 149.32	58.66
Built-up	2,233.96	3.95
Amenity grassland	1,011.32	1.79
Other	215.28	0.38
TOTAL	**56,508.65**	**100.00**

FIGURE 5 RELATIVE PROPORTIONS OF SEMI-NATURAL HABITAT CLASSES IN THE ISLE OF MAN

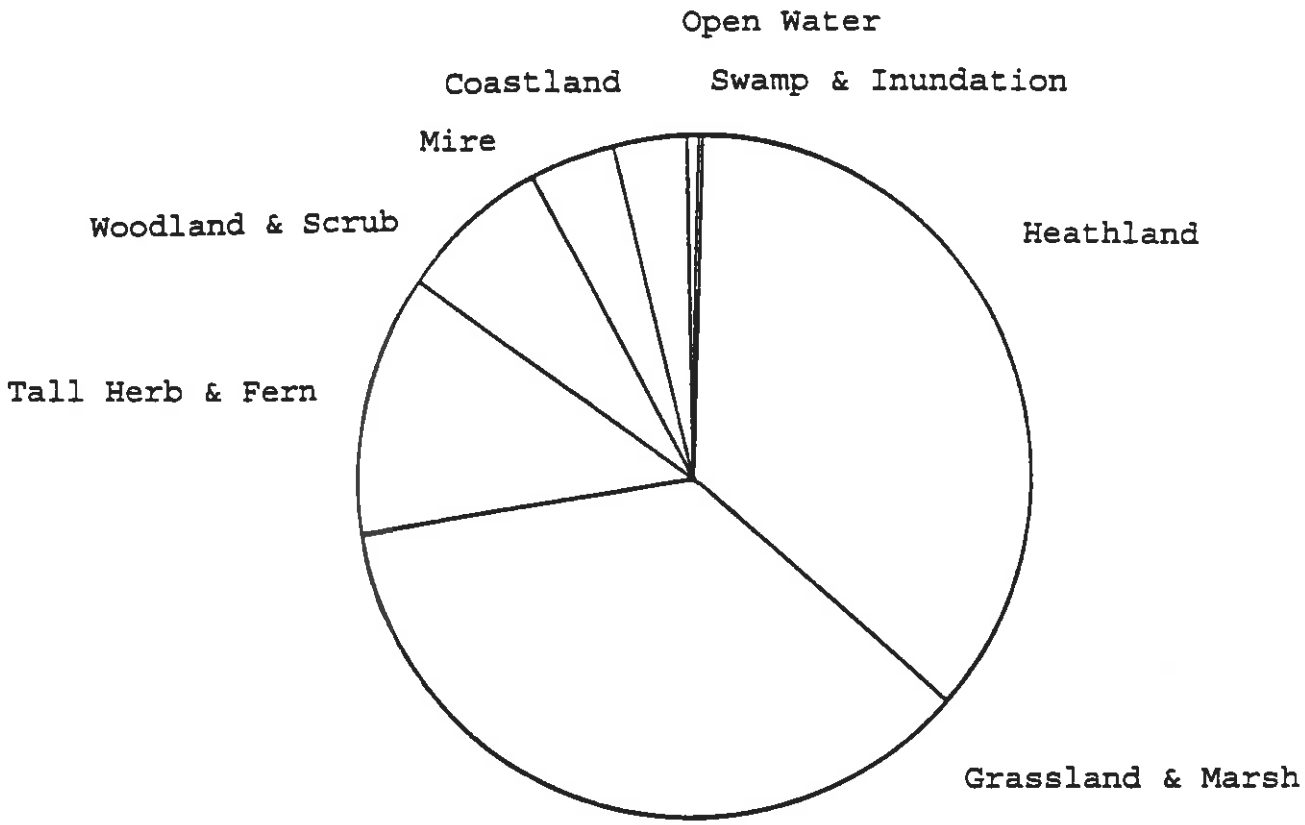


TABLE 3 ANALYSIS OF SEMI-NATURAL HABITAT CLASSES IN THE ISLE OF MAN

SEMI-NATURAL VEGETATION TYPE	TOTAL AREA hectares	% OF ISLAND	% SEMI NAT. HAB
Woodland & Scrub	1,189.88	2.11	7.24
Grassland & Marsh	5,896.80	10.44	35.87
Tall Herb & Fern	2,023.92	3.58	12.31
Heathland	5,955.66	10.54	36.23
Mire	669.32	1.18	4.07
Swamp & Inundation	24.56	0.04	0.15
Open Water	103.08	0.18	0.63
Coastland	575.68	1.02	3.50
TOTAL	**16,438.90**	**29.09**	**100.00**

4. INTERPRETATION AND DISCUSSION OF THE SURVEY

Habitat definitions follow the Phase 1 Handbook (EFU, 1990).

4.1 WOODLAND AND SCRUB

4.1.1 Introduction

Most of the natural tree cover of the Island was removed before the sixteenth century and now only 8.23% of the Island is wooded. However, 74.41% of this is plantation, mainly coniferous (78.47%), and only 3.59% is semi-natural woodland, the remainder (22%) being dense scrub.

Table 4 is an analysis of woodland types on the Island and Figure 6 is a diagrammatic representation of the relative proportions of the woodland habitat categories.

4.1.2 Semi-natural broadleaved woodland

Broadleaved woodland is defined as areas of at least 30% tree cover with 10% or less conifers in the canopy. It comprises all stands which do not obviously originate from planting.

Although broadleaved woodland occurs throughout the Island, the largest sites are associated with the edges of the central massif and woodland is scarce south of the central valley. However, there is very little broadleaved woodland of any significant extent.

Broadleaved woodland covers 167.08 ha, 0.30% of the Island, 1.02% of the semi-natural habitat total, mainly as relatively small units along rivers and streams in small, steep-sided, often fairly inaccessible valleys, for example, Laxey, Narradale and Glen Auldyn. Some of the largest areas of woodland are the Manx National Glens, which although originally planted are developing semi-natural characteristics, for example, Elfin Glen. Semi-natural broadleaved woodland is also developing along otherwise bracken-dominated slopes in association with scrub species, for example, Sulby Glen, Ballaugh Glen, Glen Tramman and Glen Roy, and along steep slopes. One of the best examples of this is Glen Duff which is dominated by birch (*Betula* spp.) with ash (*Fraxinus excelsior*). This is a good site for sanicle (*Sanicula europaea*) which is only found between Narradale and The Dhoon with the exception of two previously unrecorded sites at Groudle Glen and a site at Regaby (SC427975). Woodland is also developing in lowland sites away from the valleys, for example, in the Ballaugh Curragh where there are quite extensive areas of birch woodland, for example, 2.72 ha and 1.56 ha.

Very small patches of woodland occur in agricultural areas with well-established trees, probably planted as shelter belts. Many of these will have been recorded as semi-natural.

The largest area of semi-natural woodland is found at Narradale (9.00 ha). This site is notable for being one of the few sites for common cow-wheat (*Melampyrum pratense*).

The commonest tree species are ash (*Fraxinus excelsior*), sycamore (*Acer pseudoplatanus*) and wych elm (*Ulmus glabra*). There is only a limited amount of oak (*Quercus* sp.), some of which is thought to be descended from primeval stock (see section 1.1.4). Hazel (*Corylus avellana*) has a limited distribution but there are two important sites at SC436925 (Glen Auldyn) and SC426841 (Laxey), the latter probably planted for use in the mines.

Scrub species include hawthorn (*Crataegus monogyna*), holly (*Ilex aquifolium*), bramble (*Rubus fruticosus* agg.) and rowan (*Sorbus aucuparia*).

The groundflora of these woodlands tends to be very similar in species composition. Common species include ramsons (*Allium ursinum*), bluebell (*Hyacinthoides non-scripta*), opposite-leaved golden-saxifrage (*Chrysosplenium oppositifolium*), hard-fern (*Blechnum spicant*), common dog-violet (*Viola riviniana*), red campion (*Silene dioica*), male-fern (*Dryopteris filix-mas*), wood sage (*Teucrium scorodonia*), honeysuckle (*Lonicera periclymenum*) and pignut (*Conopodium majus*).

Other woodlands of importance are alder (*Alnus glutinosa*) carr which is of limited distribution. The largest area occurs at Ellanbane (2.04 ha) with smaller areas present near Cooilingel, Cornaa and Groudle Glen.

Broadleaved woodland throughout the Island provides shelter, food and breeding sites for a wide range of bird species including robin, wren, chiffchaff, willow warbler and goldcrest.

FIGURE 6 RELATIVE PROPORTIONS OF WOODLAND HABITAT CLASSES IN THE ISLE OF MAN

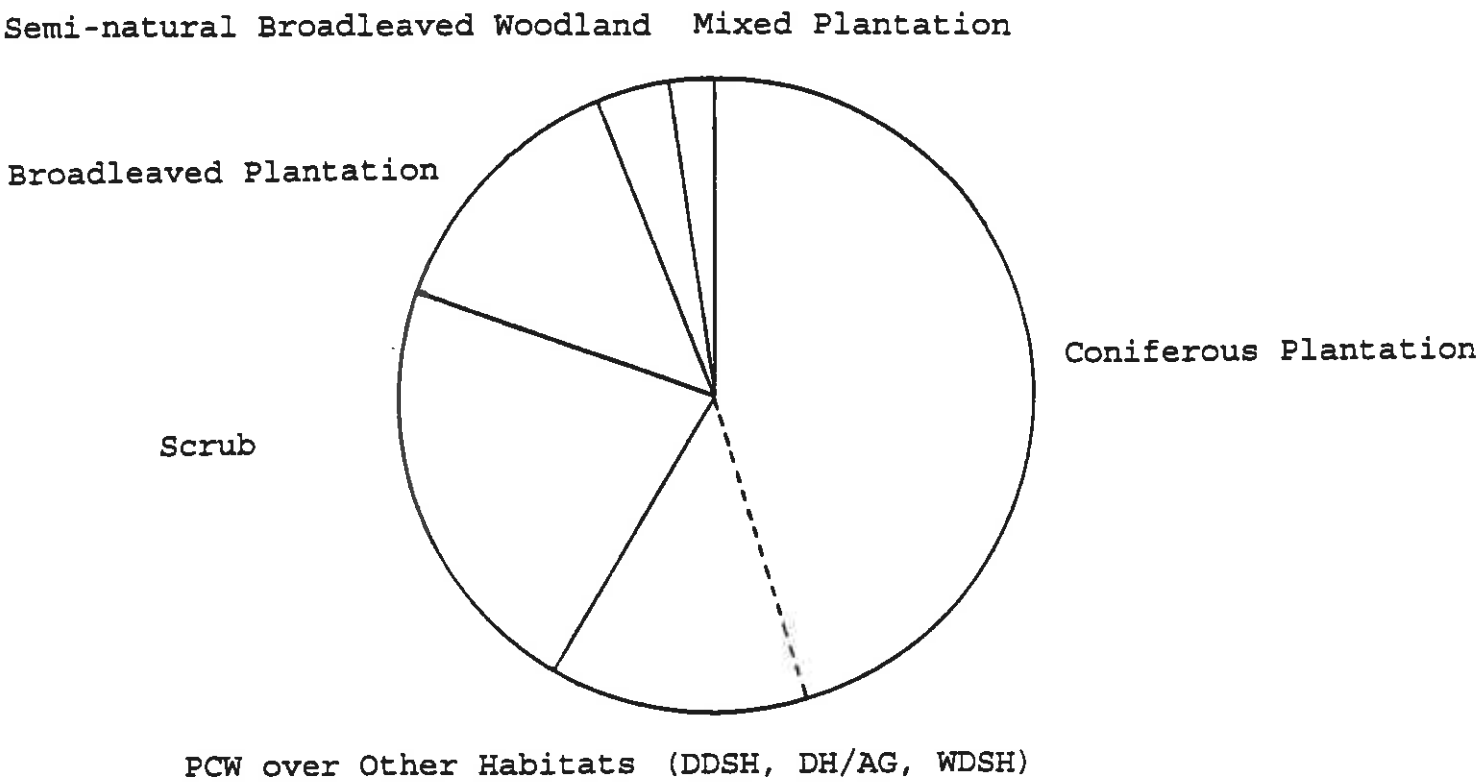


TABLE 4 ANALYSIS OF WOODLAND HABITAT CLASSES IN THE ISLE OF MAN

WOODLAND TYPE	TOTAL AREA ha	% OF ISLAND	% SEMI NAT.HAB.	% TOTAL WOODLAND
Semi-natural Broadleaved	167.08	0.30	1.02	3.59
Scrub	1,022.80	1.81	6.22	22.00
Broadleaved Plantation	618.24	1.09	-	13.30
- PBW over DDSH	10.36	0.02	-	0.22
Mixed Plantation	111.84	0.20	-	2.41
- PMW over DDSH	4.08	0.01	-	0.09
Coniferous Plantation	2,112.03	3.74	-	45.42
- PCW over DDSH	543.24	0.96	-	11.68
- PCW over DH/AG	40.84	0.07	-	0.88
- PCW over WDSH	19.24	0.03	-	0.41
TOTAL	**4,649.75**	**8.23**	**7.24**	**100.00**

PCW: Planted Conifer Woodland
PBW: Planted Broadleaved Woodland
PMW: Planted Mixed Woodland

DDSH : Dry Dwarf Shrub Heath
WDSH : Wet Dwarf Shrub Heath
DH/AG: Dry Heath/Acid Grassland Mosai

4.1.3 Dense Scrub

Dense scrub is seral vegetation dominated by locally native shrubs usually less than 5m tall which forms a link in the progression of habitat, for example, from grassland to woodland.

Included within this category may be European gorse (*Ulex europaeus*), broom (*Cytisus scoparius*), bramble (*Rubus fruticosus* agg.), hawthorn (*Crataegus monogyna*), blackthorn (*Prunus spinosa*) and willows (*Salix* spp.); grey willow (*Salix cinerea*) is recorded as scrub even when it exceeds 5m in height. However, western gorse (*Ulex gallii*), least and creeping willows (*Salix herbacea* and *S. repens*), low-growing bog myrtle (*Myrica gale*), hedges, immature trees, introduced shrubs, and dune heath and scrub are not included within this category.

European gorse (*Ulex europaeus*) was introduced to the Island for planting on to sod hedges, and has subsequently invaded and colonised areas of land which have not been managed. It is persistent, and resistant to attempts at eradication through burning. The native western gorse (*Ulex gallii*) is classified by English Nature as a heath rather than a scrub species but there have been occasions during the survey when it has proved more appropriate to include it as scrub, such as when it occurs alone (i.e. with no other heath species), or with European gorse. In these instances it has been mapped as scrub and marked on the map by its abbreviation (Ug).

Dense scrub tends to occur as single-species stands of either grey willow (*Salix cinerea* ssp. *oleifolia*) carr (curragh) or European gorse (*Ulex europaeus*). Other species occurring include holly (*Ilex aquifolium*), hawthorn (*Crataegus monogyna*), blackthorn (*Prunus spinosa*), rowan (*Sorbus aucuparia*) and elder (*Sambucus nigra*).

Tree species are invading some areas of scrub, part of the gradual succession to woodland.

