JNCC Report
No. 302

# Review of coverage of the National Vegetation Classification

**JS Rodwell, JC Dring, ABG Averis, MCF Proctor, AJC Malloch, JHJ Schaminée, & TCD Dargie**

**July 2000**

This report should be cited as:
Rodwell, JS, Dring, JC, Averis, ABG, Proctor, MCF, Malloch, AJC, Schaminée, JNJ, & Dargie TCD, 2000
Review of coverage of the National Vegetation Classification
*JNCC Report*, No. 302



For further information please contact:
Habitats Advice
Joint Nature Conservation Committee
Monkstone House, City Road, Peterborough
PE1 1JY
UK

ISSN 0963-8091

# Contents

# Preface

The National Vegetation Classification (NVC) was commissioned in 1975 by the former Nature Conservancy Council to provide a comprehensive and systematic catalogue and description of the plant communities of Great Britain. The original specification for the work has been completed with the publication of the fifth and final volume of *British Plant Communities* (Rodwell 2000).

The Joint Nature Conservation Committee is responsible for maintaining the NVC and developing its use as a UK standard for the description of vegetation. This is important as the NVC has been used to implement key aspects of national and international site designation legislation. It has been used as the main classification for terrestrial habitats in *Guidelines for Selection of Biological SSSIs* (JNCC 1995), and has been used to interpret Annex I of the Habitats Directive where relevant (Brown *et al*. 1997).

Not only has the NVC been accepted as a standard by the nature conservation and countryside organisations, but also by forestry, agriculture and water agencies, local authorities, non-government organisations, major industries and universities. For example, it has been recommended as a standard methodology for use in environmental assessments and statements by the Institute of Environmental Assessors (IEA 1995). It has been widely welcomed as providing a much needed common language in which the character and value of the vegetation of Britain can be understood.

The original aim of the NVC was to cover all natural, semi-natural and major artificial habitats in Great Britain (but not Northern Ireland), covering virtually all terrestrial plant communities, and those of brackish and fresh waters, except where no vascular plants were the dominants. Since the publication of *British Plant Communities*, use of the NVC and comparison with European phytosociological classification systems has revealed that there are types of British vegetation which have still to be described.

As a result, the JNCC commissioned a review of the coverage of the NVC in 1998. This review has produced information on the current coverage of the NVC; identified both the known and likely gaps in the plant community descriptions; and placed these new types into the phytosociological scheme of the NVC. This publication presents the results of this review.

Much work has been undertaken both within and outside the conservation agencies on the description of plant communities and JNCC recognises the value of this work. Therefore, in consultation with others, the JNCC intends to establish a code or protocol that will circumscribe rules for the description of new variation in the NVC. The code would provide minimum standards for the description of new communities or sub-communities and a formal process for their validation and publication. An expert committee will be established and given authority to validate the descriptions of new types and ensure that the standards of the code are met.

**In publishing this report it is the intention of the JNCC to seek further response on the results of the review. Anyone wishing to comment on the content of this report or the development of a code should do so to: Deborah Jackson, Habitats Adviser, Joint Nature Conservation Committee, Monkstone House, City Road, Peterborough, PE1 IJY.**

# Acknowledgements

In addition to those named in section 2.2 who, specifically for this project or more generally over the years, have given us the benefit of their knowledge and experience about British vegetation and the coverage of the NVC, Dr John Hopkins and Deborah Jackson of JNCC provided comments on the draft report. An invaluable contribution to the collation of this material and to the production of the final report has been made by Michelle Needham, the co-ordinating secretary of the Unit of Vegetation Science. Deborah Jackson acted as nominated officer for the review and edited the final text. The views expressed in this document are those of the authors.

# 1 Introduction

## 1.1 Coverage of the original NVC project

The National Vegetation Classification (NVC) was intended to provide 'standardised descriptions of named and systematically arranged vegetation types from all natural, semi-natural and major artificial habitats in England, Scotland and Wales'. Only short-term leys and assemblages dominated entirely by non-vascular plants were specifically excluded from the contract brief.

In fact, as is freely admitted in the published volumes of *British Plant Communities* (Rodwell 1991*a et seq*.), geographical and floristic coverage of the project was somewhat patchy and uneven. A total of 31,450 relevés was available for the project (Rodwell, Malloch & Winstanley 1993) and their distribution on the 10 km by 10 km National Grid is shown in Figure 1 in Appendix 1. The geographical gaps are clearly visible, particularly in Scotland where the original project was almost entirely dependent on existing data or samples being collected contemporaneously but by other workers.

Figure 1 also shows that the intensity of sampling within squares was very variable with many 10 km by 10 km squares having fewer than five samples, some over 100. This variation is only partly related to the diversity of vegetation types sampled within an area. While every effort was made during the three seasons of field work to ensure that the team of five surveyors covered as much ground as possible (Rodwell 1991*a*), the intensity of sampling reflects a measure of convenience of access. The particular interests of external contributors, whether in distinct vegetation types or certain areas, is also seen in the intensity of coverage.

A total of 295 plant communities has been characterised in the NVC; the overwhelming majority at a level approximating, as requested by the contract brief, to the plant association of continental phytosociological systems. Figures 2 and 3 in Appendix 1 show the overall distribution of the communities and their sub-communities on the 10 km by 10 km National Grid. It should be noted that some gaps in coverage of sampling in Figure 1 have records for plant communities in Figure 2. This is because there was sometimes available reliable information about the distribution of vegetation types defined in the NVC, even though no relevés had been collected. Figures 4 to 7 in Appendix 1 show the proportions of relevés, communities and sub-communities and 10 km by 10 km squares with relevés in the major vegetation types.

Unevenness of floristic coverage and some of the more obvious gaps were referred to in the accounts of relevant plant communities and in the general introductions to the major vegetation types in *British Plant Communities*. Figures 8 to 17 in Appendix 1 show the distribution on the 10 km by 10 km grid of the communities grouped in the major vegetation types recognised in the NVC.

## 1.2 Generation of NVC-related data by the community of users

The virtually universal adoption of the NVC as a descriptive standard by nature conservation and countryside organisations, forestry, agriculture and water agencies, local authorities, NGOs, major industries and universities has generated a large and diverse community of users of the scheme.

Training programmes such as that organised from the Unit of Vegetation Science have tried to ensure high and common standards of application of the NVC approach, both in field survey and the recognition of vegetation types within the NVC frame. More formal accreditation in NVC skills is now being offered by Lancaster University but meanwhile it is our informed opinion that such competencies are fairly widely dispersed among organisations and individuals, and generally high. Some practitioners and teams are outstanding, others poor, but the overall quality of additional information obtained on the character and distribution of plant communities has been good.

NVC skills have been applied with varying degrees of co-ordination in a large and diverse range of vegetation surveys. Some such surveys, like the Sand Dune Vegetation Survey of Great Britain (summarised so far in Dargie 1993, 1995 and Radley 1994), the Coastal Vegetated Shingle Structures of

Great Britain (Sneddon & Randall 1992*a, b*; 1993*a, b*) and a review of NVC data for woodlands (Hall 1997) have been more or less co-ordinated programmes of NVC survey funded by the nature conservation agencies and published as formal reports.

Other such programmes, like the ongoing upland surveys, have been partly published as scientific papers (Brown *et al*. 1993*a, b*) or, as with the Lowland Grassland Survey of Wales, summarised as internal agency reports. In other cases, as with the NVC Review of Scottish Grassland Surveys (Cooper & MacKintosh 1996), there has been a subsequent overview of separate earlier surveys of varying character. Yet other projects, like the Cumbria Mires Survey (Fojt 1994), have produced intensive surveys of particular vegetation types within limited areas.

Meanwhile, NVC methodology has increasingly become the standard for vegetation survey in Northern Ireland which was excluded from the original project. The Department of the Environment (Northern Ireland), for example, has commissioned work on woodlands, grasslands, the maritime zone (Cooper *et al*. 1992) and fens (ECOS 1995).

Many individual site descriptions, prepared as part of Phase II survey by the nature conservation agencies, or comparable surveys by other organisations such as the Royal Society for the Protection of Birds or more local organisations like the Wildlife Trusts, now also habitually use the NVC as a survey technique or descriptive frame. From the Suffolk Wildlife Trust, for example, we have reviewed NVC data and descriptions from 29 site reports.

The NVC is also a standard methodology for environmental assessments and statements (eg. Institute of Environmental Assessors 1995) and has been widely used to produce reports from a wide variety of planning situations. It is also used by key industries as a survey tool for restoration proposals, as with RJB Mining (UK) Ltd. Reports from these sources are not easy to access and we have seen relatively few. The NVC is taught in tertiary and continuing education as a standard skill for vegetation survey at various universities and colleges and related projects often generate site or vegetation descriptions in unpublished reports. Especially significant here are postgraduate MSc or PhD theses (eg. Wrightham 1996, Lunn 1998). County floras (eg. Graham 1988, Lavin & Wilmore 1996, Halliday 1998), and other books, such as the New Naturalist volumes (Webb 1986) often now refer to vegetation types using the NVC.

These programmes and projects have variously generated NVC-style samples, inventories, maps and commentary on the relationships of the vegetation types characterised to the NVC communities. However, there is no central source of information on the extent of such work or its products, no single location for publications or unpublished reports and no overall bibliography of NVC-related work. A start has been made in the Unit of Vegetation Science to produce an NVC library and a bibliography in ENDNOTE software but this work is not funded and necessarily sporadic. The references included in this report cannot claim to be a comprehensive NVC bibliography.

Neither is there any central computerised database of NVC samples beyond those assembled for the original project. These data were encoded in a contract for the NCC in 1990 (Malloch & Rodwell 1990) and supplied with the VESPAN database management software (Malloch 1988) and the offer of a site licence from its originator. Since that time, an unknown number of further samples (over 50,000?) has accumulated, some encoded in various types of database or spreadsheet software, many not, and widely dispersed in numerous locations that are not linked electronically or even aware of the location or format of data on identical or similar vegetation types elsewhere.

The disparate (and often uncertain) location of much of this material from subsequent applications of the NVC makes a complete review of coverage of the scheme and identification of gaps extremely difficult. Nonetheless, over the past decade, the deficiencies in coverage of the NVC have become more clearly defined. In the next sections, we outline the methods we have used to review the material available to us and identify gaps and areas of new variation. In this process of review, we have tried to use the same standards of definition as were employed in the original project, so as to ensure a roughly commensurate characterisation of new syntaxa at various levels. It is as well to remember that some of those who use the NVC with enthusiasm at a local level can be eager to define new variation which is of little

significance on a national scale. We have not included much local diversity which, though often significant at that scale, is probably best regarded as variants on a national level. Whilst acknowledging that the priority of the JNCC and country agencies is the description of vegetation which is important in a international, European and national context, we have been especially careful not to compromise the characterisation of new variation and gaps on the basis of the political implications of their occurrence or scarcity.

# 2 Methodology

## 2.1 Reviewing the wider European scene

It was part of the original NVC contract brief that each vegetation type should be compared to similar syntaxa elsewhere in Europe and an attempt was made in *British Plant Communities* to at least locate every plant community in its alliance and, where possible, to provide a phytosociological synonym (Rodwell 1991 *et seq*.).

As the project neared it conclusion, a draft *Phytosociological Conspectus of British Plant Communities* (Rodwell 1997) was prepared, organising the NVC vegetation types into the hierarchical frame of alliances, orders and classes currently being prepared by the European Vegetation Survey (Mucina 1997, Rodwell *et al* 1998). A revised version of this conspectus is now included in the final volume of *British Plant Communities* (Rodwell 2000). Those alliances considered to be ill-covered in the NVC were highlighted in this document and, in a further unsolicited report to JNCC (Rodwell & Dring 1996), these were set within a review of geographical coverage of the NVC. In common with approaches elsewhere in Europe, assemblages of stoneworts (*Chara*, *Nitella*, *Nitellopsis* and *Tolypella* spp.) were included in this phytosociological frame, though the exclusion of other freshwater algal communities and cryptogam assemblages may seem illogical.

Comments on the coverage of the NVC within this phytosociological framework have been provided for this project by Dr Joop Schaminée of the Instituut voor Bos- en Natuuronderzoek in The Netherlands, Co-ordinator of the Dutch Vegetation Survey, and Professor Victor Westhoff, chair of the Co-ordinating Committee for that project. This has provided an expert perspective from a neighbouring part of Europe whose own vegetation survey is now published (Schaminée *et al*. 1995 *et seq*.).

An extensive review has been undertaken of other phytosociological literature from the Atlantic biogeographic zone summarised in Julve (1993), Pott (1994), Dierschke *et al*. (1997), Fremstad (1997) and the older but still very valuable *catalogue raisonée* from Ireland (White & Doyle 1982), to assess whether plant communities occurring in neighbouring countries and so far not described in the UK are likely to be represented here.

Such information needs to be treated with some caution since, as is obvious already from *British Plant Communities*, certain vegetation types that are clearly defined in neighbouring parts of Europe tend to lose their integrity in the UK. This is especially true of those plant communities with strong Continental affinities, whose characteristic species begin to disappear with the shift to the cooler and wetter climate of the Atlantic seaboard. Certain habitats, like acidic dune sands, also tend to be less well represented in this country than in mainland Europe, so their vegetation types are correspondingly scarce.

The *Phytosociological Conspectus* has been used as the basis for the presentation of the results of this review, so as to contextualise any proposed additions to the NVC within a sensible overview of the existing communities. This annotated conspectus is presented in section 6.

## 2.2 Reviewing NVC surveys

Major NVC surveys such as those of sand dunes (Dargie 1993, 1995; Radley 1994), shingle (Sneddon & Randall 1992*a*, *b*; 1993*a*, *b*) and grasslands (Cooper & MacKintosh 1996), have been reviewed and an appraisal made of any vegetation types characterised there which could not be accommodated in the NVC. The extensive (though not comprehensive) library of NVC-related reports from the conservation

and countryside agencies, NGOs and universities has been reviewed and any potential new variation identified.

Details of this project, together with a *Phytosociological Conspectus of British Plant Communities* highlighting possible gaps were sent to the country agency specialists requesting any assistance that could be provided. This was followed after four weeks by a draft of the annotated *Conspectus* containing an outline of possible new communities with a request for any further comments. We have received information on possible gaps in the NVC from Tim Blackstock, David Stevens and Marcus Yeo of the Countryside Council for Wales, Keith Kirby and Richard Jefferson of English Nature, and Kathy Duncan, Andrew Coupar and David Horsfield of Scottish Natural Heritage. We have also discussed various possible new plant communities with these contributors where necessary.

Additionally, information and opinions on gaps in coverage have been received from Professor Donald Pigott (various vegetation types), Chris Preston of the Centre for Ecology and Hydrology (CEH) Monkswood (freshwater aquatic vegetation); Mike Prosser and Hilary Wallace, (lowland wet grasslands and heaths), Phil Lusby (grasslands), Gordon Rothero (snow-beds), Nick Hodgetts (cryptogams), Alan Orange, Alan Fryday, Oliver Gilbert (lichens). The Biological Records Centre at CEH Monkswood kindly prepared the data for Figures 18-27 shown in Appendix 1.

More widely, the network of contacts developed over the years by the Unit of Vegetation Science has been used to review information and opinions supplied by Elizabeth Cooper (grasslands and mires), Simon Leach and Wendy Cox (lowland wet grasslands), Henry Adams (mires), Mike Harding (various), Jeff Lunn (colliery spoil vegetation).

## 2.3 Reviewing information on species

Before this project, information on the scarcity or rarity of vascular plants in Britain had already been encoded into the species lists of the UK Vegetation Database using various sources: category A in the *Atlas of the British Flora* (Perring & Walters 1962), categories A, B and C from the NCC 'dot-day' exercises on plant distribution, various categories from *British Red Data Books I: Vascular Plants* (Perring & Farrell 1977) and from *Scarce Plants in Britain* (Stewart *et al*. 1994). For this project, the IUCN categories that are employed in the revised *Red Data Book* (Wigginton ed., 1999) have been added to the Database files.

In *British Plant Communities* the first three of the above sources were used to define the rare vascular plants noted in each community description. These were lists of the rare species represented in the samples that had been used to characterise each community or which were reliably known to occur in the vegetation type. It has since been possible to produce a fuller overview of the representation of rare and scarce plants among the NVC data and this is summarised in Appendix 2 where all such species are listed with their various categorisations and an indication of whether they are represented in the floristic tables of *British Plant Communities*. For reasons of economy of space, the published floristic tables omitted any species represented in less than 5% of the samples used to define the community or sub-community, but interrogation of raw samples in the UK Vegetation Database enables any further rare or scarce plants represented in fewer samples than this to be allocated to the existing NVC communities using MATCH and SIMIL software keys. The list of such allocations has been circulated to country agency specialists for comment and is included in Appendix 2.

It has then been possible to review the rare and scarce plants not represented in the NVC data so as to provide some opinion as to where these species occur in existing NVC communities or in vegetation types so far omitted in the scheme. Expert allocations of this type have been included in Appendix 2 and used in the characterisation of gaps.

# 3 Levels of new variation and gaps

It is helpful to categorise the gaps in coverage in the NVC and new variation emerging from the review at different levels of definition (levels 1 to 6 below). So as to be comprehensive, we have included among these categories those vegetation types which were characterised at community or sub-community level in *British Plant Communities* but with no supporting samples and also those defined there at alliance level only.