Dense scrub covers 1022.80 ha, 1.81% of the Island, which represents 6.22% of the semi-natural habitat total. However, there is also a considerable amount of scattered scrub. The largest continuous area of curragh occurs in the Ballaugh curragh (75.80 ha) with scattered sites around the periphery. The other main area is in the central valley. Outside of these two main areas curragh is scattered throughout the Island, for example at Regaby, Dog Mills, Lough Cranstal, Brack-a-broom, Ballacricyrt and Kerrowkeil.

Curragh is dominated by grey willow (*Salix cinerea* ssp. *oleifolia*) usually with bramble (*Rubus fruticosus* agg.), and frequently with sycamore (*Acer pseudoplatanus*), ash (*Fraxinus excelsior*) and birch (*Betula pendula* x *pubescens*). Common groundflora species include water horsetail (*Equisetum fluviatile*), water mint (*Mentha aquatica*), devil's-bit scabious (*Succisa pratensis*), orchids (*Dactylorhiza* spp.), marsh thistle (*Cirsium palustre*), ragged-robin (*Lychnis flos-cuculi*), marsh pennywort (*Hydrocotyle vulgaris*), lesser spearwort (*Ranunculus flammula*), cuckooflower (*Cardamine pratensis*) and marsh-marigold (*Caltha palustris*).

Large areas of gorse are present on the Island particularly in a number of valleys and on steep slopes, for example, in West and East Baldwin, and Glen Rushen.

Hedgerows, which are a linear scrub habitat, are somewhat scarce on the Island and have not been measured separately but are included in the habitats they bound.

Dense scrub provides valuable cover for birds and small animals and when in a mosaic with grassland and woodland provides a sheltered habitat for a variety of birds and insects.

4.1.3.1 Scattered Scrub

Scattered scrub of any of the above types may occur in conjunction with other habitat types. Obviously this habitat has not been measured but is indicated on the maps.

4.1.4 Plantations

Plantations are obviously planted woodland of any age.

4.1.4.1 Broadleaved plantation

Broadleaved plantations cover 618.24 ha, 1.09% of the Island and tend to fall into two main categories, established and recent, with the latter further divided into upland and lowland. Some of the largest areas of established broadleaved plantations are Manx National Glens, planted largely at the end of the last century and maintained by the Forestry Division of the DAFF. These are:

Molly Quirk's Glen/Bibaloe Walk
Dhoon
Ballure Walk
Lhergy Frissel
Bishopscourt Glen
Glen Helen
Silverdale
Port Soderick
Glen Maye
Laxey Glen
Ballaglass
Elfin Glen
Tholt-y-Will
Glen Mooar
Colby Glen
Groudle
Glen Wyllin

Most of the plantations have mature stands of trees. The most commonly planted species are beech (*Fagus sylvatica*), wych elm (*Ulmus glabra*), ash (*Fraxinus excelsior*), sycamore (*Acer pseudoplatanus*) and occasionally oak (*Quercus* spp.), horse chestnut (*Aesculus hippocastanum*) and sweet chestnut (*Castanea sativa*). The main understorey species is holly (*Ilex aquifolium*). Other shrubs commonly occurring include hawthorn (*Crataegus monogyna*), European gorse (*Ulex europaeus*), bramble (*Rubus fruticosus* agg.), blackthorn (*Prunus spinosa*), rowan (*Sorbus aucuparia*) and willows (*Salix* spp.). Typical groundflora species include foxglove (*Digitalis purpurea*), red campion (*Silene dioica*), male-fern (*Dryopteris filix-mas*), Atlantic ivy (*Hedera helix* ssp. *hibernica*), bluebell (*Hyacinthoides non-scripta*), opposite-leaved golden-saxifrage (*Chrysosplenium oppositifolium*), wood-sorrel (*Oxalis acetosella*) and hard-fern (*Blechnum spicant*).

Montpelier is particularly noted for its fungal flora although recreational use and grazing by sheep in this area means that the understorey and groundflora is limited.

Recent planting in the lowlands is on private land, often small and frequently linear (i.e. along the edge of a field) or triangular (i.e. in a field corner). Some planting has recently taken place under a tree planting campaign organised by the local branch of Friends of the Earth.

Recent broadleaved planting in the uplands has occurred within the new conifer plantations, where the original habitat is still present. These have been recorded and measured separately.

In some instances trees are being planted over land which is of ecological interest, for example, marshy grassland, and wet and dry dwarf shrub heath.

No account has been taken of the area occupied by trees which have been planted along hedge boundaries etc.

Due to the age and species composition of the established plantations, being generally fairly well mixed, with only small stands of single-species and with many native species present, the wildlife value of these sites is quite high. Many of the sites had a certain amount of natural tree cover which has been augmented by planting, and thus seeds of groundflora species associated with this habitat were present in the soil, allowing a typical woodland groundflora to develop.

Broadleaved plantations provide shelter, food and breeding sites for a wide range of bird species.

4.1.4.2 Coniferous plantation

Coniferous plantations are defined as areas of obviously planted coniferous species with 10% or less broadleaved trees in the canopy.

There are two main categories of plantation, those planted predominantly in the 1950's and 60's, and those planted between 1986 and 1991 as a part of the present afforestation programme.

Coniferous plantations in the first category cover 2112.03 ha, 3.74% of the Island. An additional 603.32 ha has been planted since 1986. Most of this afforestation has taken place in the uplands on heathland owned by DAFF and thus represents a considerable loss of semi-natural habitat. Figure 7 lists the conifer plantations.

The main species planted include Sitka spuce (*Picea sitchensis*), Japanese larch (*Larix kaempferi*), European larch (*L. decidua*), lodgepole pine (*Pinus contorta*), Scots pine (*P. sylvestris*) and Corsican pine (*P. nigra* ssp. *laricio*).

The established coniferous plantations were given only a brief survey and as it is Government policy to replant cleared areas it was considered an inappropriate use of time to identify cleared forest on the maps.

Figure 7. Conifer plantations surveyed

Established plantations:

Name	Name
The Ayres	Claughbane
Ballure	Dreemskerry
Abbeyville	Ballakillingan
Skyhill	Brookdale
Gob-y-Volley	Ballacuberagh
Ohio	Ballakerka
Ballaugh	Slieu Curn
Tholt-y-Will	Axnfell
Conrhenny	Barroose
Sartfell	Slieu Maggle
Injebreck	Colden
Glen Helen	Eairy Beg
The Vaaish	Beary
Ballig	Slieu Whallian
Knockaloe	Greeba
The Rhenny	Ballakelly
Archallagan	Kion Slieu
Stoney Mountain	South Barrule
Arrasey	Lhargan
Kerroodhoo	Glen Rushen
Slieu Mooar	Chibbanagh
Cringle	Earystane
Ballacostain	Fleshwick

Recent plantations (between 1986 and 1991)

Name	Ref.	Map
Round Table	SC247764	27NW
Stoney Mountain	SC285763	27NE
Cross Vein Shelterbelt	SC259779	27NE
Corlea	SC261752	27NE
Creg ny Crock	SC240770	27NW
Slieau Managh	SC401911	49SW
Glion Gill	SC319846	38SW
" "	SC326840	38SW
Boayl Curragh	SC372905	39SE

Some of the long-established plantations exhibited varying degrees of failure due to exposure, competition from western gorse (*Ulex gallii*) and heather (*Calluna vulgaris*), poor drainage and poor soils, for example, Earystane, Lhargan, Slieau Curn, Slieau Maggle, Stoney Mountain and sections of Colden and Greeba. Examples of failed or "checked" areas can be found within these plantations. A number have poor internal road systems making access for management difficult. This problem is now being addressed.

Conifer plantations are planted in uniform, close-ranked, often single-species blocks which are clear-felled and replanted. In comparison with broadleaves, coniferous species attract few species of insect and thus few birds. However, in the early stages when a groundflora is present and before the canopy closes, newly planted areas can provide food sources for hen harrier, kestrel, linnet and meadow pipit and a number of other birds. When the canopy closes, light levels are low and the floor of dense needles shades out existing plants and prevents a groundflora developing. The high phenol content of pine needles prevents their decay which results in the accumulation of a deep litter layer and so ground flora tends to be restricted to tracks and failed areas. At this stage the density of birds of open habitats declines and their range is reduced.

Where there are gaps in the canopy, varying proportions of the following species may be found: bracken (*Pteridium aquilinum*), bell heather (*Erica cinerea*), heather (*Calluna vulgaris*), soft-rush (*Juncus effusus*), heath rush (*J. squarrosus*), purple moor-grass (*Molinia caerulea*), bilberry (*Vaccinium myrtillus*), heath bedstraw (*Galium saxatile*), hard-fern (*Blechnum spicant*), gorse (*Ulex* spp.), wavy hair-grass (*Deschampsia flexuosa*), mat-grass (*Nardus stricta*), wood sage (*Teucrium scorodonia*) and bramble (*Rubus fruticosus* agg.).

4.1.4.3 Mixed plantation

Mixed plantation may be defined as those areas of trees which are obviously planted with 10-90% of either broadleaved or coniferous species.

Mixed plantations cover 111.84 ha, 0.20% of the Island. The largest areas are long-established and within government ownership, for example, Glen Maye (9.32 ha) and Churchtown (9.96 ha). There are numerous small sites scattered throughout the Island, both established and recent, mostly in private ownership. Species composition varies but usually contains a mix of the species outlined in sections 4.1.4.1 and 4.1.4.2.

There has been some mixed planting (4.08 ha) within the afforestation programme. Since the early 1980s, the Forestry Division has operated a Small Woods Scheme where grants are given towards the costs of tree planting for areas ranging from 50 trees to 2 hectares.

The conservation value of mixed plantations depends upon the species mix and density of planting. If there is an even mix of conifers and broadleaves and they are broadly spaced, light penetration will be good resulting in the development of a varied groundflora.

4.1.5 Scattered broadleaved trees

This is defined as wooded areas with less than 30% cover of broadleaved species, including parkland, windbreaks and avenues.

These areas have not been measured but appear on the maps usually with a species code.

4.1.6 Scattered conifers

Areas as above but made up of coniferous trees.

4.1.7 Recently-felled woodland

Areas are defined thus only if their future use is uncertain.

4.2 GRASSLAND AND MARSH

4.2.1 Introduction

This category includes both areas of herbaceous vegetation dominated by grasses and certain wet communities dominated by rushes (*Juncus* spp.), sedges (*Carex* spp.) or other marsh herbs.

Phase 1 survey categorises grasslands according to the degree to which they have been improved agriculturally. They are recorded as being improved or as being in one of four categories of unimproved: acid, neutral, calcareous or marshy. Calcareous grassland was not recorded on the Island. The ecological interest of grasslands is inversely related to the level of agricultural improvement. An intermediate category, "semi-improved" is used to record grasslands which have undergone a low to moderate degree of improvement but which still retain some of their ecological interest. A further category of "poor semi-improved" has been introduced to distinguish grasslands on the continuum between semi-improved and improved. The total area of each category on the Island is given in Table 5 and shown diagrammatically in Figure 8. No figures are presented for improved grassland as this was included with arable.

Unimproved grasslands are the most extensive grassland type on the Island, covering 3163.96 ha, however only 11.08 ha was classified as unimproved neutral grassland, the rest being acid grassland.

4.2.2 Acid grassland

Acid grassland develops where precipitation exceeds evaporation resulting in the leaching of basic nutrient ions from the surface layers of the soil down the soil profile. Under these wet conditions decomposition is slow and a layer of acidic mor humus develops under the undecomposed litter. Hydrogen-ions from the humus layer replace bases in the underlying soil making it acidic (pH <5.5).

Grassland in this category is often unenclosed, as on hill grazing land. It is generally species-poor and often grades into wet or dry heath although it must always have less than 25% dwarf shrub cover. Many areas of surveyed acid grassland were described as wet, where the species composition includes plants characteristic of flush or bog. Many transitional areas exist due to man's influence, particularly peat digging and drainage.

Unimproved acid grassland covers 3152.88 ha, which is almost 6% of the land area and 19% of the semi-natural total. It occurs where sheep grazing prevents heathland species dominating and where mire cannot form. It is likely that much of the acid grassland has been derived from dry dwarf shrub heath as a result of burning and grazing. The greater proportion of acid grassland occurs in the northern hills, with that in the southern hills usually occurring as a mosaic with dry dwarf shrub heath, for example, off the Round Table road at SC228738.

In the north, acid grassland occupies very large areas, for example, a large continuous block to the east of the northern hills which includes Beinn-y-Phott, Mullagh Ouyr, Snaefell and Clagh Ouyr, covering 2654.60 ha, the largest continuous area on the Island.

Acid grassland is usually dominated by mat-grass (*Nardus stricta*), heath rush (*Juncus squarrosus*), wavy hair-grass (*Deschampsia flexuosa*) and bilberry (*Vaccinium myrtillus*) with heath bedstraw (*Galium saxatile*), heath-grass (*Danthonia decumbens*), green-ribbed sedge (*Carex binervis*), sheep's-fescue (*Festuca ovina*), tormentil (*Potentilla erecta*) and bent (*Agrostis* spp.).

Acid grassland is by definition species-poor as there is only a limited range of species which can tolerate the conditions. However there are frequently small areas of richer habitat within acid grassland, for example, flushes, spring and blanket bog. These have been mapped separately when greater than 0.12 ha but there are innumerable smaller examples.

4.2.3 Semi-improved acid grassland

Semi-improved acid grassland contains species indicative of both neutral and acid conditions, having undergone some agricultural improvement.