## 3.1 Level 1: plant communities or sub-communities characterised in the NVC but with no supporting samples

A number of vegetation types figure in the NVC as plant communities with a name, code number and description but with no supporting relevés. These are the A6 *Ceratophyllum submersum* community, SM2 *Ruppia maritima* salt-marsh community, SM3 *Eleocharis parvula* salt-marsh community, SM4 *Spartina maritima* salt-marsh community and SM5 *Spartina alterniflora* salt-marsh community, all of which have been characterised too in other parts of Europe. For some of these vegetation types, relevés have been traced, for others sampling is still necessary, but all are either widespread or occur at a few well-known localities so further survey would be relatively simple. It is especially pressing for *Eleocharis parvula* and *Spartina alterniflora* which are rare species.

A single vegetation type described in the NVC at sub-community level, the *Arrhenatherum* sub-community of MG3 *Anthoxanthum-Geranium* grassland, has no supporting data. It is quite widespread on ungrazed road verges within the range of these traditional northern hay-meadows and is of importance as a locus for some of the typical species of this vegetation type. These ranker swards with northern montane plants are also interesting because, in Scotland, typical hay-meadow species of this sort also occur in M27 *Filipendula-Angelica* tall-herb fen and under *Pteridium aquilinum* in vegetation that is transitional to the U17 *Luzula-Geum* tall-herb community. This whole range of vegetation types would repay further study.

## 3.2 Level 2: vegetation types described in the NVC at alliance or similar level where further sampling will characterise one or more plant communities

Several vegetation types were given a name and code and described in general terms at alliance or similar level in the NVC with the suggestion that further survey could characterise one or more units at community level. These are the M30 Hydrocotylo-Baldellion communities of seasonally inundated habitats, M36 Cardaminion vegetation of shaded lowland springs and streambanks, S23 Glycerio-Sparganion water-margin vegetation, SM1 Zosterion eel-grass communities and SM27 Saginion maritimae ephemeral salt-marsh vegetation. Relatively few data have since been accumulated for these alliances but it is now possible to be rather more precise about the character of the communities they comprise. In the light of surveys or overviews from neighbouring parts of Europe, it may be possible to recognise as many as 16 new communities among these alliances, with those of the M30 Hydrocotylo-Baldellion being of especial interest in providing a locus for rare or scarce plants such as *Deschampsia setacea* and *Pilularia globulifera.*

## 3.3 Level 3: plant communities described in the NVC which lose their integrity beyond a main geographic limit

Some vegetation types encountered since the development of the NVC have presented problems of definition where stands occur beyond the geographical limit of some of the more distinctive plants of an NVC community but are so generally similar in floristics and habitat relationships as to be of essentially the same vegetation type. Especially problematic has been M24 *Molinia-Cirsium dissectum* fen-meadow which is extensively found in Wales and Southern Scotland in more or less typical form but beyond the limit of *Cirsium dissectum* and sometimes also of *Juncus subnodulosus*. Other examples of this kind are CG7 *Festuca-Hieracium-Thymus* grassland on somewhat drought-prone lime-rich soils beyond the range

of more thermophilous calcicoles like *Thymus pulegioides* and *Cirsium acaule*, humid heath of the H4 *Ulex-Agrostis* type beyond the range of *Agrostis curtisii*, soakways of the M29 *Hyperico-Potametum* type outwith the distribution of *Hypericum elodes* and the M14 *Schoenus-Narthecium* mire which certainly has a range wider than that described in *British Plant Communities* but which loses some of its Oceanic West European plants in the shift from the Cornish coast to Wales.

Sometimes, this kind of floristic shift has been catered for in the NVC by characterising sub-communities which have a poor representation of a particular phytogeographical element, usually towards the north and west of their range. This can be seen in CG2 *Festuca-Avenula* grassland and W10 *Quercus-Pteridium-Rubus* woodland. Further sampling of problematic communities and reanalysis of new and old data should help clarify these situations. For the moment, it seems sensible to retain the stands within the relevant vegetation type at sub-community level.

## 3.4 Level 4: basal vegetation impoverished in floristics and of rank structure

A different kind of floristic impoverishment is seen where one or two competitive species from a widely occurring plant community become overwhelmingly dominant, crowding out less robust associates to produce rank, tall or tussocky vegetation. Often, this is the result of a reduction or abandonment of grazing, mowing or burning and a fall in the ground water table and it is seen especially clearly in M24 *Molinia-Cirsium* and M26 *Molinia-Crepis* fen-meadows, M25 *Molinia-Potentilla* mire and M15 *Scirpus-Erica* wet heath, in all of which *Molinia caerulea* can become extremely abundant.

In some of the accounts in *British Plant Communities*, such impoverishment is described as being especially associated with particular sub-communities of the vegetation types concerned but often the impoverishment is such that it is impossible to characterise the vegetation even at community level. One possibility then would be to recognise what in Continental schemes have been called 'basal communities' (Kopecky & Hejny 1974), affiliated to a higher-level syntaxon like an alliance or order, or the splendidly named 'rump communities' of Schaminée *et al*. (1995 *et seq.)*.

Some newly-described ranker grasslands may, however, be better characterised at community level where there is a somewhat more varied assemblage of dominants and associates. Various surveys, for example, have recognised rank swards with an abundance of *Festuca rubra* and *Holcus lanatus* with frequent *Anthoxanthum odoratum*, *Poa pratensis* and *Trifolium repens* but lacking the maritime character of MC9 *Festuca-Holcus* grassland. This seems often to derive from a neglect of mowing in traditional meadows, often compounded by a drop in ground water levels where this has been important in helping maintain species-richness.

## 3.5 Level 5: plant communities well characterised in the NVC but perhaps needing further sub-communities

Extensive further sampling since the NVC has revealed considerable variation within some vegetation types that are already described in *British Plant Communities* which is not adequately covered by the range of existing sub-communities. In other cases, new variation looks like vegetation that is intermediate between communities already defined in the NVC that could well be considered as a sub-community of one or the other.

In some cases, existing NVC communities have been found to include floristic and physiognomic variation on a scale that is elsewhere in the scheme represented by several separate communities. A prime example here is M15 *Scirpus-Erica* wet heath which, though acknowledged as diverse in *British Plant Communities* probably encompasses as much variety as several of the blanket and raised mire communities together. Drier heaths, too, like H10 *Calluna-Erica*, H12 *Calluna-Vaccinium* and H21 *Calluna-Vaccinium-Sphagnum* heaths have been found to include forms with abundant *Juniperus communis*, *Arctostaphylos uva-ursi* and *Racomitrium lanuginosum* which cannot readily be accommodated among existing sub-communities, while upland swards like U5 *Nardus-Galium* and U6 *Juncus-Festuca* grasslands have transitions to heaths and tall-herb communities that are not covered in the NVC.

Some more montane communities like U7 *Nardus-Galium* grass-heath and U8 *Carex-Polytrichum* sedge-heath have distinctive types characterised by suites of oceanic bryophytes, and further survey among snow-beds suggests both new sub-communities in U11 *Polytrichum-Kiaeria* vegetation as well as some new communities.

Unimproved grasslands of the MG5 *Centaureo-Cynosuretum* type include more variation than is described in the NVC and there are transitions between these swards and the MG3 *Anthoxanthum-Geranium* meadow in the North Pennines. Between there and the Vale of York, there are also transitions between the latter and MG4 *Alopecurus-Sanguisorba* flood-meadow. The MG6 *Lolio-Cynosuretum* also appears to have a distinctive sub-community on reclaimed coastal marshes.

Among tall-herb fens, there seems to be an additional type of M27 *Filipendula-Angelica* mire from Scotland characterised by Northern Montane preferentials, and stands of M25 *Phragmites-Eupatorum* and M26 *Phragmites-Urtica* communities where Junci and associates typical of Junco-Molinion rush pastures are frequent.

Woodlands such as W10 *Quercus-Pteridium-Rubus*, W11 *Quercus-Betula-Oxalis*, W16 *Quercus-Betula-Deschampsia* and W17 *Quercus-Betula-Dicranum* communities can have field layers so overwhelmingly dominated by either *Luzula sylvatica* or *Pteridium aquilinum* that they cannot readily be included in any existing sub-community. Then, in wetter W4 *Betula-Molinia* and W7 *Alnus-Fraxinus-Lysimachia* woodlands in the Scottish uplands, *Salix aurita* is such a distinctive local dominant in shrubby canopies that distinctive types of vegetation ought perhaps to be recognised.

## 3.6 Level 6: new variation and gaps at plant community level

Finally, and most obvious among the variation emerging from survey subsequent to the NVC or as gaps suggested by a consideration of associations characterised elsewhere in Europe, are potential new communities. We can provisionally recognise 50 such vegetation types in addition to those likely to be defined from existing alliances (level 2 above). In total, this would increase the number of communities in the NVC by 20%, though most of the newcomers are relatively modest in scale and may have no sub-communities. Indeed, further sampling may reveal that this is too generous an estimate altogether as some Continental syntaxa we have included may occur no more than very fragmentarily in the UK.

The distribution of these provisional new communities (plus those characterised at level 2 from existing NVC alliances) within the phytosociological frame is summarised in Table 3.1. For most of these, it has been possible to provide an outline description in Section 6, though some (marked with an asterisk in Table 3.1) have been treated together because, at the moment, we know so little about each.

Given the particular methodology adopted by the NVC with its focus on homogeneous stands and the limited resources available for survey (5 staff for 3 field seasons, plus some external contributors), the weaknesses in coverage and the gaps identified in this exercise are to some extent predictable. In habitat terms, they tend to be:

- transitional or marginal situations like woodland fringes or hedge-bottoms;
- fragmentary habitats like rock outcrops and scree crevices;
- ephemeral situations such as seasonally-flooded hollows and temporary pools; and
- more remote, inaccessible or awkward situations like cliff ledges, snow-beds and open waters.

In phytosociological terms, the biggest weaknesses and most numerous gaps are among the freshwater aquatic vegetation of moving and standing waters (Parvopotamion, Callitricho-Batrachion, Ranunculion, and Charetea vegetation: perhaps 11 new communities) shallow or fluctuating pools (Eleocharition, Hydrocotylo-Baldellion and Nanocyperion: perhaps 8 new communities) and water-margins and springs (Cardamino-Montion and Sparganio-Glycerion: perhaps 7 new communities).

**Table 3.1** Provisional new communities characterised at levels 2 and 6 arranged under their phytosociological formations and alliances

| | |
|---|---|
| COASTAL MUD-FLATS AND BRACKISH WATERS | |
| SM1 Zosterion marinae | 2 |
| Ruppion maritimae | 1 |
| SHINGLE, STRANDLINE AND SAND-DUNE COMMUNITIES | |
| Silenion maritimae | 1 |
| Salsolo-Honkenyion | 1 |
| Atriplicion littoralis | 3 |
| FRESHWATER AQUATIC VEGETATION | |
| Nitellion | 1 |
| Charion fragilis | 2 |
| Charion vulgaris | 3 |
| Parvopotamion | 1 |
| A16 Callitricho-Batrachion | 4 |
| SPRINGS, SHORELINES, SWAMPS AND TALL-HERB FENS | |
| Cardamino-Montion (including M36) | 3 |
| Eleocharition | 2 |
| M30 Hydrocotylo-Baldellion | 5 |
| Nanocyperion | 1 |
| Phragmition australis | 1 |
| SM23 Sparganio-Glycerion | 4 |
| WEED COMMUNITIES | |
| Sisymbrion | 1 |
| Convolvulion | 3 |
| Aegopodion | 2 |
| Galio-Alliarion | 1 |
| Arction | 2 |
| Onopordion | 1 |
| Dauco-Melilotion | 1 |
| Atropion | 1 |
| MIRES | |
| Caricion nigrae | 1 |
| GRASSLANDS AND HEATHS | |
| Calthion palustris | 1 |
| Potentillion anserinae | 2 |
| Cynosurion cristati | 1 |
| Thero-Airion | 3 |
| Alysso-Sedion | 1 |
| Sedion anglici | 1 |
| ROCK-CREVICE AND SCREE VEGETATION | |
| Cystopteridion fragilis | 3 |
| MONTANE HEATHS, TALL-HERB COMMUNITIES AND SNOWBEDS | |
| Nardo-Caricion | 1 |
| Adenostylion | 1 |
| Salicion herbaceae | 2 |
| FRINGE, SCRUB AND BROADLEAF WOODLAND COMMUNITIES | |
| Geranion sanguinei | 2 |
| Melampyrion pratensis | 2 |
| Sambuco-Salicion auritae | 1 |
| CONIFEROUS WOODLAND COMMUNITIES | |
| Dicrano-Pinion | 1 |

A further substantial group of new communities comprises weedy vegetation (Sisymbrion, Arction, Onopordion, Dauco-Melilotion: 5 communities) or rank vegetation of clearings, woodland fringes and river banks and shoals (Convolvulion, Aegopodion, Galio-Alliarion, Arction and Atropion: 9 possible communities). Saum proper comprises a related group (Geranion and Melampyrion: 3 communities perhaps).

Shingle and strandline vegetation (Silenion, Salsolo-Honkenyion and Atriplicion: perhaps 5 communities) and mud-flat and lagoon assemblages (Zosterion and Ruppion: 3 communities) are the major omissions at this level among maritime vegetation.

Among lowland grasslands, the most substantial deficiency appears to be among wetter swards in floodplains, on grazed river terraces that are kept very moist and from periodically inundated hollows among pastures and more base-poor dune slacks. The realm of variation included here has emerged as quite complex and spanning parts of a number of at present distinct NVC communities (Calthion, Potentillion and perhaps also Caricion nigrae: 2 or 3 new communities). Ranker swards of damp clay banks and soil dumps (Potentillion: 1 community) and of neglected meadows and pastures (Cynosurion: 1 community) also belong to this lowland grassland group.

Ephemeral-rich vegetation of shallow, drought-prone sandy soils (Thero-Airion: perhaps 3 communities), stonecrop swards of outcrops and rock-hollows or crevices (Sedion anglici and Alysso-Sedion: 2 communities) and fern assemblages of shaded talus, rock clefts and banks (Cystopteridion: 3 communities) comprise a further distinctive and under sampled group.

From the montane zone, the major deficiencies appear to be among snow-bed assemblages (Salicion herbaceae: 2 communities), tall-herb vegetation (Adenostylion: 1 community) and fell-field (Nardo-Caricion: 1 community).

Finally, among woodlands and scrub, it appears that lowland elder-willow scrub (Sambuco-Salicion) and lichen-rich pine woodland from Scotland (Dicrano-Pinion) are the major omissions among semi-natural vegetation, though we have suggested categories for *Rhododendron ponticum* scrub and conifer plantations. Saum vegetation could also sensibly be included here (Geranion and Melampyrion: 2 communities).

# 4 Variation best seen as complexes of existing NVC vegetation types

## 4.1 Limestone pavement

Some variation encountered in vegetation survey is difficult to sample using the standard NVC methodology and hard to accommodate within the frame of the classification because it is essentially a complex of various vegetation types. A prime example of such a complex is the vegetation of limestone pavements which is frequently described as ‘not fitting the NVC’.

In fact, although some of the component communities are poorly covered in the NVC (like stonecrop stands, for example or Saum), there is nothing encountered on the various forms of limestone pavement that cannot be described in terms of fragments or complexes of a variety of vegetation types already represented in *British Plant Communities* or provisionally characterised in this overview. What is distinctive about the vegetation of limestone pavements is the intricate fashion in which these elements are disposed over a diversity of physiographic features like clints, grikes and solution hollows and transitions to the surrounding context of cliff, scree, grassland, woodland, mire or heath.

The following list gives some indication of the vegetation types associated with these various elements:

Deeper grikes
essentially a field layer of W9 *Fraxinus-Sorbus-Mercurialis* woodland

Shallower grikes and bigger clint crevices
OV38 *Gymnocarpietum robertianum* fern vegetation

Smaller crevices in grikes and clint surfaces
OV39 *Asplenietum trichomano-rutae-murariae* fern vegetation
OV40 *Asplenio-Cystopteridetum fragilis* fern vegetation

Shallower soil-filled grikes
CG9 *Sesleria-Galium* grassland
MG5 *Centaureo-Cynosuretum* grassland

Shallower peat-filled grikes
M10 *Pinguiculo-Caricetum dioicae* small-sedge fen
M26 *Molinia-Crepis* fen-meadow
M27 *Filipendula-Angelica* tall-herb fen

Solution-hollows on clint surfaces
M10 *Pinguiculo-Caricetum* small-sedge fen
algae/cyanobacterial assemblages

Seasonally-desiccated soils on clint surfaces
*Saxifrago-Poetum compressae* community
*Airo-Sedetum anglici* stonecrop community

Pavement surrounds
*Rubo-Origanetum* woodland fringe community and transitions to various grassland, woodland, mire and heath communities

## 4.2 Other complexes

There has always been difficulty in relating vegetation types distinguished by the NVC with classification units characterised from lakes, where whole water-bodies or parts of them, rather than homogeneous stands of vegetation, have been the sampling units (eg. Palmer 1992), from rivers where lengths of water course or bank have been used for sampling (eg. Holmes 1983 and Holmes *et al.* 1999), or from ditches where water and bank have often been sampled together. However, provided good quality data are available from these different approaches, there is nothing in principle to prevent informative cross-references between them being made. The other value of these alternative approaches for phytosociological survey is that they characterise distinctive aquatic complexes within which NVC sampling can then take place. This will be especially useful where such classification can help target missing vegetation types as outlined above.