This habitat covers 1002.72 ha, 1.77% of the Island, forming quite large areas, generally enclosed, and representing 61.0% of all semi-improved grassland recorded. It occurs most commonly on the flanks of hills where it forms an intermediate zone between acid grassland, heath and bog in the uplands and improved, agricultural land below. Typical species include common bent (*Agrostis capillaris*), Yorkshire-fog (*Holcus*

FIGURE 8 RELATIVE PROPORTIONS OF GRASSLAND HABITAT CLASSES IN THE ISLE OF MAN

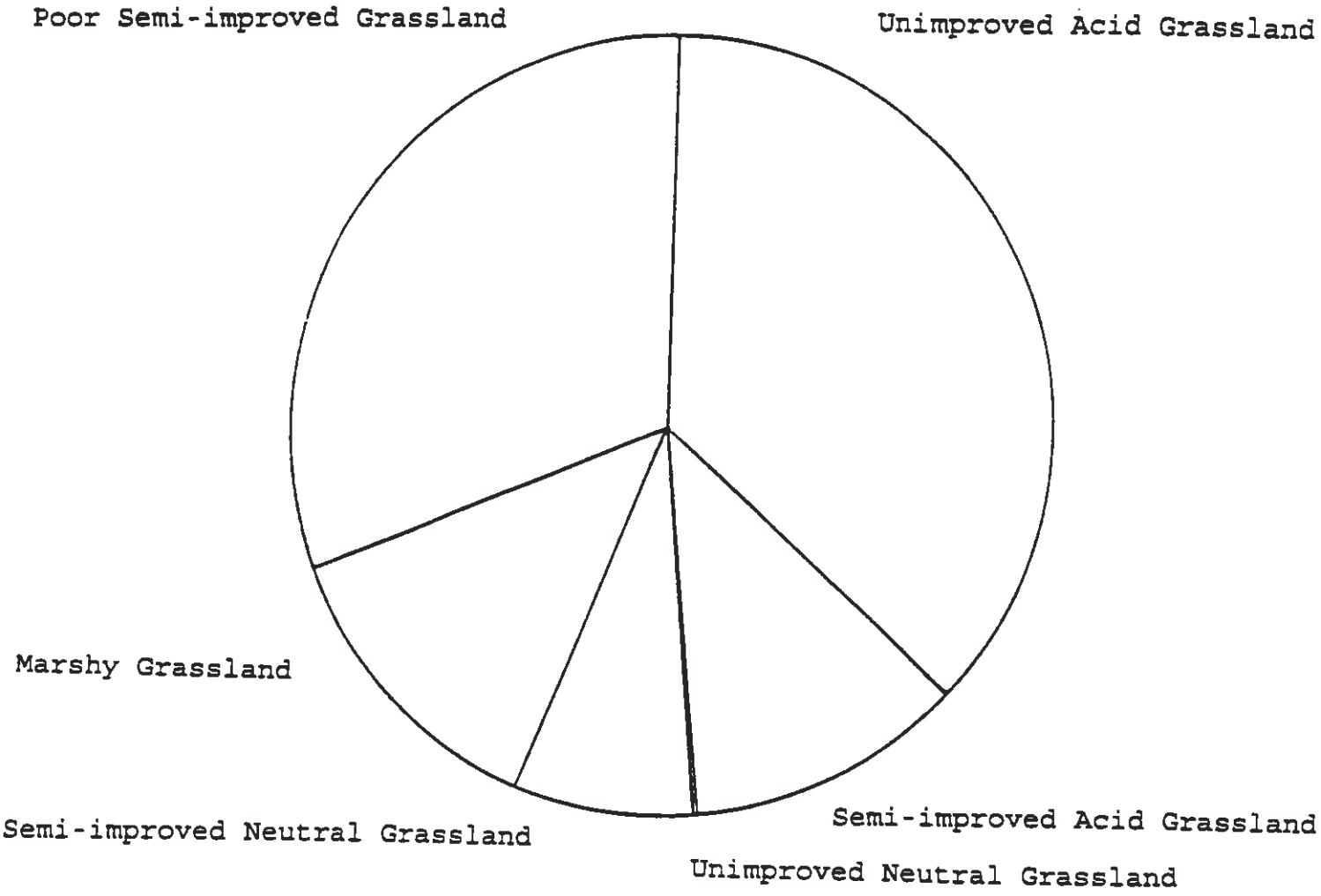


TABLE 5 ANALYSIS OF GRASSLAND HABITAT CLASSES IN THE ISLE OF MAN

GRASSLAND TYPE	TOTAL AREA ha	% OF ISLAND	% SEMI NAT.HAB.	% TOTAL GRASSLAND
Unimproved Acid	3,152.88	5.58	19.18	36.66
Semi-improved Acid	1,002.72	1.77	6.10	11.66
Unimproved Neutral	11.08	0.02	0.07	0.13
Semi-improved Neutral	633.96	1.12	3.86	7.37
Marshy	1,096.16	1.94	6.67	12.74
Poor semi-improved*	2,704.32	4.79	-	31.44
TOTAL	**8,601.12**	**15.22**	**35.88**	**100.00**

* not included as semi-natural vegetation

lanatus), mat-grass (*Nardus stricta*), bilberry (*Vaccinium myrtillus*), tormentil (*Potentilla erecta*) and western gorse (*Ulex gallii*). Other species commonly occurring in association with the above include heath bedstraw (*Galium saxatile*), purple moor-grass (*Molinia caerulea*) and heath rush (*Juncus squarrosus*).

Areas of acid grassland are good sites for a number of birds, for example, snipe and curlew; and for bryophytes, particularly in the wetter areas.

4.2.4 Neutral grassland

Neutral grassland encompasses a wide range of communities occurring on neutral soils (pH 5.5-7.0) with a number of dominant species.

Only 11.08 ha, 0.02% of the Island, was classified as unimproved neutral grassland. However, a number of sites recorded as semi-improved neutral grassland may in fact be unimproved because sites are only visited once and thus some communites may be missed due to seasonal effects. The largest area (8.24 ha) occurs in SC4096, notable for large numbers of greater butterfly orchids (*Platanthera chlorantha*). These fields persisted up until the survey date through beneficial management by the landowner.

4.2.5 Semi-improved neutral grassland

Semi-improved neutral grassland has been subjected to various agricultural improvements, resulting in modification of the sward composition. Consequently the range of species is less diverse and natural than that of unimproved neutral grassland. However, due to the scarcity of unimproved grassland, semi-improved grasslands are an increasingly important habitat.

Semi-improved neutral grassland covers 633.96 ha of the Island, which is only 1.12% of the Island and 3.86% of the semi-natural total. There is a variable species diversity, possessing indicator species of both unimproved and improved grassland. Many sites of semi-improved neutral grassland, particularly in the north within and around the curragh, and in the south around Grenaby, have a very high species diversity.

Typical species include Yorkshire-fog (*Holcus lanatus*), sweet vernal-grass (*Anthoxanthum odoratum*), common bird's-foot-trefoil (*Lotus corniculatus*), ribwort plantain (*Plantago lanceolata*), tormentil (*Potentilla erecta*), orchids (*Dactylorhiza* spp.), common knapweed (*Centaurea nigra*), sedges (*Carex* spp.), common vetch (*Vicia sativa*), yellow-rattle (*Rhinanthus minor*), meadow vetchling (*Lathyrus pratensis*), clovers (*Trifolium* spp.), yarrow (*Achillea millefolium*) and selfheal (*Prunella vulgaris*).

Roadside verges, and more particularly the sodhedges which form the commonest boundary type, have become increasingly important as the last remnants of unimproved grassland, preserving much of the meadow flora once present in the adjacent fields. A large number of verges have a high species diversity. A number are notable for their spring flowers such as pignut (*Conopodium majus*), primrose (*Primula vulgaris*), wood-sorrel (*Oxalis acetosella*), violets (*Viola* spp.) and ramsons (*Allium ursinum*), for example, in East and West Baldwin. Others are summer verges with orchids (*Dactylorhiza* spp.), for example, at Earystane; field scabious (*Knautia arvensis*), for example, along the A34; and dyer's greenweed (*Genista tinctoria*) along the A13. The Manx Nature Conservation Trust (MNCT) is currently undertaking verge surveys on the Island. The H.E.D.G.E. (Highways Edge Discussion Group on Ecology) has recently been established to advise on the management of hedges to meet the needs of conservation, land owners and road users.

The disused railway lines provide semi-natural grassland habitats through areas of predominantly agricultural land. The disused railway between Peel and Douglas is a particularly good example and, although periodically mown, has an excellent species diversity. Additional diversity is provided by the developing scrub and woodland associated with the rivers which run through this area. The central valley supports a wide variety of plant communities with a good diversity of insects and birds.

Due to their linear nature, roadside verges and the disused railways have immense value as wildlife corridors linking discrete habitat units. Thus in addition to their role as relict habitats and species reservoirs these sites are of considerable importance for nature conservation.

Neutral grasslands are particularly valuable for wildlife, especially insects, and thus birds.

4.2.6 Marshy grassland

Marshy grassland is a diffuse category covering certain purple moor-grass (*Molinia caerulea*) grasslands; those with a high proportion of rushes (*Juncus* spp.), sedges (*Carex* spp.) or meadowsweet (*Filipendula ulmaria*); and wet meadows and pastures supporting communities of species such as marsh-marigold (*Caltha palustris*) or common valerian (*Valeriana officinalis*) where broadleaved herbs rather than grasses predominate. Any poorly drained land where the cover of these species is more than 25% is classified as marshy grassland. The dominant species will vary with soil type and drainage.

Marshy grassland covers 1096.16 ha, 1.94% of the Island, 6.67% of the semi-natural habitat total. This habitat is scattered throughout the Island but particular concentrations occur in the Ballaugh curragh, Greeba curragh and around Grenaby. The sites are dominated either by rushes (*Juncus* spp.) or purple moor-grass *Molinia caerulea*), and may be species-rich or species-poor, occurring both in the uplands and lowlands.

In the uplands typical species found in association with these main species include sheep's-fescue (*Festuca ovina*), mat-grass (*Nardus stricta*), heath rush (*Juncus squarrosus*) and wavy hair-grass (*Deschampsia flexuosa*) in the drier areas, with *Sphagnum* spp., soft-rush (*Juncus effusus*), star sedge (*Carex echinata*), many-stalked spike-rush (*Eleocharis multicaulis*), cross-leaved heath (*Erica tetralix*) and common cottongrass (*Eriophorum angustifolium*) in the wetter areas.

Species-rich marshy grassland is generally dominated by soft-rush (*Juncus effusus*) and sharp-flowered rush (*Juncus acutiflorus*), frequently with meadowsweet (*Filipendula ulmaria*). A wide variety of herbs are associated with these including tormentil (*Potentilla erecta*), silverweed (*P. anserina*), orchids (*Dactylorhiza* spp.), devil's-bit scabious (*Succisa pratensis*), purple-loosestrife (*Lythrum salicaria*), wild angelica (*Angelica sylvestris*), common knapweed (*Centaurea nigra*), tufted vetch (*Vicia cracca*), wood-rushes (*Luzula* spp.), greater bird's-foot-trefoil (*Lotus pedunculatus*), horsetails (*Equisetum* spp.), sedges (*Carex* spp.), common valerian (*Valeriana officinalis*), ragged-robin (*Lychnis flos-cuculi*), lousewort (*Pedicularis sylvatica*), cuckooflower (*Cardamine pratensis*) and numerous Poaceae. This type occurs in quite large blocks, isolated fields and in poorly-drained corners of meadows and pastures.

Species-poor marshy grassland occurs in two distinct areas, fields within and around the periphery of the Ballaugh curragh and on the hills, particularly the northern hills. These sites tend to be dominated by soft-rush (*Juncus effusus*) and/or purple moor-grass (*Molinia caerulea*). Those in the hills are often associated with and grade into acid grassland, wet dwarf shrub heath and flush.

Marshy grasslands are often rich in invertebrates, particularly damselflies, dragonflies and butterflies; and are good sites for frogs, and birds such as curlew and lapwing.

4.2.7 Poor semi-improved grassland

The extent to which grassland is improved varies enormously. With low to moderate applications of fertilisers grasslands often retain some ecological interest. To allow for this continuum between semi-improved grassland and improved grassland, the intermediate category of poor semi-improved has been introduced. Any grassland appearing to have had some improvement but retaining some semi-natural characteristics or having been neglected has been recorded as poor semi-improved.

This category covers a wide range of levels of agricultural improvement and hence ecological interest, and encompasses the modified forms of all four types of unimproved grassland. The origins of the grassland are not specified in the survey and are not usually reflected by the species present which are, in general, similar to those of species-poor neutral grassland.

Poor semi-improved grassland covers 2704.32 ha, 4.79% of the Island, often occurring on proposed building sites (such as at Hillberry and the edge of Glen Vine Park), and in a number of cases has been allowed to develop on unfarmed agricultural land, for example, within and around the edges of the Ballaugh curragh and around Ballafayle-e-Callow, Maughold.

In general, poor semi-improved grassland has developed where management has ceased, facilitating tall, rank growth of grasses. Species diversity generally remains poor, with cock's-foot (*Dactylis glomerata*), perennial rye-grass (*Lolium perenne*), Yorkshire-fog (*Holcus lanatus*), false oat-grass (*Arrhenatherum elatius*), clovers (*Trifolium* spp.) and thistles (*Cirsium* spp.).

4.2.8 Improved grasslands

Grasslands may be improved by ploughing and reseeding, drainage, the application of artificial fertilisers, manure, lime or herbicides and continued heavy grazing. The result is a decline in the species diversity of the sward by creating conditions which favour the dominance of one or two coarse grass species and thus virtually eliminating the ecological interest of the grassland. Perennial rye-grass (*Lolium perenne*) is usually the dominant species. The only herbs present are those resistant to grazing by virtue of a rosette growth form or unpalatability, for example, daisy (*Bellis perennis*), greater plantain (*Plantago major*), creeping buttercup (*Ranunculus repens*) and thistles (*Cirsium* spp.). Improved grassland is generally used for grazing but may be cut for silage and hay. Continued application of fertilisers and herbicides perpetuates the dominance of these nutrient-demanding species, precluding generally uncompetitive species from the sward.

Reseeding destroys ecological interest as the resulting grassland is often a monoculture of perennial rye-grass (*Lolium perenne*). Clover (*Trifolium repens* and *T. pratense*) is frequently sown with the grass because of its ability to fix soil nitrogen. These temporary grass leys are recorded as arable land. For the purposes of area measurement improved and arable land have been measured together. This total will include the intervening hedges, ditches, farm tracks and often roads which have not been measured separately. Arable leys which have gained some species diversity through colonisation from surrounding land were usually classified as improved.

Improved grassland is of little ecological interest, especially botanically, although it may provide suitable habitats for ground nesting birds such as skylark and curlew, and feeding grounds for other birds, often pest species such as rook, jackdaw and crows, and for rabbits.

Improved grassland is particularly widespread on the Island at the margins of the northern hills, for example from Ramsey to Laxey, and from Kirk Michael to Peel; and in the southwest. Other lowland areas tend to be more arable in character.

4.3 TALL HERB AND FERN COMMUNITIES

4.3.1 Continuous bracken

Continuous bracken covers 1975.12 ha (3.5% of the Island, 12% of the semi-natural habitat total), forming extensive areas in three particular situations: valleys, for example, Laxey, Sulby and Agneash; coast, for example, Fleshwick to Cronk-ny-Arrey Laa and Bulgham slabs; and the Ayres. Scattered bracken has not been measured but is common in acid grassland and dry dwarf shrub heath.

The presence of dense bracken can be regarded as an indicator of suitability of soil conditions for the establishment of trees (by natural regeneration or planting), except for exposed coastal sites.

The development of dense bracken may represent the first stage of the succession to woodland and there are examples of areas of dense bracken which are presently developing scrub and trees, for example, in the Sulby and Glen Auldyn valleys. Typical species include hawthorn (*Crataegus monogyna*), rowan (*Sorbus aucuparia*), holly (*Ilex aquifolium*) and ash (*Fraxinus excelsior*).

Bracken spreads by underground rhizomes and spores, and suppresses other plants by the dense shade it casts in summer and its dense, slowly-decaying litter in winter.

There has been a marked spread of bracken on the Island associated with changes in agricultural practices. Formerly, cattle grazed and trampled the hills, which, in conjunction with cutting for bedding, prevented the spread of bracken. The hills are now grazed almost exclusively by sheep which do not trample the ground to the same extent. Bracken is difficult to eradicate once established and must be cut several times in a year to achieve this. It regenerates very quickly after burning and this may even encourage further growth downslope as the result of nutrients being released and washed downwards. The steep sides of the Sulby and Laxey River valleys are notable for the dense bracken on their lower slopes.

In general, bracken supports a limited flora and fauna and is regarded as unwanted because it is toxic to livestock. Bracken shoots do not appear until late spring/early summer enabling a variety of spring plants to complete their life cycles before being covered by a dense canopy of bracken fronds. Examples are primroses (*Primula vulgaris*), heath bedstraw (*Galium saxatile*), pignut (*Conopodium majus*) and bluebells (*Hyacinthoides non-scripta*); the latter are particularly spectacular in Sulby Glen on the lower slopes of Slieau Menagh.

4.3.2 Scattered bracken

Scattered bracken frequently occurs in conjunction with other habitats, generally as an intermediate stage in the transition to dense bracken.