# 5 Conservation significance

The original contract brief stated that the NVC should aim to be comprehensive in its coverage and include vegetation from all natural, semi-natural and major artificial habitats, except where non-vascular plants were the dominants. Only short-term leys were specifically excluded, and though care was to be taken to sample more pristine and long-established kinds of vegetation, no undue attention was to be given to assemblages of rare plants or to especially rich and varied sites.

This review of the NVC has continued to work to such a brief and has not focused unduly on rare or threatened communities, or on communities with high biodiversity interest. However, the review has attempted to grade the vegetation which is not yet described according to its nature conservation significance, and in particular, identify types of vegetation which characterise habitat types that are listed on Annex I of the EC Habitats Directive that are not currently described by the NVC or that have important variation which is not described. The *Interpretation manual of European Habitats* (European Commission 1999) and the site selection process has increased our understanding of the nature of these vegetation types and the variation has been taken into consideration during the site selection process. However, the description of these types will assist the country agencies in site management and safeguard and therefore is a priority for further work.

Some of this variation has already been well covered by new survey work and description and the outstanding task is to formally characterise it; for other vegetation types, there are existing samples but these would need to be supplemented with further field work before analysis to ensure that the full range of geographic variation is incorporated; and for others there are no substantial data collected for them at all or they have not been sampled in an NVC-compatible manner. New variation which may relate to habitat types listed on the Habitats Directive is marked with an asterisk in Section 6.

# 6 Annotated conspectus

The results of this review are presented below within the framework of the *Phytosociological Conspectus of British Plant Communities* (Rodwell 1997, 2000). This conspectus orders the NVC vegetation types into the hierarchical frame of alliances, orders and classes currently being prepared by the European Vegetation Survey. Throughout this conspectus commentary is provided were new variation or gaps have been identified.

The levels of new variation or gaps as set out in section 3 are given in brackets after the existing community name or a provisional name for new variation at community level. New types marked with an asterisk are potentially relate to variation of habitat types listed on Annex I of the EC Habitats Directive.

## COASTAL MUDFLATS AND BRACKISH WATERS

**ZOSTERETEA MARINAE** Pignatti 1953
Eel-grass swards on muddy and sandy substrates in the sublittoral and eulittoral zones, exposed no more than 2-3 hours at a time

ZOSTERETALIA MARINAE Beguinot 1941 em. R.Tx. et Oberdorfer 1958
Eel-grass swards of shallower waters

**Zosterion marinae** Christiansen 1934

SM1 *Zostera* communities (2)*
In *British Plant Communities*, there is a description of the vegetation with the various *Zostera* spp., but only a limited amount of data. It is certain that further sampling will enable the two associations distinguished elsewhere in Europe to be characterised.

*Zostera marina* community
*Zosteretum marinae* Harmsen 1936
Stands of *Z. marina* on firm sands, sandy muds and gravelly flats in the sub-littoral zone down to 4m. Relevés by Dargie (unpublished).

*Zostera noltii/angustifolia* community
*Zosteretum noltii* Harmsen 1936
Stands of *Z. noltii*, sometimes in mixtures or mosaics with *Z. angustifolia*, on very soft to firm muds and sands in the eu-littoral zone. 15 relevés by Proctor (unpublished) from Exe Estuary in UKVDB.

Stewart *et al*. (1994) provide updated distribution maps for all three species together with information on their current status and the Unit of Vegetation Science has extensive correspondence about these kinds of vegetation. Apart from the relative scarcity of the plants themselves, eelgrass swards are of major importance as a food source for wildfowl. The localities are known but sampling is difficult and dangerous.

**RUPPIETEA MARITIMAE** J. Tüxen 1960
Tassel-weed and spike-rush communities of brackish to saline waters in estuaries, salt-marsh pools and dykes of reclaimed coastal marshes

RUPPIETALIA MARITIMAE J. Tüxen 1960

**Ruppion maritimae** Br.-Bl. 1931

SM2 *Ruppia maritima* salt-marsh community (1)*
*Ruppietum maritimae* Iversen 1934
There is no table in *British Plant Communities* but the UKVDB holds 11 relevés from various sources (Lee 1977, Proctor, unpublished) with further data from Dargie (unpublished) and less formal information on the occurrence of *R. maritima*.

*Ruppia cirrhosa* (*spiralis*) community (6)*
Ruppietum cirrhosae Hocquette 1927
The UKVDB has only 1 relevé with this species growing among *R. maritima* but, as in the Netherlands, it may be possible to recognise a separate assemblage with *R. cirrhosa*, *Potamogeton pectinatus* and *Zannichellia palustris* on soft sediments in the brackish and often quite deep waters of tidal inlets, lagoons, pools and ditches, mainly around the south-east coast with scattered localities elsewhere (see Stewart *et al*. 1994, Preston 1995). This kind of vegetation is of conservation significance because of the scarcity of *R. cirrhosa* but it also forms an integral part of an important reclaimed landscape vulnerable to sea-level rise. Sampling should be easy but data need to be assessed in relation to the A6 *Ceratophylletum submersi* and A21 *Ranunculetum baudotii* communities.

SM3 *Eleocharis parvula* salt-marsh community (1)
*Eleocharitetum parvulae* (Preuss 1911/12) Gillner 1960
There is no table in *British Plant Communities* and no relevés in the UKVDB or elsewhere as far as we know. The Beaulieu and Maentwrog stands are quite accessible and should be sampled.

## SALT-MARSH AND SEA-CLIFF VEGETATION

**SPARTINETEA MARITIMAE** R.Tx. in Beeftink 1962
Pioneer vegetation of perennial cord grasses on intertidal mud and sand

SPARTINETALIA MARITIMAE Conard 1935

**Spartinion maritimae** Conard 1952

SM4 *Spartina maritima* salt-marsh community (1)*
*Spartinetum maritimae* (Emb. et Regn. 1926) Corillion 1953
There is no table in *British Plant Communities* though the species occurs in 21 relevés as an occasional in other NVC vegetation types and Géhu and Delzenne (1975) have 5 relevés of the community from Wittering in Sussex. Remaining stands where it is dominant there and elsewhere around the Solent, Chichester Harbour, Essex and The Wash need sampling to characterise this vegetation.

SM5 *Spartina alterniflora* salt-marsh community (1)*
Spartinetum alterniflorae Corillion 1953
There is no table in *British Plant Communities* and no relevés in the UKVDB but Géhu and Delzenne (1975) have 5 from the only apparently natural stand at Marchwood (Perring and Farrell 1977).

SM6 *Spartina anglica* salt-marsh community
*Spartinetum anglicae* Corillion 1953 corr. Géhu et Géhu-Franck 1984

**THERO-SALICORNIETEA** (Pignatti 1953) R.Tx. in R.Tx. et Oberdorfer 1958
Pioneer communities of annual glassworts, seablite or other halo-nitrophiles on tidal mud-flats

THERO-SALICORNIETALIA Pignatti 1953 em. R.Tx. 1954 ex R.Tx. et Oberdorfer 1958
Pioneer communities of annual glassworts and seablite on tidal mud-flats

**Thero-Salicornion strictae** Br.-Bl. 1933 em. R.Tx. 1950 in Tx et Oberdorfer 1958

SM7 *Arthrocnemum perenne* salt-marsh community

SM8 Annual *Salicornia* salt-marsh community
Salicornietum europaeae Warming 1906

SM9 *Suaeda maritima* salt-marsh community
*Suaedetum maritimae* (Conard 1935) Pignatti 1953

**JUNCETEA MARITIMI** R.Tx. et Oberdorfer 1958
Usually closed swards on the silt and sand of coastal and inland salt-marshes and on sea cliffs and stable shingle beaches

GLAUCO-PUCCINELLIETALIA Beeftink et Westhoff 1962

**Puccinellion maritimae** Christiansen 1927 emend Tx. 1937
Communities of the lower parts of salt-marshes, generally inundated by spring tides

SM10 Transitional low-marsh vegetation

SM11 *Aster tripolium* var. *discoideus* salt-marsh community

SM12 Rayed *Aster tripolium* stands

SM13 *Puccinellia maritima* salt-marsh community
Puccinellietum maritimae (Warming 1906) Christiansen 1927

**Puccinellio maritimae-Spergularion salinae** Beeftink 1965
Ephemeral communities in saline habitats, coastal and inland, with disturbance or fluctuating moisture regime

SM23 *Spergularia marina-Puccinellia distans* salt-marsh community
Puccinellietum distantis Feekes (1934) 1945

**Armerion maritimae** Br.-Bl. et De Leeuw 1936
Perennial communities of the upper parts of salt-marshes, rarely inundated by spring tides

SM14 *Halimione portulacoides* salt-marsh community
*Halimionetum portulacoidis* (Kuhnholtz-Lordat 1927) Des Abbayes et Corillion 1949

SM16 *Festuca rubra* salt-marsh community
Juncetum gerardii Warming 1906

SM17 *Artemisia maritima* salt-marsh community
Artemisietum maritimae Hocquette 1927

SM18 *Juncus maritimus* salt-marsh community

SM19 *Blysmus rufus* salt-marsh community
*Blysmetum rufi* (G.E. et G. Du Rietz 1925) Gillner 1960

SM20 *Eleocharis uniglumis* salt-marsh community
Eleocharitetum uniglumis Nordhagen 1923

SM21 *Suaeda vera-Limonium binervosum* salt-marsh community

SM22 *Halimione portulacoides-Frankenia laevis* salt-marsh community
Limonio vulgaris-Frankenietum laevis Géhu et Géhu-Franck 1975

SM25 *Suaeda vera* salt-marsh community
Elmyo pycnanthi-Suaedetum verae (Arènes 1933) Géhu 1975

SM26 *Inula crithmoides* stands

**Halo-Scirpion** (Dahl et Hadac 1971) Den Held et Westhoff 1969 nom.nov.
Vegetation of flushed depressions in upper salt-marsh

SM15 J*uncus maritimus-Triglochin maritima* salt-marsh

**Silenion maritimae** Malloch 1971
Closed swards of perennials on seacliff tops, ledges and stable shingle little splashed by salt-spray

MC2 *Armeria maritima-Ligusticum scoticum* maritime crevice community

MC3 *Rhodiola rosea-Armeria maritima* maritime cliff ledge community

MC8 *Festuca rubra-Armeria maritima* maritime grassland

MC9 *Festuca rubra-Holcus lanatus* maritime grassland

MC10 *Festuca rubra-Plantago* ssp. maritime grassland

MC11 *Festuca rubra-Daucus carota* ssp. *gummifer* maritime grassland

MC12 *Festuca rubra-Hyacinthoides non-scripta* maritime cliff community

*Arrhenatherum elatius-Silene maritima* grassland (6)*
Sneddon & Randall (1993*a*, *b*; 1994*a*, *b*) characterised a series of vegetation types from shingle structures around the British coastline in which *Arrhenatherum elatius* figured more or less prominently, with *Silene maritima*, *Festuca rubra*, *Hypochoeris radicata*, *Rumex crispus*, *Cerastium semidecandrum*, *Hypnum cupressiforme* occasional to frequent and varying representation of lichens - *Cladonia furcata*, *C. impexa*, *C. arbuscula*, *C. crispata* and others. One form of this vegetation (SH1 with dominant *A. elatius* and few associates) was more widespread, the others (SH37-41) more exclusively southern and especially well represented at Orfordness. No relevé data nor floristic tables are provided in the report, nor are there any precise details of the environmental conditions characteristic of each assemblage, bar some general remarks about conditions being more or less maritime, more or less stable or more or less mature. An earlier survey (Harding & Kay 1992) from the Suffolk coast covers what is probably the same vegetation and does include relevés. This

vegetation may be best considered among the Silenion communities or the Arrhenatherion and is an important element of distinctive and vulnerable coastal landscapes, but the data need a careful re-examination and better contextualising.

**SAGINETEA MARITIMAE** Westhoff, van Leeuwen et Adriani 1962
Ephemeral vegetation with winter annuals on bare or disturbed salt-marsh muds and sand, periodically wettened by saline waters

SAGINETALIA MARITIMAE Westhoff, van Leeuwen et Adriani 1962
Atlantic and Mediterranean ephemeral vegetation in saline habitats

**Saginion maritimae** Westhoff, van Leeuwen et Adriani 1962

SM27 Ephemeral salt-marsh vegetation with *Sagina maritima* (2)*
*Sagina maritima-Cochlearia danica* community
*Sagino maritimae-Cochlearietum danicae* R.Tx. et Gillner 1957
There is no floristic table for Saginion vegetation in *British Plant Communities* but sampling will probably characterise an equivalent of this association from open colonising assemblages of *Sagina maritima, Cochlearia danica, Desmazeria marina* and *Plantago coronopus* in bare patches among upper salt-marsh turf, reclaimed coastal marshland and brackish dune slacks all around the British coast. Disturbance along pathways or through grazing or, in a few localities, the removal of salt-marsh turf for lawns and bowling greens can be important in the creation of suitable habitats. This vegetation occurs as an integral element of Atlantic salt-meadows and is an important locus for salt-tolerant ephemerals like *Bupleurum tenuissimum* (in the south), *Centaurium littorale* (in the north) and *Parapholis incurva* (on Spurn Head in East Yorkshire). It also provides additional diversity and local dynamic change in a distinctive landscape. The vegetation is easy to access on coastal marshes but scarce overall now, so sampling may need patience. Figure 18 in Appendix 1 shows a potential distribution map for this vegetation type which has been created by coincidence mapping characteristic species.

**CRITHMO-LIMONIETEA** Br.-Bl. in Br.-Bl. et al. 1952
Open communities of crevices on rocky seacliffs much splashed by salt spray

CRITHMO-ARMERIETALIA MARITIMAE Géhu 1964

**Crithmo-Armerion maritimae** Géhu 1968

MC1 *Crithmum maritimum-Spergularia rupicola* maritime crevice community
*Crithmo-Spergularietum rupicolae* Géhu 1964

MC4 *Brassica oleracea* maritime cliff-ledge community

# STRANDLINE AND SAND-DUNE COMMUNITIES

**CAKILETEA MARITIMAE** R.Tx. et Preising ex Br.-Bl. & Tx. 1952
Pioneer vegetation, mostly of nitrophilous summer annuals, on nutrient-rich detritus of strandlines on sand and shingle beaches

CAKILETALIA MARITIMAE R.Tx. apud Oberdorfer (1949) 1950
Atlantic and Baltic annual halo-nitrophilous communities

**Salsolo-Honkenyion peploidis** R.Tx. 1950
Communities of strand lines with sand-covered detritus or shingle

SD2 *Honkenya peploides-Cakile maritima* standline

SD3 *Matricaria maritima-Galium aparine* standline

*Raphanus maritimus-Matricaria maritima* community (6)*
Sneddon & Randall (1993*a*, 1994*a*, *b*) characterised a series of assemblages (SH12 & 13) of pioneer vegetation from shingle structures with *Raphanus maritimus* and *Matricaria maritima* constant, *Arrhenatherum elatius*, *Atriplex prostrata*, *Festuca rubra* and *Rumex crispus* associates. This vegetation was largely northern and particularly associated with shingle beaches in Western Scotland, though also found on The Scillies. No relevés, nor floristic tables, nor precise environmental details were provided and re-examination of data from this distinctive landscape is essential if a clearer evaluation is to be obtained. In particular, we need to know how this vegetation relates to the SD3 *Matricaria-Galium* community and just how it differs from the *Arrhenatherum-Silene* vegetation which Sneddon & Randall (1993*a*) described.

**Atriplicion littoralis** (Nordhagen 1940) Tx. 1950
Communities of shingle or strand lines sometimes mixed with but not covered by sand

MC6 *Atriplex hastata-Beta vulgaris* ssp. *maritima* sea-bird cliff community
*Atriplici-Betetum maritimae* J.-M. et J. Géhu 1969

(6)*
It is quite clear (eg. Harding & Kay 1992*a*, Sneddon & Randall 1993) that MC6 *Atriplici-Betetum* occurs widely as a colonising assemblage on shingle as well as on seabird cliffs. Strandline vegetation with a local abundance of various *Atriplex* spp. was also included in *British Plant Communities* in the SD2 *Honkenya-Cakile* and SD3 *Matricaria-Galium* communities. Re-examination of these data, plus any samples subsequent to the NVC (summarised in part in Dargie 1993, 1995, Sneddon & Randall 1993 and Radley 1994, see also Dargie 1998c), will probably characterise a range of communities best placed in the Atriplicion alliance. We might thus expect equivalents of the *Atriplicetum littoralis* Libbert 1940, the *Atriplicetum laciniatae* Nordhagen 1940 and perhaps the *Atriplicetum glabriusculae-calothecae* Fröde 1957/58 described from other parts of Europe. These assemblages are an important part of the dynamic vegetation of strandlines and, in the north, provide a locus for the scarce (though probably under-recorded) *A. praecox*. They are of ephemeral duration in any locality and of awkward shape to sample but are quite accessible. Other vegetation with *Catabrosa aquatica* and *Potentilla anserina* from wet or damp strandlines in Scotland also needs appraisal (Dargie 1998*a*).