4.3.3 Tall ruderal

Tall ruderal vegetation comprises stands of tall perennial or biennial dicotyledons, usually more than 25cm high, of species such as rosebay willowherb (*Chamerion angustifolium*), common nettle (*Urtica dioica*), thistles (*Cirsium* spp.) and Japanese knotweed (*Fallopia japonica*).

Tall ruderal vegetation covers 48.80 ha, 0.09% of the Island, which is 0.30% of the semi-natural habitat total. However, this figure is likely to be an underestimate as tall ruderal species frequently occur in isolated patches too small to map. Common sites include neglected field corners and in the grounds of abandoned dwellings. Japanese knotweed (*Fallopia japonica*) occurs on the Island mainly along riverbanks and paths in fairly small areas. Tall ruderal vegetation is most often dominated by hogweed (*Heracleum sphondylium*) with docks (*Rumex* spp.) and nettles (*Urtica dioica*), although rosebay willowherb (*Chamerion angustifolium*) and common ragwort (*Senecio jacobaea*) are quite frequent.

Some tall herb species can provide food and shelter for insects: for example, the caterpillars of the elephant hawkmoth feed on rosebay willowherb (*Chamerion angustifolium*) and those of the cinnabar moth on common ragwort (*Senecio jacobaea*). Small tortoiseshell, red admiral and peacock butterflies feed on common nettle (*Urtica dioica*). Many other butterflies, moths, bees, wasps, hoverflies and other insects are attracted to their nectar. The abundance of invertebrates attracts insect-feeding birds, and the seed-heads of thistles and other plants provide food for a variety of finches.

Tall herb communities form an important stage in the colonisation of waste land, eventually invaded by scrub and tree species. Tall herb stands often occur in association with other habitats such as neutral grassland and woodlands and help to increase their diversity.

4.3.4 Non-ruderal

This category is given to non-wooded stands of species such as lemon-scented fern (*Oreopteris limbosperma*), lady fern (*Athyrium filix-femina*), buckler-ferns (*Dryopteris* spp.), or great wood-rush (*Luzula sylvatica*).

This category has not been recorded on any of the maps but the habitat does occur on the Island. On the slopes of Carraghan, Snaefell and North Barrule there are areas dominated by great wood-rush (*Luzula sylvatica*), thought to be residual from the time when these areas were wooded.

4.4 HEATHLAND

4.4.1 Introduction

Heathland includes vegetation dominated by ericoids or dwarf gorse species as well as heaths dominated by lichens and bryophytes. This type of habitat generally occurs on well-drained acid soils. Heathland is further distinguished by being arbitrarily defined as occurring on peat < 0.5m deep.

Heather dominated dwarf shrub heath is limited in its geographical extent to northwest Europe and is centred on Britain. Extensive tracts only remain in Scotland, northwest Spain, northern England and coastal regions of northern France. The landscape, plant and animal communities of the British uplands are of major scientific and conservation importance. The wildlife is very diverse and many features are of international significance being rare or localised on a global scale but well represented in Britain. The large expanses of blanket bog and dwarf shrub heath are the most notable. Heathland plants such as bell heather (*Erica cinerea*) and western gorse (*Ulex gallii*), abundant in parts of Britain (and on the Manx hills), have highly restricted distributions.

A number of characteristic British moorland birds are associated, to varying degrees, with heather dominated communities and require extensive areas of heather as a feeding range if viable populations are to be maintained. Upland habitats as a whole support a breeding bird assemblage which includes several internationally important populations. Peregrine and raven are particularly significant in having very high population densities, or main strongholds, in upland Britain and have good populations on the Island. Hen harrier reaches greater numbers locally in Britain than elsewhere in Europe. The British hen harrier represents 24% of the European Community population (Marsden, 1990), while it is estimated that the Isle of Man has perhaps as much as 10% of the British hen harrier population. Any area regularly supporting 1% or more of a biogeographical population is regarded as significant at an international level (Pritchard et al, 1992). Peregrine and hen harrier are listed in Annex 1 of the EEC Directive on the conservation of Wild Birds which requires that special measures be taken to conserve their habitats.

Heathland covers 5955.66 ha, 10.54% of the Island. This total does not include the area of lichen-bryophyte heath as this is a unique habitat found only at the coast and has thus been included in section 4.8.5. Heathland occurs in three main blocks: the northern hills, southern hills, and Mull Hill to The Sound. A number of very small sites of heathland occur in the lowlands usually associated with marshy grassland and/or semi-improved neutral grassland, for example, at SC270748, SC378792 and SC316744.

Table 6 presents an analysis of the heathland classes on the Island, diagrammatically illustrated in Figure 9.

4.4.2 Dry dwarf shrub heath

Dry dwarf shrub heath is categorised as having vegetation with >25% cover of ericoids or small gorse species in relatively dry situations. It was decided that for the purposes of this survey, the presence of western gorse (*Ulex gallii*), would be indicated on the map as either scattered or dense scrub but has been included in dry dwarf shrub heath when present with other ericoids.

Dry dwarf shrub heath covers 5645.72 ha, 9.99% of the Island, and is the largest semi-natural habitat, 34.34%. The largest continuous block of this habitat, 2143.34 ha, includes Greeba Mountain, Beary Mountain, Colden, Slieau Maggle, Slieau Freoaghane, Slieau Dhoo, Slieau Ouyr and Mount Karrin. Three large, but smaller blocks occur on the eastern edge at Slieau Ree and Slieau Meayll; Slieau Lhean and The Dreem, and Slieau Managh. A further large block of 1324.66 ha occurs from Fleshwick Bay through to South Barrule.

The dominant species are heather (*Calluna vulgaris*), bell heather (*Erica cinerea*) and bilberry (*Vaccinium myrtillus*). Other typical plants include mat-grass (*Nardus stricta*), heath rush (*Juncus squarrosus*), green-ribbed sedge (*Carex binervis*), sheep's-fescue (*Festuca ovina*), tormentil (*Potentilla erecta*), heath bedstraw (*Galium saxatile*), common milkwort (*Polygala vulgaris*) and heath-grass (*Danthonia decumbens*). In transitional types of heath, purple moor-grass (*Molinia caerulea*) and many-stemmed spike-rush (*Eleocharis multicaulis*) are often present, and occasionally crowberry (*Empetrum nigrum*) and common cottongrass (*Eriophorum angustifolium*).

4.4.3 Wet dwarf shrub heath

Wet dwarf shrub heath has more than 25% cover of ericoids and/or small gorse species on shallow peat (<0.5m). Purple moor-grass (*Molinia caerulea*) is often dominant and there is generally some *Sphagnum* spp. Bell heather

(*Erica cinerea*) is not usually present in any significant quantity.

This habitat covers 309.94 ha, 0.55% of the Island, predominantly in the uplands but small sites are present in the lowlands as indicated for dry heath. Wet heath tends to occur on the lower slopes of the hills usually associated with water courses, for example, in Glen Rushen and its tributaries, and around Windy Common and Granite Mountain.

Typical species include cross-leaved heath (*Erica tetralix*), purple moor-grass (*Molinia caerulea*) and heather (*Calluna vulgaris*) with *Sphagnum* spp., common cottongrass (*Eriophorum angustifolium*), hare's-tail cottongrass (*E. vaginatum*), sharp-flowered rush (*Juncus acutiflorus*), bulbous rush (*J. bulbosus*), heath rush (*J. squarrosus*), jointed rush (*J. articulatus*), common milkwort (*Polygala vulgaris*) and many-stalked spike-rush (*Eleocharis multicaulis*). Bog asphodel (*Narthecium ossifragum*) and round-leaved sundew (*Drosera rotundifolia*) were also recorded on some sites.

The wet heathland community is closely associated floristically with that of peatland communities and they often grade into each other. Due to the inability to determine the depth of peat, it is possible that small areas of wet heath should be classified as bog.

4.4.4 Dry heath/acid grassland mosaic

This vegetation type is a mix of dry heath and acid grassland with the relative proportions of each recorded where possible. For the purposes of this survey the total has been divided 50/50 between dry heath and acid grassland unless stated from field observation. This habitat occurs in the northern and southern hills. In the south there is very little mosaic, generally occurring on the periphery of the area, for example, below the Round Table road (SC221736). In the north there are some quite large areas, for example, at Lhargee Ruy and above Sulby Reservoir between Glen Crammag and Lhergyrhenny.

This habitat generally forms when sheep grazing (and/or burning) causes the dwarf shrub vegetation to be partly replaced by grasses. Typical species include mat-grass (*Nardus stricta*), heather (*Calluna vulgaris*), bilberry (*Vaccinium myrtillus*) and wavy hair-grass (*Deschampsia flexuosa*).

4.4.5 Wet heath/acid grassland mosaic

This vegetation type is a mix of wet heath and acid grassland with the relative proportions of each recorded where possible. This habitat was recorded only below Cronk y Vaare on the eastern edge of the northern hills.

The dominant species are heather (*Calluna vulgaris*) and purple moor-grass (*Molinia caerulea*). Other species found include mat-grass (*Nardus stricta*), sheep's-fescue (*Festuca ovina*), heath rush (*Juncus squarrosus*), soft-rush (*J. effusus*), bilberry (*Vaccinium myrtillus*), tormentil (*Potentilla erecta*), many-stalked spike-rush (*Eleocharis multicaulis*), bell heather (*Erica cinerea*), heath bedstraw (*Galium saxatile*), western gorse (*Ulex gallii*), brown bent (*Agrostis vinealis*) and green-ribbed sedge (*Carex binervis*).

FIGURE 9 RELATIVE PROPORTIONS OF UPLAND (HEATH & MIRE) HABITAT CLASSES IN THE ISLE OF MAN

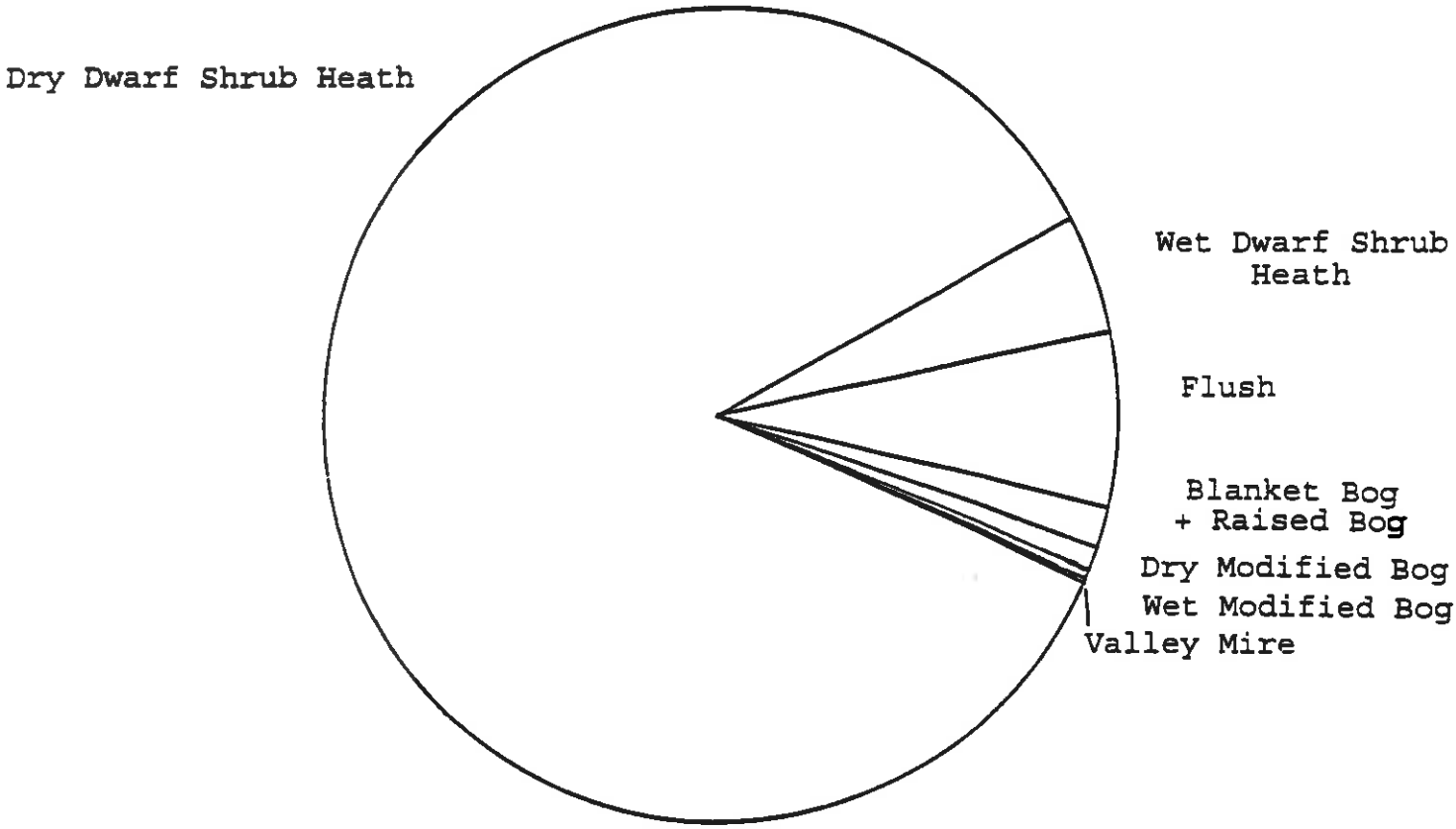


TABLE 6 ANALYSIS OF UPLAND HABITAT CLASSES IN THE ISLE OF MAN

HABITAT TYPE	TOTAL AREA ha	% OF ISLAND	% SEMI NAT.HAB.	% TOTAL HEATH/MIRE
Dry Dwarf Shrub Heath	5,645.72	9.99	34.34	85.22
Wet Dwarf Shrub Heath	309.94	0.55	1.89	4.68
Flush	455.24	0.81	2.77	6.87
Blanket Bog	105.72	0.19	0.64	1.60
Raised Bog	0.36	-	-	-
Dry Modified Bog	67.36	0.12	0.41	1.02
Wet Modified Bog	26.08	0.05	0.16	0.39
Valley Mire	14.56	0.03	0.09	0.22
TOTAL	**6,624.98**	**11.74**	**40.30**	**100.00**

4.5 MIRE

4.5.1 Introduction

Mires generally occur on deep peat (over 0.5m thick) with the water table at or just below the surface, but flushes and springs are also included in this category and these occur over shallow peat.

The term bog refers to ombrotrophic mires (blanket and raised bogs), which are fed only by direct precipitation while fens, flushes and springs, fed by ground water or streams, are termed minerotrophic. The distinction between these mires is often difficult to determine in the field and they often form a mosaic.

Mire covers 669.32 ha, 1.18% of the Island, which is 4.07% of the semi-natural habitat total. Table 6 presents an analysis of the mires, while Figure 9 illustrates the relative proportions within each class.

4.5.2 Bog

Bogs are characterised by the presence of deep peat, arbitrarily set at a minimum depth of 0.5m to distinguish them from wet heathland, and are ombrotrophic i.e. dependent only upon precipitation for peat formation. Ericoids, cottongrass (*Eriophorum* spp.) and/or *Sphagnum* species are normally dominant, although on occasion purple moor-grass (*Molinia caerulea*) may be dominant. Unmodified bog includes blanket bog and raised bog.

4.5.2.1 Blanket bog

Blanket bog comprises species-rich vegetation on deep peat, forming a blanket over both concave and convex surfaces on level to moderately sloping ground in the uplands. Drainage is usually diffuse and undisturbed blanket bog often shows a hummock-and-hollow structure, with *Sphagnum*-rich pools in the hollows. Blanket bog includes watershed mires, saddle mires, terrace bog and valleyside mire, and may also include other mire types where these occur within the blanket bog complex. This habitat category is used for relatively undamaged blanket bog with *Sphagnum* spp. usually abundant.

Blanket bog is rare on a global scale, but widely and extensively developed in the British uplands with at least 7%, possibly 13%, of the world resource. Other major examples are in Ireland, Japan and Newfoundland but many of these areas are highly dissected and fragmentary (Marsden, 1990).

Blanket bog covers 105.72 ha, 0.19% of the Island, which is 0.64% of the semi-natural habitat total. It is found exclusively in the northern block of hills, particularly on the north-facing slopes above Sulby Reservoir. The inability to determine peat depth may have resulted in an underestimation of the total area of this habitat.

Blanket bog is generally dominated by common cottongrass (*Eriophorum angustifolium*), hare's-tail cottongrass (*E. vaginatum*) and *Sphagnum* spp. Other species commonly occurring include purple moor-grass (*Molinia caerulea*), heather (*Calluna vulgaris*), pondweeds (*Potamogeton* spp.), marsh violet (*Viola palustris*), marsh pennywort (*Hydrocotyle vulgaris*), carnation sedge (*Carex panicea*), star sedge (*C. echinata*), mat-grass (*Nardus stricta*), heath rush (*Juncus squarrosus*), bulbous rush (*J. bulbosus*), sharp-flowered rush (*J. acutiflorus*), bog asphodel (*Narthecium ossifragum*), cross-leaved heath (*Erica tetralix*), round-leaved sundew (*Drosera rotundifolia*), many-stalked spike-rush (*Eleocharis multicaulis*), heath milkwort (*Polygala serpyllifolia*) and tormentil (*Potentilla erecta*). Small pools of open water are sometimes present.

4.5.2.2 Raised bog

Raised bogs occur on level areas with impeded drainage in the lowlands. In a classic raised bog, a rare habitat in Britain, the peat is several metres deep forming a dome.

Only one very small area of 0.36 ha was classified as raised bog and this occurs at SC284816, Port-y-Candass, in the moat of a round house. The area was dominated by *Sphagnum* spp. and *Polytrichum* spp. with abundant bottle sedge (*Carex rostrata*). Other species found include sharp-flowered rush (*Juncus acutiflorus*), bogbean (*Menyanthes trifoliata*), cuckooflower (*Cardamine pratensis*), wild angelica (*Angelica sylvestris*) and common sedge (*Carex nigra*).

4.5.2.3 Wet modified bog

This category comprises modified bog vegetation with little or no *Sphagnum* spp., often with bare peat and

patches of deergrass (*Trichophorum cespitosum*) and/or purple moor-grass (*Molinia caerulea*). Ericoids may be abundant, sparse or absent.

Wet modified bog covers only 26.08 ha, 0.05% of the Island, mainly in the Ballaugh curragh but with smaller areas in the northern hills: below The Bungalow and in the Laxey valley at SC403872 and SC414867. Wet modified bog represents only 0.16% of the semi-natural habitat total.

In the hills, purple moor-grass (*Molinia caerulea*) is the dominant vegetation. Other species recorded include common sedge (*Carex nigra*), star sedge (*C. echinata*), green-ribbed sedge (*C. binervis*), mat-grass (*Nardus stricta*), tormentil (*Potentilla erecta*), heath grass (*Danthonia decumbens*), common cottongrass (*Eriophorum angustifolium*), bulbous rush (*Juncus bulbosus*), marsh violet (*Viola palustris*), bog asphodel (*Narthecium ossifragum*) and cross-leaved heath (*Erica tetralix*).

In the curragh, wet modified bog is generally dominated by one or a combination of the following: bogbean (*Menyanthes trifoliata*), purple moor-grass (*Molinia caerulea*), bog myrtle (*Myrica gale*), bottle sedge (*Carex rostrata*) or marsh cinquefoil (*Potentilla palustris*), often with encroaching grey willow (*Salix cinerea* ssp. *oleifolia*). Other species typically occurring include devil's-bit scabious (*Succisa pratensis*), *Sphagnum* spp., tormentil (*Potentilla erecta*), water horsetail (*Equisetum fluviatile*), meadowsweet (*Filipendula ulmaria*), sharp-flowered rush (*Juncus acutiflorus*), wild angelica (*Angelica sylvestris*), purple-loosestrife (*Lythrum salicaria*), common cottongrass (*Eriophorum angustifolium*), water mint (*Mentha aquatica*), marsh pennywort (*Hydrocotyle vulgaris*), sedges (*Carex* spp.) and orchids (*Dactylorhiza* spp.).

4.5.2.4 Dry modified bog

The vegetation of dry modified bog is dominated by heather (*Calluna vulgaris*) and other ericoids or by hare's-tail cottongrass (*Eriophorum vaginatum*) on peat more than 0.5m deep. *Sphagnum* spp. is notably absent but under the dwarf shrubs there may be a carpet of hypnoid mosses, with lichens such as *Cladonia arbuscula*. Where hare's-tail cottongrass (*Eriophorum vaginatum*) is dominant, other species may be sparse or absent. This habitat is typical of areas of blanket bog or raised bog subject to heavy grazing, burning and draining.

Dry modified bog covers 67.36 ha, 0.12% of the Island, which represents 0.41% of the semi-natural habitat total. It only occurs in the northern hills, for example, on the lower slopes of Beinn y Phott (47.04 ha) and Snaefell. The area of Beinn y Phott has been and still is being cut over for peat and is dominated by hare's-tail cottongrass (*Eriophorum vaginatum*) with common cottongrass (*E. angustifolium*) and bilberry (*Vaccinium myrtillus*). Other species found include crowberry (*Empetrum nigrum*), wavy hair-grass (*Deschampsia flexuosa*), sheep's-fescue (*Festuca ovina*), heath rush (*Juncus squarrosus*), green-ribbed sedge (*Carex binervis*), star sedge (*C. echinata*), common sedge (*C. nigra*), mat-grass (*Nardus stricta*), tormentil (*Potentilla erecta*), great wood-rush (*Luzula sylvatica*) and purple moor-grass (*Molinia caerulea*). *Sphagnum* spp. were present but infrequent and several pools of standing water were observed.

4.5.3 Flush and spring

4.5.3.1 Introduction

These types of minerotrophic mire are termed soligenous because they are associated with water movement, for example, along stream courses. They may or may not form over peat, but where they do, the peat is often less than 0.5m deep. Flushes occur on gently sloping ground, are often linear or triangular and may include small watercourses. They may be extensive or too small to map, in which case they are target noted. Where flushes feed a fen they are target noted and mapped as an integral part of the mire complex, unless they are very large and distinct, when they are individually mapped.

Flushes typically have an open or closed ground layer of *Sphagnum* spp. and/or other bryophytes together with small sedges (*Carex* spp.) and rushes (*Juncus* spp.). The presence of a well-developed bryophyte ground layer and the lack of dominant grasses distinguishes flush habitats from marshy grassland and from wet acid, neutral and calcareous grasslands. Complex mosaics of grassland, heath, bog and flush are very common in the north.

Flushes may be acid, neutral or basic. Only acid/neutral flushes occur on the Island.

4.5.3.2 Acid/neutral flush

Acid/neutral flush covers 455.24 ha, 0.81% of the Island, which represents 2.77% of the semi-natural habitat

total. Acid/neutral flush occurs in the hills, predominantly in the north. However, as this vegetation type is often linear and frequently small, it is likely to be under-recorded and the area measurement likely to be an underestimate. Flushes are often found in association with marshy grassland and wet dwarf shrub heath.

There are a number of very large but species-poor flushes in the Island, for example at the head of the Blaber River (SC323832).

In general, the acid/neutral flushes are dominated by *Sphagnum* spp. with rushes, particularly soft-rush (*Juncus effusus*) and sharp-flowered rush (*J. acutiflorus*). Other species frequently occurring include bulbous rush (*Juncus bulbosus*), heath rush (*J. squarrosus*), marsh violet (*Viola palustris*), purple moor-grass (*Molinia caerulea*), star sedge (*Carex echinata*), carnation sedge (*C. panicea*), common yellow-sedge (*C. viridula*), marsh pennywort (*Hydrocotyle vulgaris*) and many-stalked spike-rush (*Eleocharis multicaulis*). Round-leaved sundew (*Drosera rotundifolia*) was recorded in a number of sites, while orchids (*Dactylorhiza* spp.) were noted at SC234751. The flush at SC367910 was noted for having bogbean (*Menyanthes trifoliata*) and pondweeds (*Potamogeton* spp.).

Flushes are excellent sites for invertebrates and amphibians.

4.5.4 Fen

4.5.4.1 Introduction

Fens are defined as minerotrophic mires, usually over peat more than 0.5m deep. The water table is at or just below the surface. Fens differ from bogs in that they are dependent on ground water rather than precipitation for *Sphagnum* spp. and peat to develop. Three main types of fen can be distinguished using topographic rather than vegetational criteria. These are valley mire, which because there is obvious water flow, is classified as soligenous, and basin and flood plain mires, which have impeded drainage and are termed topogenous.

4.5.4.2 Valley mire

A valley mire develops along the lower slopes and floor of a small valley and receives water from springs and seepages on the valley sides, feeding a central watercourse. Such a fen can be distinguished from a flush because the former is a complex, whereas a flush is a discrete single feature, usually of limited extent.

Valley mires are often dominated by acidophilous vegetation containing *Sphagnum* spp., sedges (*Carex* spp.) and ericoids. Floating mats of mosses and sedges may be present. Valley mires are frequently associated with flushes which feed into them.

Valley mire covers 14.56 ha, 0.03% of the Island, which accounts for 0.09% of the total area of semi-natural vegetation. Valley mire occurs along the Druidale Valley, the Laxey River and at the head of Glen Roy, SC402833. Common cottongrass (*Eriophorum angustifolium*) is usually the dominant species with purple moor-grass (*Molinia caerulea*) and hare's-tail cottongrass (*Eriophorum vaginatum*). Other species typically occurring include *Sphagnum* spp., soft-rush (*Juncus effusus*), bulbous rush (*J. bulbosus*), heath rush (*J. squarrosus*), jointed rush (*J. articulatus*), heather (*Calluna vulgaris*), star sedge (*Carex echinata*), many-stalked spike-rush (*Eleocharis multicaulis*), tormentil (*Potentilla erecta*), round-leaved sundew (*Drosera rotundifolia*), mat-grass (*Nardus stricta*) and bog asphodel (*Narthecium ossifragum*).

4.5.4.3 Basin mire

This type of fen develops in a waterlogged basin and contains very little open water. The water table within the basin is level, but small flushes may occur around the edges and there is limited through flow of water. The vegetation may be dominated by *Sphagnum* spp., together with bottle sedge (*Carex rostrata*) and ericoids, or by tall swamp plants.

This survey found several examples of basin mire which were too small to map and measure in the area calculations, hence are described in target notes. The basin mire has developed, or is developing, within former ponds (for example, on the slopes of Snaefell at SC339870 and South Barrule at SC265778) or lagoons (at Snaefell mines, SC405873), and is dominated by a mat of *Sphagnum* spp. with cottongrasses (*Eriophorum* spp.) and small sedges (*Carex* spp.) and rushes (*Juncus* spp.).

4.5.5 Bare peat

Patches of bare peat more than 0.25 ha in extent (i.e. approximately 50 x 50m) should be mapped. However, while this survey recorded several areas of bare peat, none were more than 0.25 ha. The areas of bare peat, described in target notes, are associated with peat digging, for example, on the slopes of Beinn-y-Phott (SC385868), Snaefell (SC402885) and Mullagh Ouyr (SC397865).

4.6 SWAMP, MARGINAL AND INUNDATION

4.6.1 Introduction

This category encompasses emergent or frequently inundated vegetation, occurring on peat or mineral soils where the water table is above the surface for most of the year.

Table 7 presents the relative proportions of standing water, swamp and inundation vegetation on the Isle of Man, diagrammatically illustrated in Figure 10.

4.6.2 Swamp

Swamp vegetation represents the transition between aquatic vegetation and that of dry land. Swamp is generally found in standing water, but may be found in sites rarely flooded, for example, in the later stages of the seral succession to marshy grassland.

Species composition varies with the trophic status of the water and the substrate. Swamp is dominated by tall monocotyledonous species such as bulrush (*Typha* spp.), common reed (*Phragmites australis*), reed canary-grass (*Phalaris arundinacea*) and tall sedges such as greater tussock-sedge (*Carex paniculata*) and bottle sedge (*Carex rostrata*). In deep water swamp vegetation tends to consist of a single species. Strips of swamp of less than 5m in width at the edges of watercourses are classified as marginal vegetation.

Swamp vegetation covers 19.00 ha, 0.03% of the Island and accounts for 0.12% of the semi-natural habitat total. However, this will be an underestimate due to the small size of many of the sites. Most of this habitat occurs in the north of the Island, with the largest examples at Lough Cranstal (2.20 ha) and Dog Mills (1.32 ha). These sites are dominated by common reed (*Phragmites australis*) or reed canary-grass (*Phalaris arundinacea*). Lough Cranstal is notable for being the only site for greater pond-sedge (*Carex riparia*) on the Island and also has bulrush (*Typha latifolia*) which is fairly local in its distribution.

Unusually there are some areas of swamp along the coast north of Niarbyl. Other significant areas occur associated with the Eairy Dam and along the Sulby River upstream of the White Bridge, SC434949. The latter site is dominated by common reed (*Phragmites australis*), and a pair of nesting mute swans were observed at the time of survey.

4.6.3 Marginal vegetation

This includes all strips of vegetation of less than 5m in width at the edges of watercourses, where the water table is permanently high.

This habitat is typically found around dubs (ponds) and along the edges of ditches and slow-flowing streams.

Species typical of marginal vegetation include sweet-grasses (*Glyceria* spp.), water-cress (*Rorippa nasturtium-aquaticum*), fool's water-cress (*Apium nodiflorum*), water-plantains (*Alisma* spp.), water-dropworts (*Oenanthe* spp.), common marsh-bedstraw (*Galium palustre*), forget-me-nots (*Myosotis* spp.), soft-rush (*Juncus effusus*), branched bur-reed (*Sparganium erectum*) and water-speedwells (*Veronica* spp.). There may also be small stands of taller plants such as bulrush (*Typha* spp.), reed canary-grass (*Phalaris arundinacea*) and common reed (*Phragmites australis*).

Such areas are by definition too small to map and are described in target notes.

4.6.4 Inundation Vegetation

This category includes open, unstable communities, subject to periodic inundation, as found on sorted or unsorted silts, sands and gravels of river beds and islands and on the draw-down zone around pools, lakes and reservoirs.