**HONCKENYO-ELYMETEA** R.Tx. 1966
Vegetation of coastal shingle, boulders or rocky cliffs enriched with organic detritus

ELYMETALIA ARENARII Br.-Bl. & R.Tx. 1943

**Elymion pycnanthi** Géhu 1968
Communities of salt-marsh strandlines in warmer parts of Europe

SM24 *Elymus pycnanthus* salt-marsh
*Atriplici-Elymetum pycnanth*i Beeftink et Westhoff 1962

Honkenyo latifoliae-Crambion maritimae (Géhu 1968) J.-M et J. Géhu 1969
Communities of enriched coastal habitats, mostly boreal

SD1 *Rumex crispus-Glaucium flavum* shingle community

MC7 *Stellaria media* seabird cliff community

**AMMOPHILETEA ARENARIAE** Br.-Bl. et R.Tx. ex Westhoff et al. 1946
Vegetation dominated by rhizomatous grasses or sedges on mobile or fixed coastal or inland dunes

AMMOPHILETALIA ARENARIAE Br.-Bl. 1933

**Elymo-Honkenyion peploidis** R.Tx. apnd Br.-Bl. et R.Tx. 1952
Pioneer vegetation of coastal foredunes

SD4 *Elymus farctus boreali-atlanticus* foredune community

**Ammophilion arenariae** Br.-Bl. 1933 em. R.Tx. 1955
Vegetation of young to fixed dunes around the Atlantic coast of Europe

SD5 *Leymus arenarius* mobile dune community

SD6 *Ammophila arenaria* mobile dune community

SD7 *Ammophila arenaria-Festuca rubra* semi-fixed dune community (5)*
Dargie (1993) describes a very widespread form of SD7 *Ammophila-Festuca* dune with *Galium verum*. More localised around Moray Firth (Dargie 1994*a*, *b*) is a type with a thick carpet of pleurocarpous mosses, notably *Hylocomium splendens* and *Rhytidiadelphus triquetrus*, which seems to provide a link with Boreal dunes.

SD9 *Ammophila arenaria-Arrhenatherum elatius* dune grassland (5)*
High cover of *Hylocomium splendens* and other pleurocarpous mosses in a thick carpet, occasionally with *Deschampsia flexuosa*, are a feature of this community around the Moray Firth (Dargie 1994*b*).

SD10 *Carex arenaria* dune community

# FRESHWATER AQUATIC VEGETATION

**LEMNETEA** de Bolos et Masclans 1955
Free-floating duckweed communities of still, relatively nutrient-rich, fresh waters in more winter-warm parts of Europe

LEMNETALIA MINORIS Tüxen 1955

**Lemnion minoris** Tüxen 1955
Duckweed communities of eutrophic and hypertrophic waters

A2 *Lemna minor* community
Lemnetum minoris Soó 1947

**Lemnion gibbae** R.Tx. et Schwabe 1972
Duckweed communities of more base-rich (and/or hypertrophic) waters

A1 *Lemna gibba* community
*Lemnetum gibbae* Miyawaki et J. Tüxen 1960

A3 Spirodela polyrrhiza-Hydrocharis morsus-ranae community

**Lemnion trisulcae** Den Hartog et Segal 1964 em. Tüxen et Schwabe in Tüxen 1974
Duckweed and liverwort communities of shallow, more mesotrophic waters

(5)
Elsewhere in Europe, vegetation with *Riccia fluitans* and *Ricciocarpus natans* growing among duckweeds in shallow waters or on muddy margins (A2c in the NVC) is sometimes included in this alliance as distinct communities, the *Riccietum fluitantis* Slavnic 1956 emend R.Tx. 1974 and the *Riccicarpetum natantis* Segal 1963 emend R.Tx. 1974 (see, for example, Schaminée *et al*. 1995).

**CHARETEA FRAGILIS** Fukarek ex Krausch 1964
Submerged stonewort swards

With an extension of sampling to include vegetation dominated by stoneworts (now comprehensively described in Moore 1986 with threatened species in Stewart & Church 1992), it might be possible to characterise assemblages equivalent to the following associations recognised from The Netherlands (Schaminée *et al*. 1995) and elsewhere. No relevés available.

NITELLETALIA FLEXILIS Krause 1969

**Nitellion flexilis** Dambska 1966 em. Krause 1969

*Nitella translucens* community (6)*
Nitelletum translucentis Corillion 1957
Stands of *Nitella translucens* with *N. flexilis*, *Potamogeton natans*, *Juncus bulbosus*, *Eleocharis palustris*, *Alisma plantago-aquatica*, *Spirodela polyrrhiza* and *Lemna minor* in clear, circumneutral standing waters in unshaded ditches, ponds, lakes and pools in fens.

**Charion fragilis** Krause 1964 em. van Daam et Schaminée

in Schaminée et al. 1995
Submerged stonewort swards of lime-rich freshwaters

*Nitellopsis obtusa* community (6)*
*Nitellopsidetum obtusae* Sauer ex Dambska 1961
Stands of *Nitellopsis obtusa* with *Chara globularis* and occasional other stoneworts, *Urticularia vulgaris* and *Fontinalis antipyretica* in deeper lakes and sluggish streams at lower altitudes, especially around the coast where the waters can be of high pH and mildly brackish.

*Chara hispida* community (6)*
Charetum hispidae Margalef 1947
Stands of *Chara hispida*, occasionally with *C. vulgaris* and *C. globularis*, in often calcareous, peaty waters, only moderately deep, of lakes, ponds, canals, gravel pits and peat cuttings in fens.

*Chara aspera* community (6)*
*Charetum asperae* Corillion 1957
Stands of *Chara aspera*, occasionally with *C. hispida*, *Elodea nuttallii*, *Potamogeton natans* with emergents like *Phragmites australis* or *Scirpus maritimus* in shallower, fresh and brackish waters of lakes, ponds, ditches and peat cuttings.

**Charion vulgaris** (Krause ex Krause et Lang 1977) Van Raam et Schaminée 1995
Submerged stonewort swards of more eutrophic waters

*Chara vulgaris* community (6)*
Charetum vulgaris Corillion 1957
Stands of *Chara vulgaris* with occasional *Elodea nuttallii*, *E. canadensis*, *Potamogeton pusillus*, *P. lucens* and emergent helophytes in every kind of lake, pond, puddle or ditch, including brackish situations.

*Tolypella prolifera* community (6)*
Tolypelletum proliferae Guerlesquin 1961
Annual stands of *Tolypella prolifera* with occasional *Chara vulgaris*, *Elodea nuttallii*, *Lemna trisulca*, *L. minor* and *Ranunculus circinatus* in shallow, often ephemeral puddles and ditches.

*Chara canescens* community (6)*
*Charetum cranscentis* Corillion 1957 em. Van Raam et Schaminée
Stands of *Chara canescens*, *C. aspera*, *C. connivens* and *C. baltica* with *Potamogeton pectinatus* and *Zannichellia palustris* in usually shallow, brackish waters of lakes, pools and ditches by the sea and very rare in the UK.

**POTAMETEA** Klika in Klika et Novák 1941
Communities of rooted, floating or submerged plants in mesotrophic and eutrophic fresh or brackish waters

NUPHARO-POTAMETALIA Schaminée, Lanjouw et Schipper 1990

**Parvopotamion** (Vollmar 1947) den Hartog et Segal 1964
Rooted aquatic communities in moderate to deep standing waters, often open to wave action

A5 *Ceratophyllum demersum* community (5)
*Ceratophylletum demersi* Hild 1956
*Ranunculus circinatus* has its main occurrence in the NVC in this community but a separate *Ranunculetum circinati* Bennema et Westhoff ex Segal 1965 has been characterised in the Netherlands with *C. demersum*, *Elodea canadensis*, *Lemna* spp. and *Potamogeton pusillus*. Is this synonymous with A5a?

A11 *Potamogeton pectinatus-Myriophyllum spicatum* community (5)*
A11 was originally defined in the NVC using some data collected in a somewhat different fashion (Palmer 1992: see Rodwell 1994). Further relevés will probably refine the characterisation of sub-communities within this vegetation type.

A12 *Potamogeton pectinatus* community

A13 *Potamogeton perfoliatus-Myriophyllum alterniflorum* community (5)*
A13 was originally defined in the NVC using some data collected in a somewhat different fashion (Palmer 1992: see Rodwell 1994). Further relevés will probably refine the characterisation of sub-communities within this vegetation types.

A15 Elodea canadensis community

*Groenlandia densa* community (6)
*Groenlandietum densae* Segal ex Schipper, Lanjouw et Schaminée 1995
In *British Plant Communities*, *Groenlandia densa* occurs occasionally among aquatic and swamp vegetation but it is a widespread though local plant through southern and eastern England in shallow, usually calcareous, waters of ponds, ditches, canals, streams and rivers that have escaped eutrophication. In the Netherlands, *G. densa* occurs in a distinct association among *Elodea nuttallii*, *Potamogeton pusillus*, *Ceralophyllum demersum*, *Lemna minor* and *Spirodela polyrhiza* with emergents like *Alisma plantago-aquatica* and *Sparganium erectum* but the chalk river habitat where it is especially distinctive in the UK (Holmes 1983) may support a different assemblage. Of conservation significance as a locus for a declining species and as a landscape element, this vegetation is easy to locate and sample.

**Nymphaeion** Oberdorfer 1957
Communities of rooted aquatics with floating leaves in sheltered and nutrient-rich fresh waters

A7 *Nymphaea alba* community
*Nymphaeetum albae* Oberdorfer et Mitarb. 1967

A8 *Nuphar lutea* community

A9 *Potamogeton natans* community

A10 *Polygonum amphibium* community

A19 *Ranunculus aquatilis* community
*Ranunculetum aquatilis* Géhu 1961

**Hydrocharition morsus-ranae** Rübel 1933 em. Westhoff et den Held 1969
Communities of free-floating macrophytes in fairly nutrient-rich waters

A4 *Hydrocharis morsus-ranae-Stratiotes aloides* community (5)
*Stratiotetum* Nowinski 1930
Both *Myriophyllum verticillatum* and *Hottonia palustris* have their main locus here in the NVC but in the Netherlands they are characteristic together of *Myriophyllo-Hottonietum* Segal ex Schipper, Lanjouw et Schaminée 1995, an association of the Parvopotamion. Further sampling of vegetation with these species is essential to clarify the existence of any additional variation.

CALLITRICHO-POTAMETALIA Schipper, Lanjouw et Schaminée 1995
Crosswort, crowfoot and milfoil vegetation of moving waters and water margins

**Callitricho-Batrachion** Den Hartog et Segal 1964
Crosswort vegetation of shallow waters and muddy margins of streams, ditches and pools

A16 *Callitriche stagnalis* community (2)*
All vegetation in which various *Callitriche* spp. were prominent was subsumed under the *Callitriche stagnalis* community in *British Plant Communities*. Further sampling is necessary in shallow lowland standing waters, flooded trackways and muddy water margins to see whether we also have equivalents of associations like the *Callitricho-Hottonietum* Tüxen ex Roll 1940 and the *Ranunculetum hederacei* Schnell 1939 where *C. platycarpa* is characteristic, or the *Callitricho-Myriophylletum alterniflori* Steuslof 1939 and the *Callitricho-Ranunculetum fluitantis* Oberdorfer 1957 where *C. hamulata* is the more frequent species. As well as contributing small-scale diversity to the landscape, these kinds of vegetation provide a locus for the scarce *C. truncata* (map in Stewart *et al*. 1994). Widespread, common and easy to sample, but care is needed with identification of the starworts.

A20 *Ranunculus peltatus* community
*Ranunculetum peltati* Sauer 1947

**Ranunculion fluitantis** Neuhäusl 1959
Crowfoot and milfoil vegetation of moving waters

(6)*
This kind of vegetation was poorly sampled in the NVC and needs further attention. The river typology developed by Holmes (1983) and Holmes *et al*. (1999) should provide a useful framework within which sampling could be undertaken.

A14 *Myriophyllum alterniflorum* community
Myriophylletum alterniflori Lemée 1937

A17 *Ranunculus pencillatus* ssp. *pseudofluitans* community

A18 *Ranunculus fluitans* community
*Ranunculetum fluitantis* Allorge 1922

ZANNICHELLIETEALIA PEDICILLATAE Schaminée, Lanjouw et Schipper 1990
Communities of rooted aquatics in brackish waters

**Zannichellion pedicellatae** Schaminée, Lanjouw et Schipper 1990

A6 *Ceratophyllum submersum* community
*Ceratophylletum submersi* Den Hartog et Segal 1964

A21 *Ranunculus baudotii* community
*Ranunculetum bandotii* Br.-Bl. 1952

## SPRINGS, SHORELINES, SWAMPS AND TALL-HERB FENS

**MONTIO-CARDAMINETEA** Br.-Bl. et Tüxen ex Klika 1948
Vegetation of cold springs, commonly dominated by bryophytes

MONTIO-CARDAMINETALIA Pawlowski in Pawlowski, Sokotowski et Wallisch 1928

**Cardamino-Montion** Br.-Bl. 1926 em. Zechmeister 1993
Spring vegetation of base-poor waters

M32 *Philonotis fontana-Saxifraga stellaris* spring
*Philonoto-Saxifragetum stellaris* Nordhagen 1943

M33 *Pohlia wahlenbergii* var. *glacialis* spring
*Pohlietum glacialis* McVean & Ratcliffe 1962

*Pohlia ludwigii* snow-bed (6)
Where *Pohlia ludwigii* is abundant to dominant, with associates including frequent *Polytrichum sexangulare, Nardia scalaris* and *Deschampsia cespitosa*, on north-facing slopes irrigated by snow melt at 1050-1230 m in the Scottish Highlands, a distinct assemblage was characterised from 9 relevés by Rothero (1991).

M34 *Carex demissa-Koenigia islandica* flush
Subsequent survey makes it clear that this vegetation essentially comprises stands of *Koenigia islandica* within something like M11 *Carex-Saxifraga* mire. Survey by Averis (1997) and Averis & Averis (1997) indicates that on the Trotternish Ridge on Skye (the sole site for M34 in *British Plant Communities*), *Koenigia* is equally frequent in M11 and a new *Festuca-Oliogotrichum* fell-field in the Nardo-Caricion alliance (see below).

M35 *Ranunculus omiophyllus-Montia fontana* rill

M31 *Anthelia julacea-Sphagnum auriculatum* spring
*Sphagno-Anthelietum julaceae* Shimwell 1972

M36 Lowland springs & streambanks of shaded situations
Sampling of springs, flushes and streambanks kept damp by acid or neutral ground water and overhung with trees, shrubs or tall herbs throughout the lowlands will probably characterise assemblages like the following:

*Chrysosplenium oppositifolium-Pellia epiphylla* community (6)
*Pellio-Chrysosplenietum oppositifolia* Maas 1959 emend Siebum, Schaminée et Weeda 1995
Some stands of W7 *Fraxinus-Alnus-Lysimachia* woodland can have a rather open canopy of trees and shrubs but flush and streamside vegetation on sloppy silt or wet loamy soils that are hardly overhung or totally devoid of a woody cover are probably best referred to this association. Low, luxuriant carpets of *Chrysoplenium oppositifolium, Ranunculus repens*,

*Cardamine amara*, and *Stellaria alsine* are characteristic, with locally abundant *Carex laevigata* and various other occasionals of the Alno-Padion with *Brachythecium rivulare*, *B. rutabulum*, *Chiloscyphus polyanthos*, *Pellia epiphylla* and *Calliergon cuspidatum* in a sometimes extensive ground cover. This sort of vegetation is widespread but local on or below hillslopes of grits, shales and other less base-rich rocks from The Weald westwards and north around all our upland fringes. Similar vegetation, transitional to MG10 *Holcus-Deschampsia* grassland, was recorded from rides in Suffolk woods by Harding *et al*. (1993) and Harding (1994). Of no great conservation significance by virtue of any nationally scarce or rare plants, this assemblage adds important diversity to less intensive landscapes. It is easy of access and readily sampled.

*Ranunculus ficaria-Conocephalum conicum* community (6)
*Pellio-Conocephaletum conicum* Maas 1959 emend Weeda 1994
This vegetation is often more distinctive by virtue of its bryophyte cover than its vascular plants, so it tended to be unsampled in the NVC or subsumed as part of field and ground layers in W10 *Quercus-Pteridium-Rubus* and W8 *Fraxinus-Acer-Mercurialis* woodlands. Here, mats of *Conocephalum conicum*, *Pellia epiphylla*, *Marchantia polymorpha*, *Mnium hornum*, *Rhizomnium punctatum*, *Plagiomnium undulatum* and *Atrichum undulatum* are characteristic, sometimes with a spring show of *Anemone nemorosa*, *Ranunculus ficaria* and (in East Anglia) *Primula elatior*, and a patchy cover of *Glechoma hederacea*, *Adoxa moschatellina*, *Aegopodium podagraria* and *Moehringia trinervia*. This vegetation is typical of overhung damp clay banks and streamsides throughout lowland Britain. It may be of importance as a locus for rare bryophytes though has no great conservation value for any nationally scarce vascular plants, rather as an element of landscapes. Easy of access and readily sampled.