This habitat was frequently found around the edges of dubs and was described in target notes. Inundation vegetation covers 5.56 ha, 0.01% of the Island and represents 0.03% of the semi-natural habitat total. Only two areas were large enough to map, at Ballacorey (SC436992) and in the drawdown zone of Cringle Reservoir. The former area was dominated by floating sweet-grass (*Glyceria fluitans*), marsh foxtail (*Alopecurus geniculatus*) and marsh cudweed (*Gnaphalium uliginosum*). The drawdown zone of Cringle Reservoir is dominated by marsh arrowgrass (*Triglochin palustre*) with lesser spearwort (*Ranunculus flammula*), marsh pennywort (*Hydrocotyle*

vulgaris), floating sweet-grass (*Glyceria fluitans*), bulbous rush (*Juncus bulbosus*), marsh foxtail (*Alopecurus geniculatus*) and marsh cudweed (*Gnaphalium uliginosum*). Other species commonly found in this habitat include knotgrasses (*Polygonum* spp.), bur-marigolds (*Bidens* spp.), soft-rush (*Juncus effusus*) and creeping bent (*Agrostis stolonifera*), as well as many ruderal species.

Despite their small size sites of swamp and inundation vegetation are important for wildlife. The variety and abundance of vegetation above and below the water level provides a wide range of habitats for invertebrates, particularly dragonflies and damselflies, and thus vertebrates such as birds and amphibians. This habitat provides food, cover and nesting sites for moorhen, coot, grasshopper warblers and ducks. Many sites are surrounded and/or being invaded by willows which increases the diversity of the habitat. Examples of this can be found at Lough Cranstal and Curragh Beg.

FIGURE 10 RELATIVE PROPORTIONS OF SWAMP, INUNDATION & STANDING WATER HABITAT CLASSES IN THE ISLE OF MAN

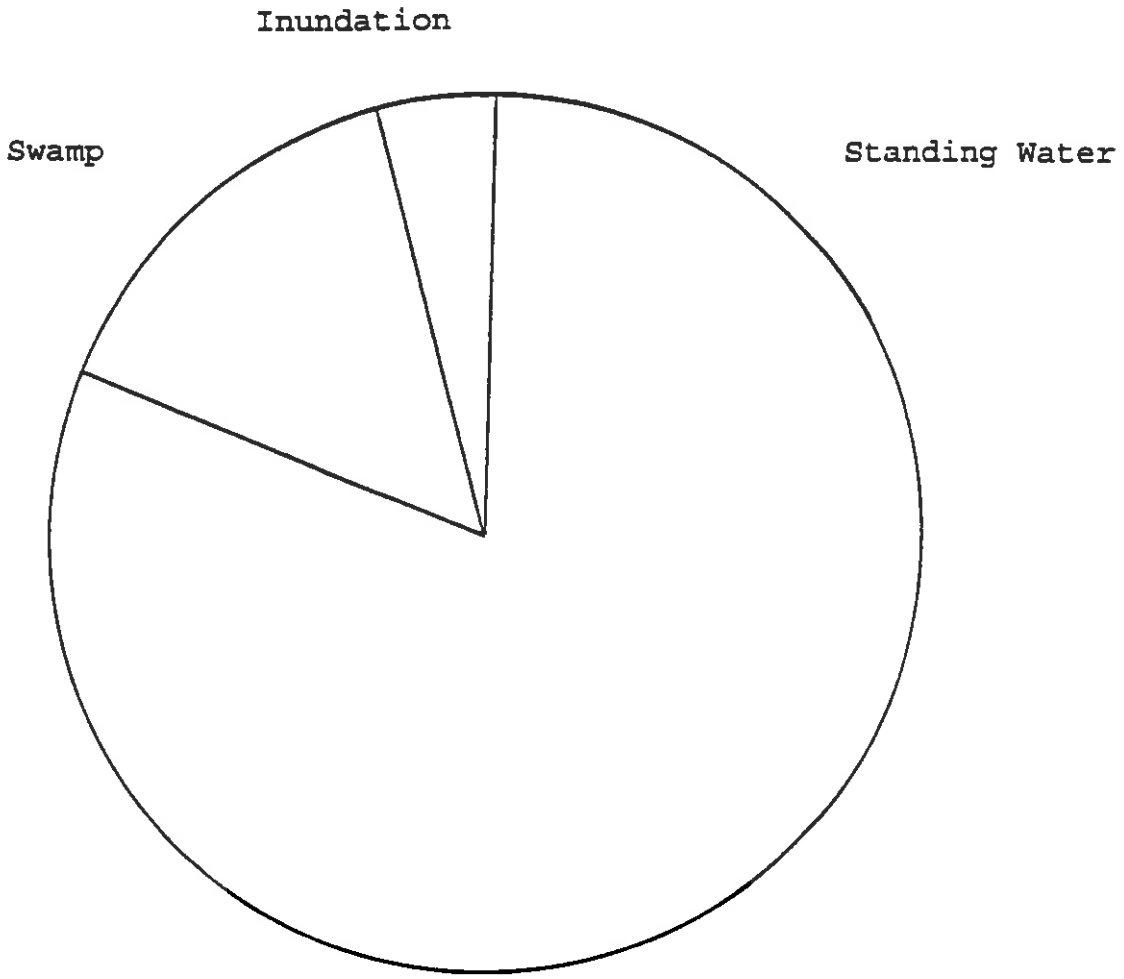


TABLE 7 ANALYSIS OF SWAMP, INUNDATION & STANDING WATER HABITAT CLASSES IN THE ISLE OF MAN

HABITAT TYPE	TOTAL AREA hectares	% OF ISLAND	% SEMI-NAT HABITAT	% AQUATIC HABITAT
Standing Water	103.08	0.18	0.63	80.76
Swamp	19.00	0.03	0.12	14.89
Inundation	5.56	0.0098	0.03	4.35
TOTAL	**127.64**	**0.2198**	**0.78**	**100.00**

4.7 OPEN WATER

4.7.1 Introduction

Open water is defined as water lying beyond the limits of swamp or emergent vegetation, although it may contain submerged, free-floating or floating-leaved vegetation. This category includes running and standing water and forms an important habitat for flora and fauna.

Table 7 presents the relative proportions of standing water, swamp and inundation vegetation on the Isle of Man, diagrammatically illustrated in Figure 10.

4.7.2 Standing water

Standing water covers 103.08 ha, 0.18% of the Island, although this will be an underestimate since most sites were too small to be included within area measurements.

On the Isle of Man reservoirs represent most of the standing water area total. They include:

Sulby	Block Eary	West Baldwin
Kion Slieau	Ballure	Cringle
Clypse	Kerrowdhoo	Eairy

In addition, there are small reservoirs at Ballamoar (Patrick), Glen Roy, Earystane and Agneash. Two of the three reservoirs at Earystane have open water with some limited inundation and marginal vegetation, while the third had a well-developed aquatic mat of vegetation including pondweeds (*Potamogeton* spp.), bulbous rush (*Juncus bulbosus*), lesser spearwort (*Ranunculus flammula*) and creeping bent (*Agrostis stolonifera*), with other aquatic plants.

The remainder of the standing water on the Island falls into four main categories:

4.7.2.1 Hill Ponds

These tend to be peaty and are often ephemeral. Examples include those at SC411915. Hill ponds are generally devoid of vegetation although those at SC340883 were choked with common cottongrass (*Eriophorum angustifolium*), hare's-tail cottongrass (*E. vaginatum*) and a filamentous pondweed (*Potamogeton* sp.). There was usually a limited fringe of marginal vegetation.

4.7.2.2 Flooded Quarries

Examples are those at Billown (limestone quarries: see section 4.9.2.1), Glen Rushen (slate) and Oatlands, Santon (sand and gravel). At SC246782 there is a quarry, now a reservoir, with frequent common butterwort (*Pinguicula vulgaris*) and abundant bog asphodel (*Narthecium ossifragum*).

4.7.2.3 Dubs

This is the Manx name for ponds of any size, generally used to describe the flooded clay and marl pits, and glacial kettle holes, found particularly in the north of the Island. Many of them have a rich flora and may contain plants rare or absent in the rest of the Island; they are also attractive sites for wildfowl. Botanically, among the most interesting dubs are those at Loughcroute, the Nappin, Curragh y Cowle (now infilled by tall swamp and marshy grassland vegetation) and Ballakinnag, supporting species such as golden dock (*Rumex maritimus*), bur-marigolds (*Bidens* spp.), grey club-rush (*Schoenoplectus tabernaemontani*, northern yellow-cress (*Rorippa islandica*) and sometimes pennyroyal (*Mentha pulegium*).

A number of the northern ponds are being lost through neglect leading to natural infill or shrinkage through unchecked plant growth while others have been actively filled-in or are used as rubbish dumps. Some, such as the Glascoe dub, are highly eutrophic due to drainage of nutrients from farmland. The Glascoe, Ballacorey and Ballacain dubs are important sites for visiting and breeding wildfowl.

4.7.2.4 Created Ponds

Existing ponds of various sizes are to be found in the grounds of large houses and in amenity areas. Recently an increasing number of ponds have been created in gardens and for wildlife, for example, at SC256721, SC258724 and SC272744.

A number of these sites of open water are good for wildlife. The smaller sites with surrounding vegetation are good for insects, particularly damselflies and dragonflies, and many sites have frogs. The large reservoirs are generally fairly limited in their wildlife interest although Kerrowdhoo reservoir is a good site for wintering waterfowl.

4.7.3 Running water

Water courses are numerous but are generally small, all in the form of rivers and their tributaries. All the rivers are well below the arbitrary limit for map measurement in being less than 25m wide, consequently no data is available for the area covered by running water.

On the northern plain the two main water courses are the Lhen Trench and the Killane River, with the Sulby River flowing along the boundary between the hills and the northern plain. There are also a number of ditches. Reed canary-grass (*Phalaris arundinacea*), common reed (*Phragmites australis*) and hemlock water-dropwort (*Oenanthe crocata*) are widespread particularly around slow-flowing water-courses, such as the Lhen Trench and Killane River. Swamp vegetation is developing along the Sulby River (see section 4.6.2) with saltmarsh on the tidal stretch (see section 4.8.2).

The southern lowlands are drained by several rivers, the main ones being the Colby River, the Silverburn, the Santan Burn and the Crogga and Port Soderick Rivers.

The River Neb and the Greeba River, which becomes the River Dhoo, flow through the central valley, draining both the northern and southern hills. The River Glass and the Baldwin River flow parallel to each other and south through the northern hills to join the River Dhoo at Douglas. The other main rivers draining the northern hills are the Sulby River, flowing north to the northern plain and the Laxey and Glen Roy Rivers flowing south and east to converge and enter the sea at Laxey. The main river flowing through the southern hills is the Glen Mooar River which enters the sea at Glen Maye. Some of the upland stream valleys are sites for lemon-scented fern (*Oreopteris limbosperma*).

There are numerous smaller rivers in the Island which are also of ecological importance. Due to restrictions of time and accessibility it was not possible to make full surveys of rivers and streams, a process which would have necessitated walking their lengths.

In the hills the rivers appear clean but in the lowlands many are polluted with industrial, domestic and agricultural effluents, notably the River Glass and the Summerhill stream.

4.8 COASTLAND

4.8.1 Introduction

The Island's coastline may, broadly, be divided into two sections: the north, from Ramsey to Glen Mooar, composed of maritime soft cliff and dune; and the remainder, which is generally rocky and classified as maritime hard cliff.

Within the northern section the maritime soft cliff between Ramsey and Phurt is eroding, although there are stabilised patches which are being colonised by plants. The cliffs are generally fairly low (10-20m), peaking at Shellag Point where they reach 40-50m in conjunction with the edge of the Bride Hills. Between Phurt and the Point of Ayre there is an area of accreting shingle, deposited by longshore drift.

Between the Point of Ayre and Sartfield is a section of stabilised dunes. South of Sartfield maritime soft cliffs again of 10-20m in height recur and extend as far as Glen Mooar. Erosion is occurring within most of this area but in some small patches the coast is accreting and stabilising.

From Glen Mooar south, the coast is mainly rocky although as far as Peel there are sections of maritime soft cliff and many sandy bays, the largest of which are at Lynague, White Strand, Cain's Strand and Peel Bay.

From St. Patrick's Isle south, maritime hard cliff resumes forming some fairly high cliffs (40-50m) in the section to Glen Maye. Between Dalby Point and Niarbyl the coast is rocky but low-lying. From Niarbyl Bay to Port Erin the coast slopes steeply from heights of 250-300m to cliffs of 30-40m; these become much lower at Port Erin where there is a sandy bay.

Around the Sound and Spanish Head to Perwick Bay the coast once more becomes steep with high cliffs but in the section between Perwick Bay and Cass ny Hawin Head the coast, though still rocky, has no cliffs and there are several sandy bays.

From Cass ny Hawin to Douglas cliffs reappear and are 30-40m in height, although in the Marine Drive section the coast is very steep to heights of 70-80m.

Douglas Bay and Laxey Bay are sandy but in between there are some very high cliffs and steep coastlines in particular between Onchan Head and The Clett.

North of Laxey continuous maritime hard cliff extends as far as Port Lewaigue with outcrops to Ballure at the south of Ramsey Bay. The steepest sections are between Laxey Head and Skerrip, and at Bulgham Bay, Glau Wooar and Maughold Brooghs. Cliffs in this section reach almost 50m in places, for example, at Gob ny How and Maughold Head.

Where the coast is very steep survey was difficult. Some inaccuracy in mapping and habitat area measurement is inevitable since habitats on slopes are distorted when transcribed onto a flat map. Hence the sizes of maritime habitats occurring in such areas are likely to be underestimated and those on vertical surfaces, such as crevice and ledge vegetation, grossly under-represented.

Geologically, the northern section of coast from Gob ny Creggan Glassey to Ramsey, is Recent/Pleistocene in origin. There are several sections of raised beach and blown sand while the remainder is Glacial.

Most of the Island's coast is composed of Cambrian Manx slates (Lonan and Niarbyl flags, Barrule and undifferentiated slates), with outcrops of Agneash/other grits at Gob yn Ushtey, north of Fleshwick Bay, Kione y Ghoggan, Santan Head, Garwick and Maughold Head. Red sandstone cliffs outcrop between Peel Bay and Will's Strand. Throughout this section run dykes of greenstones and altered greenstones, microgranite, olivine-dolerite and diorite-camptonite.

The most interesting section of the Island's coast is that between Perwick Bay and Cass ny Hawin, where Carboniferous limestone occurs. This outcrops at Port St. Mary Head; from Strandhall to Poyllvaaish; Scarlett Point to Castletown; to the west of Langness and from Derbyhaven to Cass ny Hawin. Scarlett is notable for its igneous volcanic basalt, Poyllvaaish for its black "marble" (limestone) and Langness for its conglomerate and numerous microgranite, greenstone and diorite-camptonite dykes.

The Chasms, above Bay Stack, are a unique geological feature composed of a series of vertical fissures extending deep into the ground.

The coastline of the Island is a valuable habitat for many seabirds. The steep vertical cliffs and exposed rocks, are important sites for kittiwakes, fulmars, guillemots, razorbills, puffins and shags, while the dunes to the north of the Island are good sites for oystercatcher, ringed plover, common terns, dunlin and redshank. The most notable species is the little tern which nests at the Ayres. This represents 2½ % of the British population and the Ayres are thus a site of international importance (Pritchard et al, 1992).

The Manx sea cliffs, the Ayres, the Ballaugh curragh, the hills and the Calf of Man have been identified as important sites for birds (Pritchard et al, 1992).