**Cratoneurion commutati** Koch 1928
Spring vegetation of calcareous waters

M37 *Cratoneuron commutatum-Festuca rubra* spring

M38 *Cratoneuron commutatum-Carex nigra* spring

**ISOETO-LITTORELLETEA** Br.-Bl. et Vlieger in Vlieger 1937
Hairgrass swards and related communities in nutrient-poor, standing or slow-flowing, sometimes fluctuating waters with sandy, gravelly or peaty substrates

LITTORELLETALIA Koch ex Tüxen 1937
Hairgrass swards and related communities in waters with mineral substrates

**Littorellion uniflorae** Koch 1926 ex Tüxen 1937
Water lobelia and quillwort swards in deep and cold, nutrient-poor standing waters with sandy or stony substrates

A22 *Littorella uniflora-Lobelia dortmanna* community

A23 *Isoetes lacustris/setacea* community

**Eleocharition acicularis** Pietsch 1966 em. Dierßen 1975
Vegetation of fluctuating waters with loamy soils in boreal and continental parts of Europe

(6)
*Eleocharis acicularis* is a perennial of shallow, eutrophic, standing or slack waters or, more commonly, of winter-wet water margins or pools throughout the lowlands, variable in its abundance from year to year, easily overlooked but probably generally declining (Stewart *et al.* 1994). It occurs as an occasional in various NVC communities but when growing in

abundance with *Elatine hexandra, Littorella uniflora* and *Juncus bulbosus*, it may represent vegetation like the *Eleocharitetum acicularis* Koch 1926 or *Littorello-Eleocharitetum acicularis* Malcuit 1929 recorded from Ireland (Braun-Blanquet and Tüxen 1952, Ivimey-Cook and Proctor 1966 and Schoof van Pelt 1973) and the Netherlands (Schaminée *et al*. 1995). In other situations, the presence of plants such as *Chenopodium rubrum*, *Gnaphalium uliginosum*, *Juncus bufonus*, *Rorippa palustris* and *Polygonum* spp. suggests a location among the Nanocyperion or Bidention alliances rather than here. This is another vegetation type whose conservation significance is to do with both its scarce plants and its contribution to the diversity of habitats in relatively unimproved landscapes. Of local and sporadic occurrence but easy to sample.

**Hydrocotylo-Baldellion** R.Tx. et Dierssen in Dierssen 1972
Vegetation of soakways and shallow, strongly fluctuating, mesotrophic to oligotrophic standing waters

M29 *Hypericum elodes-Potamogeton polygonifolius* soakway (3)
*Hyperico-Potametum polygonifolii* (Allorge 1921) Br.-Bl. & R.Tx.1952
Beyond the geographical range of *Hypericum elodes*, essentially similar vegetation to this community is widespread and locally frequent in small, often linear, very wet soakways at low altitudes.

M30 Related vegetation of seasonally-inundated habitats (2)
In *British Plant Communities*, a brief account suggested that further sampling of fluctuating or ephemeral lowland pools with more nutrient-poor waters and silty, sandy or peaty margins having species such as *Eleocharis multicaulis, Baldellia ranunculoides, Deschampsia setacea, Pilularia globulifera, Apium inundatum* and *Scirpus fluitans* might characterise a range of communities whose affinities are with the Hydrocotylo-Baldellion: the *Eleocharitetum multicaulis* R.Tx. 1937, the *Scorpidio-Eleocharitetum* Ivimey-Cook and Proctor 1966, the *Baldellio-Littorelletum* Ivimey-Cook and Proctor 1966, the *Pilularietum globuliferae* Tüxen ex Müller et Gors 1960 and the *Scirpetum fluitantis* Lemée 1937 emend Hofstra 1982, recognised in Ireland (White & Doyle 1982) or in neighbouring parts of mainland Europe. These assemblages are now of very local occurrence among lowland heaths, mires and rush-pasture and, in addition to providing a key locus for various rare and scarce plants, are of significance in providing an important kind of diversity in threatened landscapes. Updated national maps of scarcer species represented here are provided in Stewart *et al*. (1994) and local floristic experts should help locate stands with such plants. Further sampling is of high priority and easy to accomplish.

UTRICULARIETALIA INTERMEDIO-MINORIS Pietsch 1965
Bladderwort and bog-moss communities of dystrophic or lime-rich peaty waters

**Sphagno-Utricularion** Th. Müller et Görs 1960
Bladderwort and bog-moss communities of dystrophic peaty waters

A24 *Juncus bulbosus* community

**ISOETO-NANOJUNCETEA** Br.-Bl. et Tüxen ex Westhoff *et al*. 1946
Pioneer, ephemeral, dwarf cyperaceous and therophyte communities on damp, bare, periodically flooded ground

NANOCYPERETALIA Klika 1935

**Nanocyperion flavescentis** Koch ex Malcuit 1929

OV31 *Rorippa palustris-Filaginella uliginosa* community

OV34 *Allium schoenoprasum-Plantago maritima* community

OV35 *Lythrum portula-Ranunculus flammula* community

OV36 *Lythrum hyssopifolia-Juncus bufonius* community

*Cicendia filiformis-Radiola linoides* community (6)*
*Cicendietum filiformis* Allorge 1922
British stands of this kind of vegetation sampled so far (Coombe unpublished) have frequent records for ephemerals such as *Juncus pygmaeus*, *J. bulbosus*, *J. bufonius*, *Cicendia filiformis*, *Radiola linoides* and *Isolepis cernua* and the scarce perennial *Chamaemelum nobile* in more open places among a patchy carpet of *Agrostis stolonifera*, *A. canina*, *Carex demissa*, *C. panicea*, *C. flacca*, *Leontodon taraxacoides*, *L. autumnalis*, *Plantago maritima* and *Ranunculus flammula*, locally with *Salix repens*, *Molinia caerulea* and *Erica vagans*. Conditions suitable for this assemblage (quite variable from stand to stand) develop around the oceanic seaboard of south-west England and Wales where winter rains accumulate in shallow pools and along trackways and in areas of heath and pasture kept open by disturbance and grazing, and then evaporate leaving bare ground baked hard. Other species like *Illecebrum verticillatum* may find a locus here in the New Forest and Cornwall (Stewart *et al*. 1994) although in the Netherlands, this plant is characteristic of another association, the *Panico-Illecebretum* Diemont, Sissingh et Westhoff 1940 (Lemaire & Weeda 1994). Vegetation more or less like the *Cicendietum* is now very scarce and fragmentary but can probably still be found widely dispersed through the south-west, where local floristic experts will most likely know stations. As what is probably our most widespread Nanocyperion community, this is of significance for nature conservation at international level and a key element of local distinctiveness among threatened landscapes like lowland heaths and extensively-managed cliff-top pastures. 31 relevés are available from Coombe, but it is a high priority for further survey and demanding a keen eye and subtle approach to sampling. Figure 19 in Appendix 1 shows a potential distribution map for this vegetation type which has been created by coincidence mapping characteristic species.

**PHRAGMITO-MAGNOCARICETEA** Klika in Klika et Novák 1941
Swamp, fen and marginal communities of fresh or brackish waters dominated by graminoids, sedges and forbs

PHRAGMITETALIA Koch 1926
Swamp and fen dominated by gramionoids, sedges and forbs, often species poor

**Phragmition australis** Koch 1926
Swamps and fens dominated by tall graminoids in standing or gently moving waters and winter-flooded fens

S2 *Cladium mariscus* swamp & sedge beds
*Cladietum marisci* Zobrist 1933 em. Pfeiffer 1961

S4 *Phragmites australis* swamp & reed beds
*Phragmitetum australis* Gams (1927) Schmale 1939

S5 *Glyceria maxima* swamp
*Glycerietum maximae* (Nowinski 1928) Hueck 1931 em. Krausch 1965

S8 *Scirpus lacustris* ssp. *lacustris* swamp
*Scirpetum lacustris* (Allorge 1922) Chouard 1924

S10 *Equisetum fluviatile* swamp

S12 *Typha latifolia* swamp

*Typhetum latifoliae* Soó 1927

S13 *Typha angustifolia* swamp
*Typhetum angustifoliae* Soó 1927

S14 *Sparganium erectum* swamp
*Sparganietum erecti* Roll 1938

S15 *Acorus calamus* swamp
*Acoretum calami* Schulz 1941

S19 *Eleocharis palustris* swamp
*Eleocharitetum palustris* Schennikow 1919

S20 *Scirpus lacustris* ssp. *tabernaemontan*i swamp
*Scirpetum tabernaemontani* Passarge 1964

S21 *Scirpus maritimus* swamp
*Scirpetum maritimi* (Br.-Bl. 1931) R.Tx. 1937

S24 *Phragmites australis-Peucedanum palustre* tall-herb fen (5)
*Peucedano-Phragmitetum australis* Wheeler 1978 em.
The transfer in the NVC of what Wheeler (1978, 1980), the original author of the *Peucedano-Phragmitetum*, called the *caricetosum* sub-community to the M9 *Carex-Calliergon* fen was never entirely satisfactory and may merit reappraisal in the light of further data. This particular type of fen is renowned for its Broadland rarities: *Liparis loeselii*, *Anagallis tenella*, *Drosera anglica*, *Parnassia palustris* and *Hypericum elodes*.

S25 *Phragmites australis-Eupatorium cannabinum* tall-herb fen

S26 *Phragmites australis-Urtica dioica* tall-herb fen (5)
Various forms of *Phragmites* fen have been reported (eg. from Suffolk in Ausden & Harding 1991, Harding 1993*c*, Hughes 1995, Parmenter 1996) in which either large *Juncus* spp. or *Arrhenatherum elatius* become so abundant as to make fits to any existing Phragmition vegetation problematic.

Species-poor *Iris pseudacorus* swamp (5)
Swamps which are often more or less mono-dominant stands of *Iris* occur widely around machair lochs in the Hebrides (surveys summarised in Dargie 1995, see also Dargie 1998*a*) and in Northern Ireland. More relevés are needed to see whether this vegetation is a new community among the Phragmition or a form of, for example, M28 *Filipendulo-Iridetum*.

**Magnocaricion elatae** Koch 1926
Vegetation dominated by bulky sedges on mineral and peaty soils

S1 *Carex elata* swamp
*Caricetum elatae* Koch 1926

S3 *Carex paniculata* swamp
*Caricetum paniculatae* Wangerin 1916

S6 *Carex riparia* swamp
*Caricetum ripariae* Soó 1928

S7 *Carex acutiformis* swamp
*Caricetum acutiformis* Sauer 1937

S9 *Carex rostrata* swamp
*Caricetum rostratae* Rübel 1912

S11 *Carex vesicaria* swamp
*Caricetum vesicariae* Br.-Bl. et Denis 1926

S27 *Carex rostrata-Potentilla palustris* tall-herb fen
*Potentilla-Caricetum rostratae* Wheeler 1980

S28 *Phalaris arundinacea* tall-herb fen
*Phalaridetum arundinaceae* Libbert 1931

*Menyanthes trifoliata* bog pools (5)
*British Plant Communities* notes that what Continental phytosociologists would call 'societies' of Magnocaricion associates like *Menyanthes trifoliata* and *Potentilla palustris* can be locally prominent. In this case, emergent *Menyanthes trifoliata* is abundant in pools some 5-100 square metres in area, with water 30-100 cm deep, forming what could be regarded as either aquatic vegetation or a very open swamp. Other plant species are scarce, consisting mainly of small amounts of aquatic *Sphagnum cuspidatum* and *S. auriculatum*. These pools are larger and deeper than M1/M2 pools and are locally frequent in N and W Scotland. They are identified among the Drought-sensitive pools (A3) and Permanent pools (A4) in the Aquatic (A) part of the classification of bog microtopes and vegetation types by Lindsay (1995). 11 relevés from NW Sutherland (A.B.G. Averis, unpublished data).

**Cicution virosae** Hejný 1960 em. Segal in Westhoff et den Held 1969
Vegetation with a floating raft of sedges in eutrophic waters

S17 *Carex pseudocyperus* swamp (5)
Dargie (1998a) describes a distinctive form of *Phragmites* swamp with occasional *Carex diandra* and carpets of *Calliergon cordifolium* and *C. giganteum* occurring in the Western Isles and in scattered localities elsewhere, surrounded by machair marsh and wet mesotrophic grassland. On Loch Hallan in South Uist, this vegetation provides a locus for the scarce *Cicuta virosa*. More relevés (from, for example, Torrs Warren candidate Special Area of Conservation) are needed to analyse with Dargie's data and define potential new variation here or as a Phragmition assemblage.

NASTURTIO-GLYCERIETALIA Pignatti 1953 em. Kopecký in Kopecký et Hejný 1965
Vegetation dominated by mixtures of small grasses and herbs along the banks of streams and ditches

**Sparganio-Glycerion fluitantis** Br.-Bl. et Sissingh in Boer 1942 nom. invers. Oberdorfer 1957

S16 *Sagittaria sagittifolia* swamp

S18 *Carex otrubae* swamp
*Caricetum otrubae* Mirza 1978

S22 *Glyceria fluitans* water-margin vegetation
Glycerietum fluitantis Wilczek 1935

S23 Other water-margin vegetation (2)
In *British Plant Communities*, there is a standard account but no data for a miscellany of Glyceno-Sparganion vegetation from unshaded silty margins of lowland streams and pools included together under this heading. With further sampling, it should be possible to characterise distinctive assemblages with such associates as *Myosotis palustris*, *Mentha aquatica*, *Veronica beccabunga*, *Agrostis stolonifera*, *Berula erecta* and variously dominated by *Rorippa nasturtium-aquaticum*, *Apium nodiflorum*, *Veronica anagallis-aquatica*, *Glyceria plicata* and *Hippuris vulgaris*, such as the *Eleocharito palustris-*

*Hippuridetum* Passarge 1955 (see, for example, Dargie 1998*a*, *c*), the *Polygono-Veronicetum anagallidis-aquaticae* (Zonneveld 1960) Schaminée & Weeda 1995, the *Apietum nodiflori* Br.-Bl. ex Boer 1942 and the *Glycerietum plicatae* Kulczynski 1928 described from elsewhere in Europe. These communities generally contain no rare or scarce plants but are significant in providing diversity, sometimes in quite improved landscapes, that is important floristically but also for associated invertebrate and bird faunas. Widespread and still quite common, this vegetation is easy to sample.

## INUNDATION AND WEED COMMUNITIES

**BIDENTETEA TRIPARITITAE** Tüxen, Lohmeyer et Preising ex Rochow 1951
Pioneer vegetation, mostly of nitrophilous summer annuals, on periodically flooded mud

BIDENTETALIA TRIPARTITAE Br.-Bl. et Tüxen ex Klika et Hadac 1944

**Bidention tripartitae** Nordhagen 1940 em. Tx. in Poli et Tx. 1960
Communities of enriched margins of still and sluggish waters and damp disturbed places

OV30 *Bidens tripartita-Polygonum amphibium* community
Polygono-Bidentetum tripartitae Lohmeyer in R.Tx. 1950

OV32 *Myosotis scorpioides-Ranunculus sceleratus* community
*Ranunculetum scelerati* R.Tx. 1950 ex Passarge 1959

OV33 *Polygonum lapathifolium-Poa annua* community

**STELLARIETEA MEDII** Tüxen, Lohmeyer et Preising ex Rochow 1951
Weed communities of agricultural crops, gardens and waste places

POLYGONO-CHENOPODIETALIA R.Tx. et Lohmeyer 1950 emend. J.Tx. 1961

**Arnoseridion minimae** Malato-Beliz et al. 1960
Weed communities of cereal fields on lime-deficient soils

OV1 *Viola arvensis-Aphanes microcarpa* community

OV2 *Briza minor-Silene gallica* community

OV3 *Papaver rhoeas-Viola arvensis* community
*Papaveretum argemones* (Libbert 1933) Kons & Vl 1939

**Panico-Setarion** Sissingh in Westhoff et al. 1946
Weed communities of root, bulb and summer cereal crops usually dominated by graminoids

OV4 *Chrysanthemum segetum-Spergula arvensis* community
*Spergulo-Chrysanthemetum segetum* (Br.-Bl. & De.Leeuw 1936) R.Tx. 1937

OV5 *Digitaria ischaemum-Erodium cicutarium* community

**Polygono-Chenopodion polyspermi** W. Koch 1926 em. Sissingh 1946
Weed communities of root crops and summer cereals dominated by herbs

OV6 *Cerastium glomeratum-Fumaria muralis* ssp. *boraei* community

OV7 *Veronica persica-V. polita* community
*Veronico-Lamietum* hybridi Kr. & Kl. 1939

OV8 *Veronica persica-Alopecurus myosuroides* community
*Alopecuro-Matricarietum chamomillae* Wascher 1941

OV9 *Matricaria perforata-Stellaria media* community

OV10 *Poa annua-Senecio vulgaris* community

OV11 *Poa annua-Stachys arvensis* community

OV12 *Poa annua-Myosotis arvensis* community

CENTAUREETALIA CYANI R.Tx., Lohmeyer et Preising in R.Tx. 1950
Weed communities of arable crops, gardens and waste places

**Fumario-Euphorbion** Th. Müller ex Görs 1966
Communities of arable and garden weeds on base-rich soils

OV13 *Stellaria media-Capsella bursa-pastoris* community
includes *Fumarietum officinalis* R.Tx. 1950 & *Fumarietum bastardii* Br.-Bl. 1950

OV14 *Urtica urens-Lamium amplexicaule* community
*Spergula arvensis-Lamium amplexicaule* community Sissingh 1950

**Caucalidion platycarpi** R. Tüxen 1950
Communities of cereal weeds on base-rich soils

OV15 *Anagallis arvensis-Veronica persica* community
*Kickxietum spuriae* Kr. & Vl. 1939

OV16 *Papaver rhoeas-Silene noctiflora* community
*Papaveri-Sileneetum noctiflori* Wascher 1941

OV17 *Reseda lutea-Polygonum aviculare* community
*Descuriano-Anchusetum arvensis* Silverside 1970

SISYMBRIETALIA J. Tüxen in Lohmeyer et al. 1962

**Sisymbrion officinalis** Tüxen, Lohmeyer et Preising in Tüxen 1950 em. Hejny in Hejny *et al*. 1979
Weed communities of compost and dung heaps, disturbed tracksides and recreation areas

(6)
*British Plant Communities* has no assemblages of this widely distributed alliance though grassier stands of cynocoprophilous vegetation figure in the OV23 *Lolium-Dactylis* community. Diligent sampling among rank stands of *Chenopodium album, Sonchus oleraceus,* and *Polygonum aviculare* with distinctive contributions from *Descurania sophia, Hordeum murinum* and such introductions as *Conyza canadensis, Sisymbrium officinale, S. altissimum, Galinsoga parviflora, Chenopodium vulvaria* and *Lactuca serriola* should help characterise various communities recognised elsewhere in Europe. This is vegetation from demolition sites, rubbish tips, railway yards, the squalid corners of bus stations and other 'filthie obscure base places' (Johnson 1636), of interest (only?) in providing loci for introduced and alien plants. Widespread in the south-east, but surveyors should watch for dangerous rubbish and nasty waste. Figure 20 in Appendix 1 shows a potential distribution

map for this vegetation type which has been created by coincidence mapping characteristic species.

**GALIO-URTICETEA** Passarge ex Kopecký 1969
Semi-natural and weedy vegetation dominated by perennials on nutrient-rich, relatively stable substrates

CONVOLVULETALIA SEPIUM Tüxen 1950
Semi-natural and natural nitrophilous communities of tall perennial herbs of river banks and shallows

**Convolvulion sepium** Tüxen 1947
Communities of tall herbaceous nitrophiles around eutrophic lakes and ditches

OV26 *Epilobium hirsutum community*

*Calystegia sepium-Angelica archangelica* community (6)
*Convolvulo-Archangelicetum littoralis* Passarge 1964
Mixtures of *Urtica dioica, Rumex obtusifolius* and *Calystegia sepium* figure in the OV25 *Urtica-Cirsium* community but, on periodically flooded river banks and shoals, often with unsorted silt, sand and pebbles, these species may be subordinate to a varied canopy of *Angelica archangelica, Symphytum officinale, Phalaris arundinacea* and *Carduus crispus* with the naturalised *Heracleum mantegazzianum* a striking companion in some places. Widespread through the lowlands and of significance as an interesting element of even quite intensive landscapes, except where the vegetation is completely dominated by more eutrophic or naturalised plants. Very few relevés in the UKVDB and further sampling is necessary to characterise this assemblage and any other river shoal vegetation. For example, are the diverse mixtures of smaller herbs found among periodically-flooded sand and shingle on river shoals all part of this community or not?

*Impatiens glandulifera* community (6)
Species-poor stands of *Impatiens glandulifera*, often tall and lush, sometimes with *Heracleum mantegazzianum*, along stream, ditch and canal sides, especially in the Midlands and northern England, equivalent to societies recognised in various Continental schemes (eg. Pott 1984). 10 relevés in UKVDB.

*Reynoutria japonica* community (6)
If we are to recognise such vegetation (it's real and widespread enough), then it probably belongs here. No relevés in UKVDB.

LAMIO ALBI-CHENOPODIETALIA BONI-HENRICI Kopecky 1969
Weed and semi-natural communities of tall mesophilous and nitrophilous perennials

**Aegopodion podagrariae** R.Tx. 1967
Communities of sunny and semi-shaded margins and clearings of woody vegetation

*Aegopodium podagraria-Urtica dioica* community (6)
*Urtico-Aegopodietum podagrariae* (R.Tx. 1963) Oberdorfer 1964 in Görs 1968
More eutrophic field layers occur in some drier woodlands such as the W8 *Fraxinus-Acer-Mercurialis* and unflooded W6 *Alnus-Urtica* communities but shady woodland margins, hedge-bottoms, gloomy gardens and neglected cemeteries throughout the lowlands can also have carpets of *Aegopodium podagraria, Glechoma hederacea* and *Lamium maculatum* with no actual tree or shrub cover but with *Anthriscus sylvestris, Alliaria petiolata, Galeopsis tetrahit* and *Vicia sepium* plus clumps of *Urtica dioica* that are probably best referred to this community. Of no great floristic interest and generally an unwanted element of landscapes, easy to access and sample. No relevés in the UKVDB and any analysis needs to define the assemblage in relation to *Galio-Alliarion* communities like OV24 *Urtica-Galium* vegetation and the *Alliario-Chaerophylletum*.

*Petasites hybridus-Aegopodium podagraria* community (6)
*Phalarido-Petasitetum hybrid*i Schwickerath 1933
Eutrophic tall-herb vegetation of alluvial flats figures in the NVC among assemblages like S26 *Phragmites-Urtica* fen, OV24 *Urtica-Galium* and OV26 *Epilobium hirsutum* communities but further sampling will certainly characterise an additional assemblage that has sparse carpets of *Poa trivialis, Aegopodium podagraria* and *Lamium maculatum*, clumps of *Urtica dioica* and, by summer, a striking canopy of *Petasites hybridus* leaves up to 2 m tall. This vegetation occurs throughout the lowlands on seasonally-flooded river terraces and stream sides with moist silty soils, dying down to leave virtually bare ground in winter or a patchy bryophyte cover. It has no particular significance in its floristics, though it can provide a locus for bulbous garden escapes like *Galanthus nivalis* which wash downstream and provide a striking display of flowers in spring. Its main conservation value is that it represents a riverside habitat with modest uncontrolled flooding and a welcome element of diversity even among industrial landscapes. Very few relevés are available (though see Harding 1991) but the vegetation is easy to access and sample.

**Galio-Alliarion** (Oberdorfer 1957) Lohmeyer et Oberdorfer in Oberdorfer et al. 1967
Thermophilous, semi-natural communities of nitrophilous perennials of sunny forest/meadow ecotones

OV24 *Urtica dioica-Galium aparine* community

OV25 *Urtica dioica-Cirsium arvense* community

*Alliaria petiolata-Chaerophyllum temulentum* community (6)
*Alliario-Chaerophylletum temulenti* Lohmeyer 1949
In *British Plant Communities*, grassier hedgebank vegetation with brambles is included in W24 *Rubus-Holcus* underscrub but sampling among tall-herb assemblages with *Chaerophyllum temulentum, Alliaria petiolata, Anthriscus sylvestris, Urtica dioica, Galeopsis tetrahit, Lapsana communis* and *Aeogopodium podagraria* will probably characterise this community. It is widespread and very common throughout the lowlands along sunny hedge-bottoms and woodland margins, providing a narrow vertical fringe, often sharpened up by mowing of the neighbouring verge. Of little floristic significance, though elsewhere in Europe vegetation of this general type provides a locus for the, with us, nationally rare *Cynoglossum germanicum*, as in the *Alliario-Cynoglossetum germanici* Géhu, Richard et Tx. 1972. With only one exception, British stations of this plant have it in woodland edge vegetation which might be accommodated in the OV24 *Urtica-Galium* community. 15 relevés with this plant from Pigott (unpublished). Easy enough to find stands but their long narrow shape demands ingenuity in sampling.

**ARTEMISIETEA VULGARIS** Lohmeyer *et al*. ex Rochow 1951
Perennial and thistle-rich sub-xerophilous communities of temperate and Mediterranean regions

ONOPORDIETALIA ACANTHII Br.-Bl. & Tx. ex Klika & Hadac 1944
Xero-mesophilous weed communities of biennials on nutrient-rich soils

**Arction lappae** Tüxen 1937 em. Gutte 1972
Mesophytic communities of moister soils in cooler climates

*Arctium minus* agg. - *Artemisia vulgaris* community (6)
*Arctio-Artemisietum vulgaris* Oberdorfer ex Seybold et Th.Müller 1972
Some rank nettle-bed vegetation with burdocks already finds a place in the NVC as part of the OV25 *Urtica-Cirsium* community. Where *Arctium minus*, *A. lappa* and *Artemisia vulgaris* become more dominant with *U. dioica*, *C. arvense*, *C. vulgare* and *Dactylis glomerata* frequent but subordinate, it will probably be sensible to recognise a community of this type. Such vegetation is a widespread and common feature of roadsides, trackways, disturbed woodland margins and rides, soil dumps and waste ground with loam or clay soils throughout the lowlands. *Conium maculatum* may also belong here though, in Continental schemes, this plant is sometimes seen as characteristic of a distinct *Lamio albi-Conietum maculatae* Oberdorfer 1957, perhaps in a separate Balloto-Conion maculatae alliance. Of no conservation significance for its floristics but part of graded transitions even in intensive landscapes. No relevés available but only too easy to find and survey.

*Lamium album-Ballota nigra* community (6)
*Lamio albi-Ballotetum nigrae* Lohmeyer 1970
Less widespread than the above is vegetation in which *Arctium minus* agg. and *Artemisia vulgaris* occur with *Lamium album, Ballota nigra, Malva neglecta, Elymus repens, Taraxacum officinale* agg. and declining species which were once an important feature of cottage gardens such as *Chrysanthemum parthenium*, the local *Artemisia absinthum* and the rare *Leonurus cardiacus*. This is an assemblage of roadsides and tracks around villages and farmsteads in the drier and warmer south-eastern lowlands. Figure 21 in Appendix 1 shows a potential distribution map for this vegetation type which has been created by coincidence mapping chatacteristic species. *Chenopodium bonus-henricus* may also have a distinct locus here but it tends to be more characteristic of disturbed places like farmyards, and elsewhere in Europe, vegetation in which it is prominent has sometimes been placed in a separate *Balloto-Chenopodietum boni-henrici* Th. Müller in Seybold et Th. Müller 1972. This vegetation is of conservation interest because it provides a locus for weeds of declining distribution typical of less intensively-managed agricultural landscapes. No samples in the UKVDB and local in occurrence but easy to sample.

**Onopordion acanthii** Br.-Bl. ex Br.-Bl. et al. 1936
Xero-mesophilous weed communities of prickly biennials on nutrient-rich soils

*Onopordum acanthium-Cardus nutans* community (6)
*Onopordetum acanthii* Br.-Bl. ex Br.-Bl. *et al*. 1936
This kind of continental thistle-bed vegetation extends into only the warmer and drier south-east of the UK and is probably now found only in fragmentary form on dry calcareous soils in disturbed and waste places, particularly near the sea. Characteristic species include *Onopordum acanthium, Carduus nutans, C. acanthoides, Silybum marianum, Hyoscyamus niger, Reseda lutea, R. luteola, Cynoglossum officinale, Pastinaca sativa* and *Cichorium intybus*. The last species is also typical, with species like *Picris echioides, Ononis spinosa* and *Trifolium ochroleucon*, of clayey soils in this region which bake hard and crack in dry summer weather. These vegetation types have declining species and represent weedy assemblages of less intensive agricultural landscapes. There are no relevés in the UKVDB and further sampling within the south-east is needed to characterise one or more

assemblages of this alliance. Figure 22 in Appendix 1 shows a potential distribution map for this vegetation type which has been created by coincidence mapping chatacteristic species.

**Dauco-Melilotion** Görs ex Oberdorfer *et al*. 1967

*Artemisia vulgaris-Tanacetum vulgare* community (6)
*Tanaceto-Artemisietum vulgaris* Br.-Bl. 1931 corr. 1949
*Echium vulgare-Melilotus albus* community
Echio-Melilotetum albae R.Tx. 1947
Tall-herb vegetation with *Daucus carota, Melilotus officinalis, Artemisia vulgaris, Pastinaea sativa, Picus hieracioides, Tanacetum vulgare, Coronilla varia* and *Cichorum intybus* is not represented in the NVC but occurs widely on waysides in the warmer and drier south-east of Britain. It adds some floristic and structural diversity to such habitats and sampling may reveal good stands of communities described from elsewhere in Europe. Figure 23 in Appendix 1 shows a potential distribution map for this vegetation type which has been created by coincidence mapping chatacteristic species.

**EPILOBIETEA ANGUSTIFOLII** Tüxen et Preising ex van Rochow 1951
Species-poor vegetation of damp fertile soils in woodland margins, clearings and burned places

ATROPETALIA Vlieger 1937

**Carici piluliferae-Epilobion angustifolii** Tüxen 1950
Communities usually associated with or replacing Quercetea woodlands

OV27 *Epilobium angustifolium* community (5)
In Continental schemes, *Calamagrostis epigejos* is a locally prominent plant in various assemblages, most notably vegetation characterised by *Epilobium angustifolium* and other associates of clearances and rides in this alliance. Stands dominated by this plant (eg. Gibbons 1996) need further sampling to assess whether they belong here as a sub-community of OV27 or a distinct community.

**Atropion bellae-donnae** Br.-Bl. et Aichinger 1933
Communities usually associated with or replacing Querco-Fagetea woodlands

*Atropa belladonna-Hypericum hirsutum* community (6)
*Atropetum belladonnae* (Br.-Bl. 1930) R.Tx. 1931 emend 1950
In cleared areas or sunny windthrows among W8 *Fraxinus-Acer-Mercurialis* and W12 *Fagus-Mercurialis* woodlands or where the former has been coppiced, in the warmer and drier south-eastern lowlands, tall-herb vegetation with *Atropa belladonna, Hypericum hirsutum, Verbascum nigrum, V. thapsus, Bromus ramosus* and *Fragaria vesca* can develop on rubbly lime-rich soils, with young *Fraxinus, Fagus, Cornus sanguinea* and other woody plants re-establishing. Often grading to Geranion Saum, this vegetation can add considerable diversity and a dynamic element to wooded landscapes and be very important as part of the sunny glade vegetation attractive to various scarcer butterflies. There are unpublished relevés available from Pigott and further sampling will be simple.

# BOGS AND FENS

**SCHEUCHZERIO-CARICETEA FUSCAE** R. Tx. 1937

SCHEUCHZERIO-CARICETEA NIGRAE (Nordhagen 1936) Tüxen 1937
*SCHEUCHZERIETALIA PALUSTRIS Nordhagen 1937*
Bog pool, flush and mire vegetation usually dominated by mixtures of small sedges and bryophytes

**Rhynchosporion albae** W. Koch 1926
Vegetation of stagnant, acid and dystrophic waters in the pools of Sphagnion bogs on deep peats

M1 *Sphagnum auriculatum* bog pool community

M2 *Sphagnum cuspidatum/recurvum* bog pool community

M3 *Eriophorum angustifolium* bog pool community

M4 *Carex rostrata-Sphagnum recurvum* mire

CARICETALIA FUSCAE Koch 1926 em. Klika 1934
*CARICETALIA NIGRAE (W. Koch 1926) Nordhagen 1936 em. Br.-Bl. 1949*
Small-sedge poor-fens of base-poor waters

**Caricion fuscae** Koch 1926 em. Klika 1934
*Caricion nigrae W. Koch 1926 em. Klika 1934*
Small-sedge poor-fen vegetation of acid, oligotrophic flushes and soligenous mires on peats or peaty mineral soils

*Carex nigra-Ranunculus flammula* mire (6)
In this kind of mire, a variety of small sedges are abundant to dominant with a low cover of associates such as *Ranunculus flammula, R. acris, Potentilla erecta, Viola palustris, Juncus articulatus, J. bulbosus, Molinia caerulea, Dactylorhiza maculata, Succisa pratensis, Holcus lanatus, Anthoxanthum odoratum, Calliergon cuspidatum* and *Pellia epiphylla. Sphagnum warnstorfii, S. contortum* and *S. teres* are locally prominent. Some stands are strongly dominated by a dense sward of *Carex nigra* 30-40 cm tall. Other stands have a more open cover of mixtures of *Carex nigra, C. panicea, C. demissa* and *C. echinata*. There is a superficial resemblance to M6 *Carex-Sphagnum* and M10 *Carex-Pinguicula* mires, and in terms of the associated species the vegetation is somewhat intermediate between these two. This mire typically occupies small, damp, soligenous depressions among grassland and heath at low altitudes in western parts of Britain becoming frequent in the western Highlands. It is usually grazed at medium to high intensity, and most stands appear to be grazed derivatives of M15 *Scirpus-Erica* wet heath or M25 *Molinia-Potentilla* mire. Relevés are available from Scotland (Averis & Averis 1995, 1996 and recent unpublished data), Cooper & Mackintosh 1996) and Wales (M.Yeo, unpublished data). Similar vegetation in Ireland has been described as a *Carici nigrae-Juncetum articulati* Br.-Bl. & Tx. 1952 sometimes placed in the Caricion nigrae, sometimes (O'Criodain & Doyle 1994) in the Caricion davallianae.

M5 *Carex rostrata-Sphagnum squarrosum* mire

M6 *Carex echinata-Sphagnum recurvum/auriculatum* mire

M7 *Carex curta-Sphagnum russowii* mire

M8 *Carex rostrata-Sphagnum warnstorfii* mire

CARICETALIA DAVALLIANAE Br.-Bl. 1949
Small-sedge rich-fens of base-rich waters

**Caricion davallianae** Klika 1934
Small-sedge rich-fen vegetation of calcareous oligotrophic flushes, soligenous mires and dune-slacks with peats or peaty mineral soils at low to moderate altitudes

M9 *Carex rostrata-Calliergon cuspidatum/giganteum* mire (5)*
The broadening of the *Calliergo-Caricetum diandrae* as defined by Wheeler (1975, 1978, 1980) to include more generally characterised fens with *Carex rostrata* and a carpet of brown mosses and what Wheeler called the *Peucedano-Phragmitetum caricetosum* needs reappraisal in the light of further survey (Shaw & Wheeler 1991, Cooper 1993, Fojt 1994). These kinds of fens provide an important locus for various national and local rarities.

M10 *Carex dioica-Pinguicula vulgaris* mire
Pinguiculo-Caricetum dioicae Jones 1973 em.