There are also some important sites for rare plant species around the coast. Sea wormwood (*Seriphidium maritimum*) was rediscovered during the course of the survey at Traie ny Gill and due to the scarcity of saltmarsh, all associated species are rare.

Coastal habitats cover 575.68 ha, 1.01% of the Island, which represents 3.51% of the semi-natural habitat total. The different habitat classes which have been measured are analysed in Table 8, and the relative proportions illustrated in Figure 11.

4.8.2 Saltmarsh

Saltmarsh is often the characteristic vegetation in the intertidal zone of estuaries and beaches where the substrate is mud or sand, and where there is a degree of protection from the action of the waves. There tends to be a zonation of species within saltmarsh areas according to the duration of salt-water cover. Species characteristic of saltmarsh must be salt-tolerant and often have modifications to achieve this, such as mealy leaves, swollen fleshy parts or reduced leaves to help prevent dehydration; or a high concentation of salt in the cell sap to enable water uptake by osmosis even when in a saline environment.

Saltmarsh covers only 6.72 ha, 0.01% of the Island, which represents 0.04% of the semi-natural habitat total. Saltmarsh occurs in four distinct areas: Ramsey, Cornaa, Langness and Poyllvaaish. The largest single area, 3.44ha, is found at Langness, with all other units (7), less than one hectare. Cornaa and Langness saltmarshes were formerly grazed but none of the saltmarshes now receive any grazing.

Typical species include common saltmarsh-grass (*Puccinellia maritima*), oraches (*Atriplex* spp.), sea-purslane (*Atriplex portulacoides*), annual sea-blite (*Suaeda maritima*), sea-milkwort (*Glaux maritima*), common glasswort (*Salicornia europaea* agg.), salt-marsh rush (*Juncus gerardii*), sea arrow-grass (*Triglochin maritima*), thrift (*Armeria maritima*), sea aster (*Aster tripolium*), red fescue (*Festuca rubra*), common scurvy-grass (*Cochlearia officinalis)* and lesser sea-spurrey (*Spergularia marina*).

The saltmarshes at Langness and Strandhall are of great importance for bird life. Their invertebrate fauna feeds the wintering waders and some breeding species, while their vegetation feeds the grazing wildfowl. Species regularly occurring include wigeon, teal, shelduck, goldeneye, golden plover, ringed plover, dunlin, turnstone and redshank.

4.8.3 Strandline vegetation

This may occur on either shingle or rock, along the drift line of the shore.

Strandline vegetation occurs in only a few areas of the coast: on the south coast from Bay ny Carrickey to Derbyhaven; on the west coast only at Traie Vane (Niarbyl Bay) and Spaldrick Bay; on the east coast along Ramsey Bay north of the harbour and from the Dog Mills to Phurt; and to the north just west of the Point of Ayre.

Species often recorded along the strandline include oraches (*Atriplex* spp.), sea beet (*Beta vulgaris* ssp. *maritima*), sea sandwort (*Honckenya peploides*), sea rocket (*Cakile maritima*), cleavers (*Galium aparine*), sow-thistles (*Sonchus* spp.) and curled dock (*Rumex crispus*).

On the Island, sea mayweed (*Tripleurospermum maritimum*) is a common strandline species; saltwort (*Salsola kali*) occurs only along the north and west coasts and in the Castletown area.

FIGURE 11 RELATIVE PROPORTIONS OF COASTLAND HABITAT CLASSES IN THE ISLE OF MAN

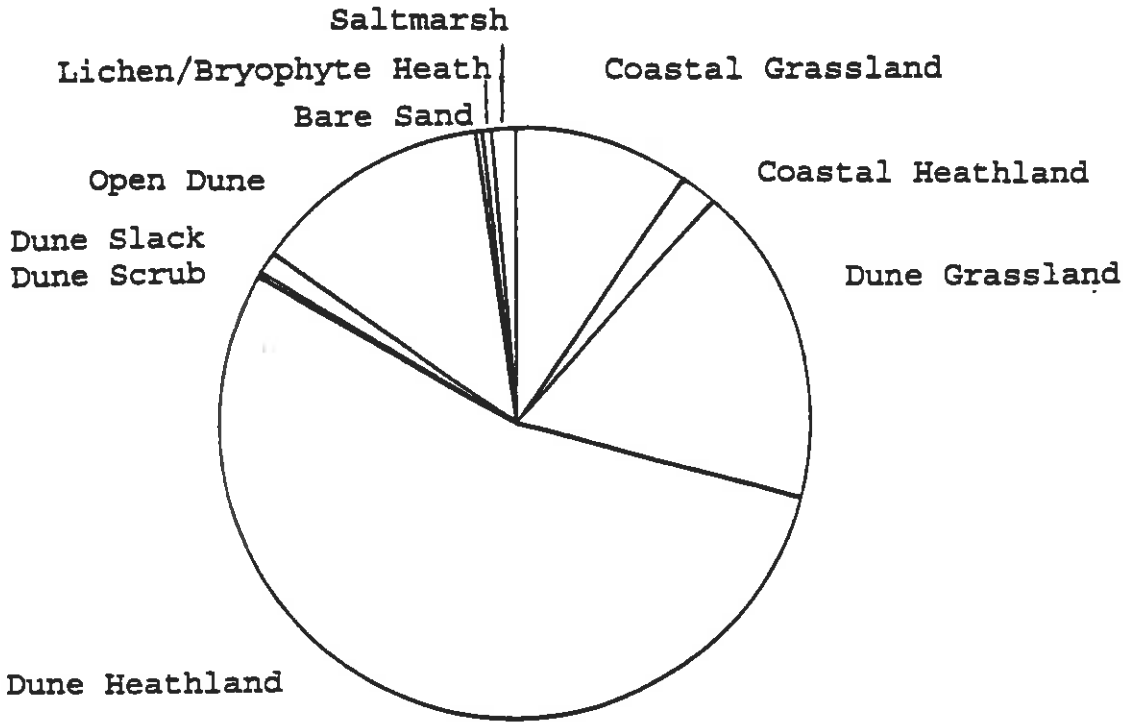


TABLE 8 ANALYSIS OF COASTLAND HABITAT CLASSES IN THE ISLE OF MAN

COASTLAND HABITAT TYPE	TOTAL AREA ha	% OF ISLAND	% SEMI-NAT.HAB.	% OF COASTLAND
Coastal Grassland	55.84	0.10	0.34	9.70
Coastal Heathland	11.44	0.02	0.07	1.99
Dune Grassland	101.20	0.18	0.62	17.58
Dune Heathland	311.08	0.55	1.89	54.04
Dune Scrub	1.40	0.003	0.009	0.24
Dune Slack	7.28	0.01	0.04	1.26
Open Dune	74.92	0.13	0.46	13.01
Bare Sand	2.68	0.005	0.02	0.47
Lichen/Bryophyte Heath	3.12	0.006	0.02	0.54
Saltmarsh	6.72	0.01	0.04	1.17
TOTAL	**575.68**	**1.014**	**3.509**	**100.00**

4.8.4 Sand dune

4.8.4.1 Introduction

Dunes are essentially ridges of sand created by the action of the sea and the wind, which gradually become colonised by plants resistant to salt spray and wind damage, such as marram (*Ammophila arenaria*) and couch (*Elytrigia* spp.). This has the effect of stabilising the dunes by binding the sand substrate together, and allows other plants to colonise.

The dune system increases with age and stability, with increasing distance from the sea. Hence it represents an ecological succession in which each stage may be seen.

4.8.4.2 Open dune

This category encompasses the three earliest, and hence least stable, stages of dune formation. Open dune covers 74.92 ha, 0.13% of the Island, which accounts for 0.46% of the semi-natural habitat total. It is restricted to the northern coast, mainly at the Ayres, but smaller patches occur at Ramsey, Cronk ny Arrey Laa and Ballateare. The largest area, 35.24 ha, occurs from just south of Cronk y Cliwe to Blue Point.

4.8.4.2a Fore dune

These are unstable, low ridges of sand, found on the foreshore, with characteristically very open plant cover. Sand couch (*Elytrigia juncea*) is generally a typical coloniser of fore-dunes but is rarely found on the Isle of Man. Other species may include marram (*Ammophila arenaria*), sea rocket (*Cakile maritima*), oraches (*Atriplex* spp.) and sea sandwort (*Honckenya peploides*).

4.8.4.2b Yellow dune

Marram (*Ammophila arenaria*) tends to dominate these partially stabilized dunes, found between fore-dunes and grey dunes.

4.8.4.2c Grey dune

Grey dunes are stable and have almost complete vegetation cover, of a variety of species. Marram (*Ammophila arenaria*) is usually present but no longer dominant, and mosses and lichens may occur. In appearance grey dune is distinguishable from fixed dune by its undulating or even hilly surface and the lack of consolidation of the sand substrate.

4.8.4.3 Dune grassland

This represents the first successional stage of fixed dune, occurring on consolidated and flattened dunes. Characteristically there is little marram grass (*Ammophila arenaria*); red fescue (*Festuca rubra*) may dominate.

Dune grassland covers 101.20 ha, 0.18% of the Island, which represents 0.62% of the semi-natural habitat total. It is mainly found on the Ayres with smaller areas at Kionlough, Orrisdale and south of The Cronk. The largest area, 38.60 ha, extends from Rue Point to the Point of Ayre.

Dune grassland is generally dominated by red fescue (*Festuca rubra*) and burnet rose (*Rosa pimpinellifolia*). Typical species found in association include sand sedge (*Carex arenaria*), common bird's-foot-trefoil (*Lotus corniculatus*), harebell (*Campanula rotundifolia*), field wood-rush (*Luzula campestris*), wild thyme (*Thymus polytrichus*), early hair-grass (*Aira praecox*), silver hair-grass (*A. caryophyllea*), restharrow (*Ononis repens*), common mouse-ear (*Cerastium fontanum*), marram (*Ammophila arenaria*), lady's bedstraw (*Galium verum*), common stork's-bill (*Erodium cicutarium*), sweet vernal-grass (*Anthoxanthum odoratum*), mouse-ear-hawkweed (*Pilosella officinarum*), common centaury (*Centaurium erythraea*) and sheep's-bit (*Jasione montana*).

4.8.4.4 Dune heath

This may be seen as a later successional stage in the development of the dune system, occurring on consolidated and flattened dunes.

Dune heathland covers 311.08 ha, 0.55% of the Island, 1.89% of the semi-natural habitat total. It is found exclusively on the Ayres. Good examples occur between Rue and Blue Points (16.65 ha) and from Blue Point to the Point of Ayre (286.84 ha).

Bell heather (*Erica cinerea*) and heather (*Calluna vulgaris*) are usually dominant, with locally abundant burnet rose (*Rosa pimpinellifolia*) and frequently large amounts of western gorse (*Ulex gallii*). Typical species found in association with these include restharrow (*Ononis repens*), common bird's-foot trefoil (*Lotus corniculatus*), sand sedge (*Carex arenaria*), early hair-grass, (*Aira praecox*), field wood-rush (*Luzula campestris*), heath bedstraw (*Galium saxatile*) and wild thyme (*Thymus polytrichus*).

Lichens (especially *Cladonia* spp. and *Usnea articulata*) are often abundant (see lichen/bryophyte heath, 4.8.5).

4.8.4.5 Dune slack

Dune slacks are patches of marshy vegetation occurring in damp valleys or hollows between dune ridges, where the water table is near the surface for at least part of the year.

Dune slacks cover 7.28 ha, 0.01% of the Island, only 0.04% of the semi-natural habitat total, although this is liable to be an underestimate as many sites were too small to map. This habitat is restricted to the Ayres between Rue Point and Ballaghennie. The largest area, 3.48 ha, occurs to the east of the Ayres Plantation. The eight remaining sites, with one exception, are all under one hectare.

Dune slacks are variously dominated by sweet vernal-grass (*Anthoxanthum odoratum*), marsh pennywort (*Hydrocotyle vulgaris*), silverweed (*Potentilla anserina*) and various sedges (*Carex* spp.). Other species recorded include tormentil (*Potentilla erecta*), orchids (*Dactylorhiza* spp.), selfheal (*Prunella vulgaris*), cuckooflower (*Cardamine pratensis*), mint (*Mentha* sp.), sharp-flowered rush (*Juncus acutiflorus*), burnet rose (*Rosa pimpinellifolia*), field horsetail (*Equisetum arvense*), bramble (*Rubus fruticosus* agg.) and creeping willow (*Salix repens*). Adder's-tongue (*Ophioglossum vulgatum*) was recorded in a number of slacks.

Dune slacks are by definition fresh-water habitats; similar saline areas are classified as saltmarsh.

4.8.4.6 Dune scrub

Dune scrub occurs on consolidated and flattened dunes and comprises any scrub growing on the dune system, but more specifically is often characterised by sea buckthorn (*Hippophae rhamnoides*), a species not present in the Isle of Man. Introduced shrub species growing on dunes are also included within this categeory.

Dune scrub covers 1.40 ha, 0.003% of the Island, 0.01% of the semi-natural habitat total. It is only recorded on the Ayres where it is always European gorse (*Ulex europaeus*). Although gorse has become a problem in some areas it does provide an additional habitat.

4.8.5 Lichen/Bryophyte Heath

In order to be classified as this type of heath the area must be dominated by lichens and/or bryophytes with less than 30% vascular plant cover. There are extensive areas of heath with abundant lichens and bryophytes on the Ayres but only a small area, 3.12 ha, could actually be assigned to this category since most areas also contain more than 30% vascular plant cover.

Although classified as a heathland in the handbook, lichen/bryophyte heath has been included in the coastal section in this report because in the Isle of Man it only appears at the coast, and is unique in having a lichen (*Usnea articulata*) which is usually found growing on trees but here has adapted to growing on stones and sand.

Species recorded include heather (*Calluna vulgaris*), bell heather (*Erica cinerea*), burnet rose (*Rosa pimpinellifolia*) and sand sedge (*Carex arenaria*).

4.8.6 Maritime cliff and slope

4.8.6.1 Introduction

The Island has a large area of both hard and soft maritime cliff but the area has not been calculated as no account could be taken of the vertical element of cliff-faces. The distribution of these habitats is outlined in section 4.8.1.

Vascular plant cover is generally sparse, but where there was >10% vegetation (and observation was often limited by the vertical nature and inaccessiblity of the cliffs) a target note was written. Habitat classes recorded include crevice and ledge vegetation, and coastal grassland and heathland.

4.8.6.2 Crevice and ledge vegetation

This occurs in crevices and on ledges of steep cliffs and must cover at least 10% of the cliff surface, including vegetation growing on the lower "splash" zone of cliffs. Species composition is variable and may be influenced by factors such as the use of the cliff by birds.

No area measurement is available for this habitat but its presence has been indicated on the maps.

Species commonly recorded include thrift (*Armeria maritima*), sea campion (*Silene uniflora*), red fescue (*Festuca rubra*), common scurvygrass (*Cochlearia officinalis*), English stonecrop (*Sedum anglicum*), buck's-horn plantain (*Plantago coronopus*) and sea plantain (*P. maritima*).

4.8.6.3 Coastal grassland

These are grasslands which include maritime species and which occur on shallow slopes or level areas by the sea.

Coastal grassland covers 55.84 ha, 0.10% of the Island, 0.34% of the semi-natural habitat total, although this will be an underestimate due to the small size of many of the sites and the inaccessibility of others. These sites are scattered along rocky coast from Maughold Head in the east and Ballanayre in the west, southwards. The largest area, 4.32 ha, occurs at The Sound.

Red fescue (*Festuca rubra*) is often dominant, with abundant sea plantain (*Plantago maritima*), thrift (*Armeria maritima*), wild thyme (*Thymus polytrichus*), kidney vetch (*Anthyllis vulneraria*), common bird's-foot-trefoil (*Lotus corniculatus*) and lady's bedstraw (*Galium verum*). Other species commonly occurring include spring squill (*Scilla verna*), mouse-ear hawkweed (*Pilosella officinarum*), English stonecrop (*Sedum anglicum*), sea campion (*Silene uniflora*), sheep's-bit (*Jasione montana*), cat's-ear (*Hypochaeris radicata*), sand cat's-tail (*Phleum arenarium*), common centaury (*Centaurium erythraea*) and yarrow (*Achillea millefolium*).

4.8.6.4 Coastal heathland

This category encompasses all areas of heath near the sea in which maritime species occur (with the exception of dune heath).

Coastal heathland covers 11.44 ha, 0.02% of the Island, 0.07% of the semi-natural habitat total, although this will be an underestimate due to the precipitous nature of the coastal slopes on which it occurs. This habitat is mainly restricted to the south coast of the Island particularly around Langness and Bradda Head. The remaining sites occur at Port Mooar, Cornaa and Lag Birragh (Onchan).

Heather (*Calluna vulgaris*) often dominates with frequent bell heather (*Erica cinerea*) and western gorse (*Ulex gallii*). Other species found in association include many of those mentioned in section 4.9.4.4.

4.9 ROCK EXPOSURE AND WASTE

4.9.1 Introduction

This category includes both natural and artificial exposed rock surfaces (only sparsely vegetated), various forms of excavation and waste tip. Natural rock exposures (inland cliffs, scree, limestone pavement and caves) are rare or absent from the Isle of Man.

4.9.2 Artificial exposures

The boundaries of quarries, spoil and refuse tips are outlined in red and have been measured together, covering 136.60 ha, 0.24% of the Island. Any vegetation of interest has been noted.

4.9.2.1 Quarries

These are scattered throughout the Isle of Man, established for the extraction of slate, aggregate and, in the southeast, limestone. The quarries at South Barrule (slate) and Stoney Mountain (granite), Billown and Turkeylands (limestone) and the Ayres (sand and gravel) are still being worked, as well as the smaller ones at Cringle and Dreemskerry.

Those no longer in use fall into several categories. Some have been abandoned, such as the Dhoon and the upper Glen Duff Quarries, both known for the presence of bulrush (*Typha latifolia*); and another quarry at the Dhoon, becoming vegetated by scrub and trees. Others become flooded (described under section 4.7.2.2). The quarries at the Ayres (the disused part) and The Raggatt have been used as landfill sites (the latter has since been landscaped as a nature area). Others, such as those at Glen Duff and Gob-y-Volley, are no longer used but remain sites for other activities - the former is a DHPP depot, the latter a Forestry depot.

There are a number of smaller quarries scattered throughout the Island - such as the ones at Ballavolley and at Glen Rushen.

The quarry on South Barrule is noted for parsley fern (*Cryptogramma crispa*), possibly its only remaining site on the Island; while a disused quarry at Billown Lime Quarries is the only known Manx location for bee orchid (*Ophrys apifera*).

4.9.2.2 Mines

The vegetation growing around ore mine "deads" may be of interest since only those plants tolerant of the comparatively toxic surroundings are able to grow. Vegetation is generally sparse but fir club-moss (*Huperzia selago*) grows on the old mines at Foxdale, with adder's-tongue (*Ophioglossum vulgatum*) at Cornelly. Moonwort (*Botrychium lunaria*) has been recorded from the lead mine deads at Foxdale and Cornelly.

4.9.2.3 Refuse Tips

Refuse tips can support a wide range of vegetation, including alien and garden species introduced through the dumping of garden waste. Bird seed is a source of many more unusual plants.

On the old Ballacallow tip at the Ayres turves of heath were placed on top of the finished tip and appear to be regenerating.

A number of important ecological sites have, and are being used as dumps, particularly for building waste. For example, a considerable area was tipped-on at SC314802 which was the largest area of bog myrtle (*Myrica gale*) in the central valley curragh and a good site for greater tussock-sedge (*Carex paniculata*).

Tipping continues at SC408956, an area of curragh with developing birch (*Betula* spp.) woodland.

4.10 MISCELLANEOUS

4.10.1 Arable

In addition to fields planted with arable crops, this category includes areas of horticulture; recently-ploughed land; and recently-reseeded high quality grassland used for grazing or silage, generally sown with ryegrass (*Lolium perenne*) and clover (*Trifolium* spp.).

For the purposes of area measurement improved and arable land have been recorded together under agricultural land. Agricultural land covers 30,445.00 ha, 53.88% of the Island although some areas have been reclaimed by drainage and reseeding since that area was surveyed, for example, at Earystane and Narradale, and are not included in this total.

4.10.2 Amenity grassland

This comprises all areas of intensively managed and regularly mown grassland typical of lawns, golf-course fairways, parks and playing fields. In some instances it may be possible to classify the area as semi-improved acidic, neutral or calcareous grassland, according to the number and type of herb species present, in which case it will be mapped accordingly and the amenity use stated in the target note. The sward composition will depend on the original seed mixture used and on the age of the community. However, ryegrass (*Lolium perenne*) and white clover (*Trifolium repens*) usually dominate with herbs such as daisy (*Bellis perennis*), greater plantain (*Plantago major*) and common dandelion (*Taraxacum* spp.).

Amenity grassland covers 1011.32 ha, 1.79% of the Island.

The largest areas of amenity grassland are golf courses. These include; Ramsey, Peel, Rowany, Port St. Mary, Castletown, Mount Murray, Pulrose and King Edward Bay. The golf courses account for about 330 ha, the remainder being parks, sports fields and gardens. In general, all the golf courses are mown to such an extent that few "rough" areas remain and it was not possible to identify the original sward composition. However, the King Edward Bay golf course has a number of areas of acid grassland and heath around the edges. A great deal of tree planting has taken place on some golf courses, particularly the new course at Mount Murray.

4.10.3 Ephemeral/short perennial

This consists in general of low-growing patchy vegetation growing typically on a thin layer of well-drained, often stony soil such as that on railways, derelict urban sites and quarries. Similar vegetation may occur at edges of fields and in gateways but this is not included within this category.

Ephemeral vegetation covers 7.84 ha, 0.01% of the Island, although this is liable to be an underestimate due to the small size of many of the sites. Common sites include those mentioned above, for example, around the old holiday camp at Onchan.

No single species dominates but a variety of plants occur such as greater plantain (*Plantago major*), creeping buttercup (*Ranunculus repens*), white clover (*Trifolium repens*), black medick (*Medicago lupulina*), colt's-foot (*Tussilago farfara*), and groundsels/ ragworts (*Senecio* spp.). Other species often found include daisy (*Bellis perennis*), common centaury (*Centaurium erythraea*), ragwort (*Senecio jacobaea*), wood sage (*Teucrium scorodonia*), yarrow (*Achillea millefolium*), common bird's-foot trefoil (*Lotus corniculatus*) and rosebay willowherb (*Chamerion angustifolium*).

4.10.4 Introduced Shrub

This is shrub vegetation dominated by non-native species, and may be planted or self-sown. Often this type of vegetation is present as the understorey layer in glens and woodland, in which case it is not mapped, but described within the target note for the area.

Common species include hedge veronica (*Hebe* sp.), cherry-laurel (*Prunus laurocerasus*), *Rhododendron* spp., privet (*Ligustrum* spp.), snowberry (*Symphoricarpos albus*) and fuchsia (particularly *Fuchsia magellanica*). The latter is so abundant on the Island that it had to be indicated as a native species on the maps. Also included within this category are beds of shrubs such as rose-of-Sharon (*Hypericum calycinum*), *Cotoneaster* spp., heathers and dwarf conifers.

Introduced shrub covers 7.16 ha, 0.01% of the Island, but this will be an underestimate due to the small, often linear nature of many of the sites. Most of the sites occur in the urban areas.

4.10.5 Boundaries

A large proportion of the boundaries on the Island are sodhedges, created from turf, earth and stones (often a wall topped with sods) and often planted with European gorse (*Ulex europaeus*) or hawthorn (*Crataegus monogyna*), sometimes with scattered trees. Since 1577 various laws have been imposed specifying minimum dimensions for these hedges. In some areas shrubs such as fuchsia (*Fuchsia magellanica*), hedge veronica (*Hebe* sp.) and New Zealand holly (*Olearia macrodonta*) replace the gorse and hawthorn. Fuchsia is particularly widespread in the south of the Island, notably along Ballamodha Straight.

In the hills dry stone walls largely replace sodhedges as the main boundaries; many of them have become neglected and are no longer stockproof. In the lowlands walls are mainly associated with roads and buildings; they may support a wide fern flora with species such as maidenhair spleenwort (*Asplenium trichomanes*), common polypody (*Polypodium vulgare*), hart's-tongue (*Phyllitis scolopendrium*) and rustyback (*Ceterach officinarum*).

There are few hedges (i.e. boundaries composed only of scrub species) in the Island. Those present are generally composed of hawthorn (*Crataegus monogyna*), often with bramble (*Rubus fruticosus* agg.) and occasionally with holly (*Ilex aquifolium*) and more rarely blackthorn (*Prunus spinosa*). Trees may be present but these are usually lopped and kept low.

Time constraints precluded detailed study of field boundaries but their conservation (and indeed aesthetic) value should not be overlooked. When surrounded by semi-natural vegetation their value is comparatively low, although they can provide a different microclimate and support additional fauna and flora, as well as providing food and shelter for birds. However, their conservation value can be very high when surrounded by agricultural land (see section 4.2.5).

Some boundary removal has taken place to enlarge fields in the lowlands; where boundaries have disappeared in the uplands it is largely due to erosion through neglect. Hedge management is theoretically the responsibility of the landowner - hedges alongside roads are the property of the owners of the adjacent land but in practice are often cut by the DHPP in order to keep roads clear. The H.E.D.G.E. has recently been established to advise on hedge management (see section 4.2.5).

4.10.6 Built-up areas

4.10.6.1 Sea Wall

Only sea walls constructed of artificial materials are included within this category. Examples are predominantly in the south (for example around Port St. Mary) but also occur in Ramsey, Laxey and Douglas bays.

4.10.6.2 Buildings

Recently erected agricultural, industrial and domestic buildings have been added to the map, as well as building sites and tarmacced areas such as car-parks.

Buildings cover 2233.96 ha, 3.95% of the Island. Extensive developments have occurred around Douglas, Onchan and Port Erin in the last 5 years. Farm yards will tend to have been included within this category.

4.10.7 Bare ground

This category includes any significant areas of bare ground not covered by any other category, thus excluding bare peat, intertidal areas, shingle, boulders and rocks, dunes, maritime cliff and natural rock exposure.

Bare ground covers 60.00 ha, 0.11% of the Island, but much bare ground may have been included within other habitats, for example buildings, as bare ground often occurs around building sites.

4.10.8 Other habitats

Any habitat not encompassed by the above classification system has been surrounded by a black line on the map and described in a target note.

Roads and railways have not been included within area measurements: most of the Island's roads are narrow and accurate measurement or estimate would be impossible within the confines of this survey.

The disused railway lines from Peel to Douglas and Ramsey to St. John's have been surveyed in detail since these were proposed pipeline routes for the IRIS scheme (see section 4.2.5). The former in particular is an important wildlife corridor and is the site of the Heritage Trail footpath. The section of railway from Foxdale to St. Johns is also now disused; all three sections are of high ecological value.

The steam railway and electric railway lines have recently been surveyed by the MNCT.

APPENDICES

APPENDIX 1. Dominant Species Codes

Code	Scientific name	Common Name
Ae	*Arrhenatherum elatius*	False Oat-grass
Ag	*Alnus glutinosa*	Alder
Ama	*Ammophila arenaria*	Marram
Ao	*Anthoxanthum odoratum*	Sweet Vernal-grass
Ap	*Acer pseudoplatanus*	Sycamore
Bet	*Betula* sp.	Birch
Ca	*Corylus avellana*	Hazel
Cm	*Crataegus monogyna*	Hawthorn
Cxp	*Carex panicea*	Carnation Sedge
Cxro	*Carex rostrata*	Bottle Sedge
Cyc	*Cynosurus cristatus*	Crested Dog's-tail
Dc	*Deschampsia cespitosa*	Tufted Hair-grass
Dg	*Dactylis glomerata*	Cock's-foot
Ec	*Erica cinerea*	Bell Heather
Eqf	*Equisetum fluviatile*	Water Horsetail
Et	*Erica tetralix*	Cross-leaved Heath
Fe	*Fraxinus excelsior*	Ash
Fo	*Festuca ovina*	Sheep's Fescue
Fr	*Festuca rubra*	Red Fescue
Fs	*Fagus sylvatica*	Beech
Fu	*Filipendula ulmaria*	Meadowsweet
Gsx	*Galium saxatile*	Heath Bedstraw
Hl	*Holcus lanatus*	Yorkshire Fog
Hn	*Hyacinthoides non-scripta*	Bluebell
Hsp	*Heracleum sphondylium*	Hogweed
Ia	*Ilex aquifolium*	Holly
Ip	*Iris pseudacorus*	Yellow Iris
Ja	*Juncus acutiflorus*	Sharp-flowered Rush
Jar	*Juncus articulatus*	Jointed Rush
Jc	*Juncus conglomeratus*	Compact Rush
Je	*Juncus effusus*	Soft-rush
Lp	*Lolium perenne*	Perennial Rye-grass
Lx	*Larix* sp.	Larch
Mc	*Molinia caerulea*	Purple Moor-grass
Mg	*Myrica gale*	Bog Myrtle
Ns	*Nardus stricta*	Mat-grass
Pha	*Phalaris arundinacea*	Reed Canary-grass
Pin	*Pinus* sp.	Pine
Pop	*Populus* sp.	Poplar
Pt	*Pteridium aquilinum*	Bracken
Px	*Picea* sp.	Spruce
Qu	*Quercus* sp.	Oak
Rf	*Rubus fruticosus* agg.	Bramble
Rp	*Rhododendron ponticum*	Rhododendron
Sx	*Salix* sp.	Willow
Sxau	*Salix aurita*	Eared Willow
Sxci	*Salix cinerea* ssp. *oleifolia*	Grey Willow
Sph	*Sphagnum* sp.	Sphagnum Moss
Til	*Tilia* sp.	Lime
Tl	*Typha latifolia*	Bulrush
Ud	*Urtica dioica*	Common Nettle
Ue	*Ulex europaeus*	European Gorse
Ug	*Ulex gallii*	Western Gorse
Umg	*Ulmus glabra*	Wych Elm

APPENDIX 2 AN EXAMPLE OF THE HABITAT AREA RECORDING FORM

HABITAT AREA MEASUREMENT RECORD. REGION: _____
MAP: _____

RECORDER: _____
PAGE: _____

GRID SQUARES: _____ TO _____

HABITAT	GRID REF	AREA(ha)	TOT. AREA(ha)	HABITAT	GRID REF	AREA(ha)	TOT. AREA(ha)

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