M13 *Schoenus nigricans-Juncus subnodulosus* mire
Schoenetum nigricantis Koch 1926

SD13 *Salix repens-Bryum pseudotriquetrum* dune-slack (5)*
Younger stands of sub-community SD13a are clearly similar to the *Centaurio littoralis-Saginetum nodosae* Diemont, Sissingh et Westhoff 1940 which is sometimes placed in the Nanocyperion. Further survey may reveal that this vegetation is more widespread than the NVC suggests.

SD14 *Salix repens-Campylium stellatum* dune slack

SD15 *Salix repens-Calliergon cuspidatum dune* slack (5)*
Acidic types of SD15 with *Erica tetralix* and prostrate *Juniperus communis* ssp. *communis* occur extensively in the higher parts of slacks at Morrich More in Ross-shire and perhaps represent a new sub-community of SD15. Relevés in Dargie (1998).

**Caricion atrofuscae-saxatilis** Nordhagen 1943
*Caricion bicolori-fuscae Nordhagen 1936*
Small-sedge rich-fen vegetation of calcareous flushes at high altitudes

M11 *Carex demissa-Saxifraga aizoides* mire
*Carici-Saxifragetum aizoidis* McVean & Ratcliffe 1962 emend.

M12 *Carex saxatilis* mire
*Caricetum saxatilis* McVean & Ratcliffe 1962

**OXYCOCCO-SPHAGNETEA** Br.-Bl. et Tüxen ex Westhoff *et al*. 1946
Wet heath and bog vegetation of acid, oligotrophic peats, permanently or winter-waterlogged in raised, blanket or valley mires and their surrounds

SPHAGNETALIA MAGELLANICI (Pawlowski 1928) Kästner et Flössner 1933

**Erico-Sphagnion papillosi** Moore 1968
Bog vegetation on deeper, wetter peats in raised, blanket and valley mires

M17 *Scirpus cespitosus-Eriophorum vaginatum* blanket mire

M18 *Erica tetralix-Sphagnum papillosum* raised and blanket mire

M19 *Calluna vulgaris-Eriophorum vaginatum* blanket mire

M20 *Eriophorum vaginatum* blanket and raised mire

M21 *Narthecium ossifragum-Sphagnum papillosum* valley mire
*Narthecio-Sphagnetum euatlanticum* Duvigneaud 1949

ERICO-SPHAGNETALIA PAPILLOSI Schwickerath 1940

**Ericion tetralicis** Schwickerath 1933
Wet heath vegetation on drying deeper peats or winter-waterlogged peaty intergrades

M14 *Schoenus nigricans-Narthecium ossifragum* mire (3)*
Flushes of the M14 type, providing a clear link with soligenous mires of the Lusitanian zone of the Atlantic region occur more widely than suggested in *British Plant Communities* with stands on cliffs around the coast of south-west England and perhaps Wales. This vegetation needs to be reappraised in relation to *Schoenus* flushes from parts of the Scottish coast (Averis & Averis 1996) and the flushed swards of MC9c *Festuca-Plantago* grassland

M15 *Scirpus cespitosus-Erica tetralix* wet heath (5)*
M15 is the most extensive type of vegetation over vast areas in the western Highlands and is clearly extremely variable. M15a can occur in a typical form (widespread), a *Schoenus nigricans* form (base-enriched and very western), a *Narthecium ossifragum-Campylopus atrovirens* form (upland, northern, acidic) and a *Campylopus shawii* form (Skye and Outer Hebrides; one of the main habitats of the nationally scarce moss *C shawii*). M15b occurs in a typical form (widespread and extensive) and a *Calluna vulgaris-Molinia caerulea* form (co-dominated by tall *Calluna* and *Molinia;* locally frequent at low altitudes). M15c occurs in a *Racomitrium lanuginosum* form (western), a *Cladonia* form (more eastern and northern), a prostrate *Juniperus communis* form (scarce and western; one of the main habitats of the very rare liverwort *Herbertus borealis*) and a *Schoenus nigricans* form (scarce and strongly western). M15d occurs in a high-altitude form (scarce, and often containing montane species), and a low-altitude form (scarce and evidently less natural; also quite frequent in Wales). Heavily-grazed examples of all four sub-communities tend to converge into wet-heath strongly dominated by *Scirpus* and with very sparse sub-shrubs. Many releves from various surveys by A.B.G. and A.M. Averis.

M16 *Erica tetralix-Sphagnum compactum* wet heath (5)*
*Ericetum tetralicis* Schwickerath 1943
Wet heath on dunes seems almost always to be a poor fit with NVC types: *Erica tetralix* is constant, for example, but *Sphagnum* spp. are rare. Relevés from the Sand Dune Survey of Great Britain (Dargie 1993, Radley 1994) and the Sand Dune Survey of Scotland (Dargie 1998*c*,*e*, 1999) need to be brought together and reanalysed to define any new variation.

H5 *Erica vagans-Schoenus nigricans* heath

# GRASSLANDS AND HEATHS

**MOLINIO-ARRHENATHERETEA** Tüxen 1937
Anthropogenic pastures and meadows on deeper, more or less fertile mineral and peaty soils in lowland regions

MOLINIETALIA CAERULEAE Koch 1926
Meadows and pastures of moister soils, often peaty

(4)
Throughout the Molinietalia, there is a tendency for swards to become dominated by dense, tussocky *Molinia caerulea*, especially where abandonment of grazing or mowing has been accompanied by eutrophication of ground waters or drying of peats. Such vegetation is hard to place because of the increasingly poor representation of smaller associates and is best regarded as what in Continental Europe would be called a 'basal community' of the Order.

**Molinion caeruleae** Koch 1926
Meadows of moist but fresh soils of central Europe traditionally mown for litter but usually unmanured

M26 *Molinia caerulea-Crepis paludosa* mire

**Junco conglomerati-Molinion** Westhoff 1968
Meadows of moist but fresh soils in western Europe, usually unmanured

M24 *Molinia caerulea-Cirsium dissectum* fen-meadow (3)*
*Cirsio-Molinietum caeruleae* Sissingh & de Vries 1942 em.
Beyond the geographical limits of *Cirsium dissectum* and *Juncus subnodulosus*, vegetation essentially the same as M24 continues to occur in similar habitats, especially in the distinctive mosaics of fen-meadow and rush-pasture known as Rhos pasture. It seems sensible to regard such vegetation as part of M24.

M25 *Molinia caerulea-Potentilla erecta* mire (5)
Swards of the M25 type but with (sometimes very much) less *Molinia* and a distinctive contribution from *Carex panicea, C. pulicaris, C. flacca, C. hostiana, Festuca ovina, Nardus stricta, Ranunculus acris, Prunella vulgaris* and *Trifolium repens* in frequently species-rich, close-cropped mixtures have been widely described from flushed slopes and periodically flooded streamsides with modest base-enrichment in Wales (Blackstock *et al*. 1998), Malham (Cooper 1993), from New Forest lawns and among Culm grasslands in SW England (Porley pers. comm.) and in various parts of Scotland (Cooper & MacKintosh 1996). In all these situations, it constitutes an important element of variation in landscapes of conservation significance. Analysis of large numbers of relevés now available from these sources is essential to characterise a possible new sub-community of M25 *Molinia-Potentilla* mire or M24 *Molinia-Cirsium dissectum* fen meadow (see above) and transitions to M10 *Carex-Pinguicula* mire and another potential new unit, the *Carex nigra-Ranunculus flammula* mire in the Caricion nigrae.

(5)*
Vegetation dominated by *Schoenus nigricans, Festuca rubra* and *Molinia caerulea* with a variety of tall-herbs including *Eupatorium cannabinum, Angelica sylvestris* and *Filipendula ulmaria* and basiphilous bryophytes occurs locally at low altitudes in the Western Highlands and on damp ledges on basalt and limestone seacliffs on Mull, Skye, Lismore and Kerrera. It comes closest to M25c but is a poor fit and might need a new sub-community of M25. Relevés from Resipole (McVean & Ratcliffe 1962), Rum (Heritage Environmental in preparation) and Mull (Averis & Averis 1996) need analysis and appraisal in relation to M14 *Schoenus-Narthecium* mire and MC9c *Festuca-Plantago* grassland. Of significance as

a landscape element and perhaps as further variation within vegetated seacliffs of Atlantic coasts.

**Calthion palustris** Tüxen 1937 emend Balatova-Tulakova1978
Meadows and pastures of more fertile, moist mineral and peaty soils, often manured, in more Continental parts of Europe

M22 *Juncus subnodulosus-Cirsium palustre* fen-meadow (4)
An alternative trend to the dominance of *Molinia* in lowland fen-meadows like M22 is for other rank grasses such as *Holcus lanatus* and *Festuca rubra* to become very abundant with drying and abandonment of treatment or for *Arrhenatherum elatius* to invade as conditions become more eutrophic. Several reports from Suffolk Fens (eg. Harding & Kay 1992*b*, Harding 1993*a*) report this kind of vegetation which may be seen as basal Junco-Molinion or transitional to Arrhenatherion. With the abandonment of grazing Juncus subnodulosus can also become overwhelming dominant in this community (Jefferson pers. com.).

MG8 *Cynosurus cristatus-Caltha palustris* grassland (5)
The description of the *Cynosurus-Caltha* flood pasture is one of the least satisfactory parts of the mesotrophic grassland section of the NVC. The community is certainly real, the core of the description in Rodwell (1992) seems adequate but it is based on very few relevés from a limited area and the vegetation is both more widespread and diverse. For example, this community can be found at higher altitudes in the Northern Pennies (Jefferson pers. com.) and flushes within traditional hay meadows in the Durham and Yorkshire Dales have MG8 vegetation (Prosser 1990*a*, *b*) as an integral part of mosaics involving MG3 *Anthoxanthum-Geranium* and MG5 *Centaureo-Cynosuretum* swards (see also Cooch & Rodwell 1996). Then, on West Sedgemoor, where the community is particularly widespread, Prosser & Wallace (1992, 1993, 1995*a*, *b*) proposed a new *Cirsium dissectum-Thalictrum flavum* sub-community with four variants related to different parts of a hydrological gradient across the wetland and varying levels of agricultural improvement. Preferentials of the sub-community are *C. dissectum*, *T. flavum*, *Cardamine pratensis*, *Agrostis stolonifera*, *Carex riparia*, *Polygonum amphibium*, *Deschampsia cespitosa* and *Ranunculus flammula*. These data need re-examination in relation to hay-meadow relevés and the *Senecioni-Brometum* described below, so as to better define these distinctive elements of landscapes important for conservation.

*Carex nigra-Agrostis stolonifera-Senecio aquaticus* grassland (6)
*Senecio-Brometum racemosi* Tüxen et Preising 1951
Further survey on King's Sedgemoor and other parts of the Somerset Levels (Cox 1995) and re-examination of similar sites like the Derwent Ings, has also suggested the existence of a further type of seasonally-flooded sward, managed as either pasture or meadow, which resembles this Calthion association characterised from other parts of Europe (most recently by Schaminée *et al*. 1996, though as a new *Ranunculo-Senecionetum*). In Somerset (Cox & Leach 1995), this vegetation is described as having constant *Carex nigra, Agrostis stolonifera, Cardamine pratensis, Ranunculus repens, R. acris, Polygonum amphibium, Glyceria fluitans, Anthoxanthum odoratum* and *Calliergon cuspidatum* and frequent *Senecio aquaticus, Trifolium repens, Carex disticha, Festuca pratensis* and *Taraxacum officinale* agg. Marked shifts in abundance of the species can be seen from year to year and these authors consider that the timing and duration of the flood (generally December-early March and up to 1m deep) are probably critical in determining the composition of the sward. The wettest stands have the look of a species-rich MG13 *Agrostis-Alopecurus* grassland or S22 *Glycerietum fluitantis* vegetation and repeated prolonged spring flooding (mid-March onwards) could promote a succession in this direction. This kind of wet grassland is clearly of significance within the distinctive flood-plain landscape and needs re-examination, along with the new forms of MG8 *Cynosurus-Caltha* grassland described above. A further important relationship that needs clarifying is with the wet grasslands encountered among the machair and dune slacks of north-west Britain, noted below in the Potentillion anserinae.

MG9 *Holcus lanatus-Deschampsia cespitosa* grassland

MG10 *Holcus lanatus-Juncus effusus* rush-pasture
Holco-Juncetum effusi Page 1980

**Juncion acutiflori** Br.-Bl. 1947
Meadows and pastures of moist peaty mineral soils with flushing or impeded drainage in western Europe

M23 Juncus effusus/acutiflorus-Galium palustre rush-pasture

**Filipendulion ulmariae** Segal 1966
Tall herb vegetation, seldom mown or grazed, on moist fertile mineral soils and peats, often periodically flooded

M27 *Filipendula ulmaria-Angelica sylvestris* mire (5)
Ranker stands of MG3c *Anthoxanthum-Geranium* hay meadow, *Arrhenatherum* sub-community occur in Scotland with *Filipendula ulmaria* frequently represented. Where this latter becomes dominant with frequent *Geranium sylvaticum, Cirsium helenioides, Conopodium majus* and local *Meum athamanticum* and *Trollius europaeus*, it seems likely that a new sub-community of M27 should be recognised. 10 relevés in Cooper & MacKintosh (1996).

M28 *Iris pseudacorus-Filipendula ulmaria* mire
*Filipendulo-Iridetum pseudacori* Adam 1976 em.

ARRHENATHERETALIA Tüxen 1931
Pastures and meadows on well-drained, relatively fertile mineral soils

**Arrhenatherion elatioris** Koch 1926
Meadows of well-drained, relatively fertile mineral soils at lower altitudes

MG1 *Arrhenatherum elatius* grassland
Arrhenatheretum elatioris Br.-Bl. 1919

MG2 *Arrhenatherum elatius-Filipendula ulmaria* grassland
*Filipendulo-Arrhenatheretum* Shimwell 1968

**Polygono-Trisetion** Br.-Bl. et Tüxen ex Marschall 1947 nom. invers. propos.
Meadows of well-drained, relatively fertile mineral soils in montane regions

MG3 *Anthoxanthum odoratum-Geranium sylvaticum* grassland (5)
Stands of meadow vegetation transitional between MG3 and MG4 *Alopecurus-Sanguisorba* meadow occur between the Pennines and the Vale of York.

**Cynosurion cristati** Tüxen 1947
Pastures of relatively well-drained, fertile mineral soils at lower altitudes

MG4 *Alopecurus pratensis-Sanguisorba officinalis* grassland

MG5 *Cynosurus cristatus-Centaurea nigra* grassland (5)
*Centauro-Cynosuretum cristati* Br.-Bl. et R.Tx. 1952
MG5 is a more diverse grassland than the present account indicates. In particular, there are distinctive swards around the upland fringes which have more frequent records for rushes and other species characteristic of M23 *Juncus-Galium* pasture and, more locally, there is prominence of such plants as *Carum verticillatum, Sanguisorba officinalis* and *Vicia orobus*. CCW Lowland Grassland Survey has relevés, with further data for *Carum* in Wheeler

(1986). Stands of MG3 *Anthoxanthum-Geranium* grassland which have only sporadic records for distinctive preferentials also often look transitional to MG5.

MG6 *Lolium perenne-Cynosurus cristatus* grassland (5)
*Lolio-Cynosuretum cristati* (Br.-Bl. et de Leeuw 1936) R.Tx. 1937
Improved grasslands on some inland clay pastures and reclaimed coastal marshes around the Thames and perhaps also the Severn (Dargie, pers. comm.) with *Ranunculus sardous, Hordeum secalinum* and *Trifolium fragiferum* probably represent a sub-community of MG6 *Lolio-Cynosuretum* like the *juncetosum gerardii* Westhoff 1969. Further sampling is needed of this and of the grassland on the banks of large fen dykes and sea 'walls' in reclaimed salt-marshes (see Figure 25) where *Lactuca saligna* and *Petroselinum segetum* seem to be characteristic. Relevés from Hare (unpublished) and Ferry (unpublished).

*Festuca rubra-Holcus lanatus Anthoxanthum odoratum* grassland (6)
In *British Plant Communities*, grassland dominated by *Festuca rubra* and *Holcus lanatus* and with a distinctive maritime element in *Armeria maritima* and *Plantago maritima*, figures among the sea-cliff communities as MC8 *Festuca-Holcus* grassland. Subsequent surveys in Northern Ireland (Cooper *et al*. 1992), Scotland (reports summarised in Cooper & MacKintosh 1996) and various parts of England and Wales (Harding 1993*c* and pers. comm.) have recognised that similar swards without such a maritime contingent are widely distributed. Often species-poor and rank, these swards have frequent *Festuca rubra*, *H. lanatus*, *Anthoxanthum odoratum*, *Poa pratensis*, *Dactylis glomerata*, *Trifolium repens*, *Plantago lanceolata* and mosses such as *Pseudoscleropodium purum* and *Rhytidiadelphus squarrosus*, but with little or no *Lolium perenne* and relatively few of the taller dicotyledons associated with meadows. It looks as if there may be more and less calcifugous types with on the one hand species like *Luzula campestris* and *Agrostis capillaris* and, on the other, *Lotus corniculatus* and *Galium verum*. This kind of grassland grades into younger stands of MG1 *Arrhenatheretum elatioris* (often developing on sown verges) but vegetation like this seems especially associated with meadows, machair and unimproved drier pastures which have become neglected through abandonment of regular mowing and grazing and grown rank. Of little intrinsic floristic value, this grassland is an important element of marginal agricultural landscapes in western Britain and the Scottish Isles and is of potential significance for a variety of alternative uses, including perhaps reclamation for low-input agriculture. Many samples already in the UKVDB but reanalysis of these and any new data is essential.

**POLYGONO ARENASTRI-POETEA ANNUAE** Rivas-Martinez 1975 corr.. Rivas-Martinez et al. 1991
Vegetation, mostly of rosette and creeping hemicryptophytes, in moderately disturbed or trampled habitats

POLYGONO ARENASTRI-POETALIA ANNUAE R.Tx. in Géhu *et al*. 1972 corr. Rivaz-Martinez *et al*. 1991

**Lolio-Plantaginion** Sissingh 1960
Grassy communities of short-term leys, recreational swards, gateways and tracksides

MG7 *Lolium perenne* leys & related grasslands

OV21 *Poa annua-Plantago major* community

OV22 *Poa annua-Taraxacum officinale* community

OV23 *Lolium perenne-Dactylis glomerata* community

**Polygonion avicularis** Br.-Bl. ex Aichinger 1933
Weed communities of trampled places

OV18 *Polygonum aviculare-Chamomilla suaveolens* community

OV19 *Poa annua-Matricaria perforata* community

OV20 *Poa annua-Sagina procumbens* community
*Sagino-Bryetum argentii* Diemont, Sissingh & Westhoff 1940

AGROSTETALIA STOLONIFERAE Oberdorfer in Oberdorfer *et al.*. 1967

**Potentillion anserinae** Tx. 1947
*Elymo-Rumicion crispi Nordhagen 1940*
Natural and anthropogenic communities of unstable habitats, periodically wettened and dried out or alternating brackish and fresh

SM28 *Elymus repens* salt-marsh community
*Elymetum repentis maritimum* Nordhagen 1940
*Elymus repens* grassland has been recorded inland on some flood plain systems (eg. Derwent Ings in North Yorkshire) and, on very sheltered strandlines in Orkney and the Moray Firth, where there is much organic tidal litter, *Elymus repens* forms a community with *Leymus arenarius*.

MG11*Festuca rubra-Agrostis stolonifera-Potentilla anserina* grassland

MG12*Festuca arundinacea* grassland
*Potentillo-Festucetum arundinaceae* Nordhagen 1940

MG13*Agrostis stolonifera-Alopecurus geniculatus* grassland

SD17 *Potentilla anserina-Carex nigra* dune slack

*Carex nigra-Agrostis stolonifera* community (6)
Wet grassland or small-sedge fen in which *Carex nigra* is often abundant with frequent *Agrostis stolonifera, Holcus lanatus, Ranunculus repens, R. acris, Caltha palustris, Lychnis flos-cuculi, Cardamine pratensis* and *Calliergon cuspidatum* and variously enriched by *Carex panicea* and poor-fen herbs or *Juncus articulatus* and Potentillion plants (though not always *Potentilla anserina*) has been widely reported from damp hollows and wet pastures at low altitudes, especially along the western seaboard of Britain (surveys summarised in Cooper & MacKintosh 1996; see also Dargie 1993, 1998a, b, e), though also from the Suffolk coast (Harding 1993c). Further survey and analysis is needed to characterise this vegetation in relation to the *Senecioni-Brometum* (described under the Calthion), the *Carex-Ranunculus flammula* mire (under the Caricion fuscae) and to the existing MG8.

OV28 A*grostis stolonifera-Ranunculus repens* community
*Agrostio-Ranunculetum repentis* Oberdorfer et al. 1967

OV29 *Alopecurus geniculatus-Rorippa palustris* community
*Ranunculo-Alopecuretum geniculati* R.Tx. (1937) 1950

*Tussilago farfara-Festuca rubra* community (6)
Among the sea-cliff communities in the NVC, herbaceous vegetation of softer clay cliffs is noticeably absent but it occurs widely along the eastern coast of England and locally in the south and essentially similar assemblages can be seen inland throughout the lowlands colonising slumping clay banks on open ground, roadsides and building sites, often with surface runnels where rain or ground water runs away. Tussocky grasses like *Festuca*

*rubra, F. arundinacea* and *Dactylis glomerata* form an open cover with scattered *Tussilago farfara* very distinctive and, on spray-splashed sites, *Armeria maritima* and *Plantago coronopus* can figure. This vegetation provides a characteristic locus for *Rubus ulmifolius* and *Helmintha echioides* and may quickly acquire swarms of *Ophrys apifera*. There are relevés from Kent (Malloch unpublished), the Yorkshire coast (Rodwell unpublished) and from inland in Yorkshire (Lunn 1998).

**FESTUCO-BROMETEA** Br.-Bl. et Tüxen ex Braun-Blanquet 1949

Grasslands and steppes of infertile calcareous or sandy soils, often drought-prone, in temperate and sub-boreal regions of Europe

BROMETALIA ERECTI Br.-Bl. 1936
Sub-oceanic, more or less arid swards

**Xerobromion** (Br.-Bl. et Moor 1938) Moravec in Holub *et al*. 1967
Swards of more arid soils, often open and with a prominent contingent of ephemeral plants, on stable rocky slopes in sunny situations in hemi-oceanic parts of Europe

CG1 *Festuca ovina-Carlina vulgaris* grassland

**Bromion erecti** Koch 1926
Swards of less arid soils in hemi-oceanic parts of Europe

CG2 *Festuca ovina-Avenula pratensis* grassland

CG3 *Bromus erectus* grassland

CG4 *Brachypodium pinnatum* grassland

CG5 *Bromus erectus-Brachypodium pinnatum* grassland

CG6 *Avenula pubescens* grassland

CG8 *Sesleria albicans-Scabiosa columbaria* grassland

CG9 *Sesleria albicans-Galium sterneri* grassland

KOELERIO-PHLEETALIA PHLEOIDIS Korneck 1974
Swards of lime-rich sandy soils in more Continental parts of Europe

**Koelerio-Phleion phleioidis** Korneck 1974

CG7 *Festuca ovina-Hieracium pilosella-Thymus praecox/pulegioides* grassland (3)
On sunny south- and west-facing rocky slopes on igneous bedrocks with locally base-rich soils at low altitudes along Hadrian's Wall and in south-east Scotland, swards essentially like CG7 occur beyond the geographical range of thermophilous calcicoles like *Cirsium acaule* and *Thymus pulegioides*, providing a locus for *Dianthus deltoides, Astragalus danicus, Potentilla neumanniana* and *Trifolium striatum.* Releves from Averis (1996 and recent unpublished data) and Lusby (1992) need analysis to characterise a possible new sub-community.

**KOELERIO-CORYNEPHORETEA** Klika in Klika et Novák 1941

Pioneer vegetation of therophytes and hemicryptophyte perennials on dry, infertile sandy soils in the European lowlands

CORYNEPHORETALIA CANESCENTIS Klika 1934 em. Tüxen 1962
Open swards on sands

**Corynephorion canescentis** Klika 1934 em. Tüxen 1962
Colonising vegetation and open grasslands of acid sands on coastal and inland dunes

SD11 *Carex arenaria-Cornicularia aculeata* dune community

SD12 *Carex arenaria-Festuca ovina-Agrostis capillaris* dune grassland (5)*
Much SD12 vegetation in Scotland is difficult to allocate to existing sub-communities because the differentials *Anthoxanthum odoratum* and *Holcus lanatus* are both present. Sand dune survey in Scotland (Dargie 1994*a*, *b*; 1998*c*,*e*, 1999) recorded a range of forms which might constitute further sub-communities: *Ammophila arenaria* (semi-fixed dune developing without an SD7 phase), *Carex arenaria* (usually with heavy rabbit grazing), *Hylocomium splendens* (part of the Moray Firth Boreal sequence), *Racomitrium canescens* (deflating environments, very rarely with *Corynephorus canescens* at Morar in Lochaber), *Deschampsia flexuosa* (often close to H11 dune heath) and *Cladonia rangiformis-C. portentosa* (perhaps the classic grey dune, though now very rare on the east coast of Scotland).

**Thero-Airion** Tüxen ex Oberdorfer 1957
Ephemeral vegetation of bare but stable acid sands or siliceous rock outcrops

MC5 *Armeria maritima-Cerastium diffusum* ssp. *diffusum maritime* therophyte community (6)
It is clear that MC5 represents only a (distinctively maritime) part of the Thero-Airion in Britain. Inland swards rich in ephemerals like *Vulpia* spp. (relevés from Lunn 1998) are widespread on shallow acidic soils in warmer and drier parts of the country and need further sampling to characterise syntaxa like the *Airetum praecocis* (Schwickerath 1944) Krausch 1967, the *Filagini-Vulpietum myuros* Oberdorfer 1938 and the *Airo caryophylleae-Festucetum ovinae* R Tx. 1955.

**Koelerion arenariae** R.Tx. 1937 corr. Gutermann et Mucina 1993
Ephemeral vegetation of bare but stable calcareous sands

SD19 *Phleum arenarium-Tortula ruralis ruraliformis* dune annual community
*Tortulo-Phleetum arenariae* (Massart 1908) Br.-Bl. et de Leeuw 1936

SEDO-SCLERANTHETALIA Br.-Bl. 1955
Closed swards of calcareous to acidic, drought prone soils on rock outcrops

**Alysso-Sedion** Oberdorfer et Müller in Müller 1961

*Poa compressa-Saxifraga tridactylites* community (6)*
*Saxifrago tridactylitis-Poetum compressae* (Kreh 1951) Géhu & Lericq 1957
Open and often fragmentary assemblages that are probably identical to this association have small tufts of *Poa compressa* and *Saxifraga tridactylites* with patches of *Sedum acre*, ephemerals such as *Arenaria serpyllifolia, Erophila verna, Aira praecox, A. caryophyllea* and *Cardamine hirsuta* and small tufts or patches of mosses like *Tortula muralis, Ceratodon purpureus, Bryum capillare, Homalothecium sericeum* and *Grimmia pulvinata*. Stands are widespread and common on the limestones of southern Britain on sunny wall-tops and in mortared stonework but also occur in such natural habitats as fractured limestone outcrops

and clint surfaces on limestone pavement where shallow and fragmentary rendzinas dry out in summer. Figure 25 in Appendix 1 shows a potential distribution map for this vegetation type which has been created by coincidence mapping characteristic species. This kind of vegetation is clearly analogous to the assemblages reported from sunny chalk cliff tops in Limburg in the Netherlands (Schaminée *et al.* 1996) and is the British representative of the Alysso-Sedion alliance and an element of limestone pavement vegetation. There are a few relevés in the UKVDB but additional data, which are a priority, will be easy to collect.

**Sedion anglici** Br.-Bl. in Br.-Bl. et Tx 1952
Stonecrop vegetation of more oceanic regions of Europe.

*Sedum anglicum-Aira praecox* community (6)
*Airo-Sedetum anglici* Br.-Bl. in Br.-Bl. et Tx 1952.
Stonecrop vegetation with *Sedum anglicum* and a characteristic suite of ephemerals already figures in its more maritime manifestation as part of the MC5 *Armeria-Cerastium* community. However, similar assemblages lacking species such as *Aira maritima* and *Plantago maritima* can be seen widely in more inland locations in the oceanic south and west of Britain. Here, *Sedum anglicum* can occur with local abundance with such other distinctive plants as *Jasione montana*, *Vulpia bromoides* and *Umbilicus rupestris* and ephemerals like *Aira praecox*, *A. caryophyllea*, *Bromus hordeaceus* ssp. *hordeaceus*, and *Erodium cicutarium*. The vegetation probably provides a characteristic locus for *Romulea columnae*, *Polycarpon tetraphyllum*, *Tuberaria guttata*, *Ornithopus pinnatus*, *Juncus capitatus* and certain scarce *Trifolium* spp. such as *T. occidentale* (Coombe 1961). It typically occurs on outcrops of less base-rich rocks with shallow rankers, drought-prone in the warm, sunny conditions of summer, among pastures and heaths of cliff-tops, crags and rocky knolls where grazing helps keep encroaching heath and scrub away from the crag surrounds. It is widespread but uncommon through the more oceanic parts of Britain (and locally further east: see Hughes 1995 on the Suffolk coast) and is of importance for scarce and rare plants and as part of distinctive landscapes. Relevés are available from Birse (1980) in Galloway and Mull, Hopkins (1983) on the Lizard, Proctor from south-west England (unpublished, also 1975 from Alderney) and from Averis & Averis (1995) from Mull. Further data, which would be easy to obtain, are needed to define this assemblage and clarify relationships with MC5 and U1f *Festuca-Agrostis-Rumex* grassland, *Hypochoeris* sub-community. Figure 26 in Appendix 1 shows a potential distribution map for this vegetation type which has been created by coincidence mapping chatacteristic species.

**Plantagini-Festucion ovinae** Passarge 1964

U1 *Festuca ovina-Agrostis capillaris-Rumex acetosella* grassland

SD8 *Festuca rubra-Galium verum* dune grassland (5)*
This is a remarkably complex vegetation type in Scotland where the heartland of its distribution lies on the machair. Although the present five sub-communities cover much of the variation, other forms are present and have been mapped in Dargie (1998*a-e*, 1999). It may thus be possible to recognise *Centaurea nigra-Daucus carota* (on at most lightly grazed calcareous sands, an analogue to MG5), *Thymus praecox* (on shallow, partly flushed sand blown over rocky hillsides) and *Hylocomium splendens-Rhytidiadelphus triquetrus* sub-communities (the last part of a Boreal sequence: see SD7).

**CALLUNO-ULICETEA** Br.-Bl. et R. Tx ex Westhoff, Passchier et Dijk 1946
Grasslands and dwarf-shrub heaths of acidic, nutrient-poor mineral soils and peats in lowland and mountain regions

NARDETALIA STRICTAE Oberdorfer ex Preising 1949

**Violion caninae** Schwickerath 1944
Unfertilised mat-grass pastures at lower altitudes

U2 *Deschampsia flexuosa* grassland

U3 *Agrostis curtisii* grassland

U4 *Festuca ovina-Agrostis capillaris-Galium saxatile* grassland (5)
Locally in western Scotland, there is a distinctive form of this grassland with big mesotrophic herbs. The abundance of the grasses *Festuca rubra, F. ovina, F. vivipara, Holcus lanatus* and *Anthoxanthum odoratum*, together with *Potentilla erecta* and an extensive and often rather deep moss layer of *Rhytidiadelphus squarrosus* and *Hylocomium splendens* and other species, places the vegetation clearly into U4. However, the vegetation differs from each of the five sub-communities of U4 in containing an abundance of tall mesophytic herbs such as *Filipendula ulmaria, Geum rivale, Cirsium helenioides, Parnassia palustris, Angelica sylvestris, Trollius europaeus, Alchemilla glabra, Geranium sylvaticum* and *Succisa pratensis*. Intensity of grazing varies but where it is heavier these tall herbs are mostly reduced to short, non-flowering plants. This grassland has been found on steep, moist but well-drained north-facing slopes at low altitude on basalt on Mull and Kerrera, on Cambrian fucoid beds on Beinn Eighe in Wester Ross, and on schists on Ben Lui in Perthshire. It occurs mainly on concave slopes where a moss/humus layer has provided some degree of buffering from the mineral soil and where there is some flushing from basic rock outcrops above. This vegetation probably represents a new sub-community of U4 and it typically forms small stands in sometimes extensive mosaics with CG10 *Festuca-Agrostis-Thymus*, CG11 *Festuca-Agrostis-Alchemilla* and U5 *Nardus-Galium* grasslands. 13 relevés from Mull, Beinn Eighe and Ben Lui (Averis & Averis 1996, 1998a, in prep.) with further data on U4 with MG5 meadow plants from CCW Lowland Grassland Survey.

Mossy grassland with abundant *Racomitrium lanuginosum* and abundant *Alchemilla alpina* or frequent *Huperzia selago* and *Diphasiastrum alpinum* found at high altitudes in the Highlands and Snowdonia also expands the character of U4.

U5 *Nardus stricta-Galium saxatile* grassland (5)
With abundant *Calluna vulgaris*, this vegetation resembles western forms of M15c with *Scirpus* replaced by *Nardus* and *Erica tetralix* absent or very rare (18 releves from the western Highlands; Averis & Averis 1997*b*, 1997*c*, 1998*a*). Another form has little or no heather and is more of a *Nardus-Racomitrium* grassland (relevés from Skye; Averis & Averis 1997*a*). These two forms occur mainly on convex slopes which are at least moderately well-drained. The third form, which occurs in small, wetter, often linear shallow depressions (usually among drier U5e) has abundant *R. lanuginosum, Campylopus atrovirens, Sphagnum auriculatum* and *Narthecium ossifragum*. 6 releves from Skye by Averis & Averis (1997*a*).

CG10 *Festuca ovina-Agrostis capillaris-Thymus praecox* grassland (5)*
Open swards of the CG10 type with frequent records for *Aira praecox*, occasional *Plantago maritima* and a distinctive contribution in the ground layer from *Racomitrium ericoides, R. lanuginosum* and *Pogonatum aloides*, occurring on riverside shingle throughout the Scottish Highlands, may constitute a new sub-community. 5 releves from Rhidorroch, Wester Ross (Averis 1998).

CG11 *Festuca ovina-Agrostis capillaris-Alchemilla alpina* grassland

**Nardo-Juncion squarrosi** (Oberdorfer 1957) Passarge 1964
Heath-rush vegetation on peaty soils

U6 *Juncus squarrosus-Festuca ovina* grassland (5)
*G*raminoid-dominated swards with a low cover of *Juncus squarrosus* and including abundant *Anthoxanthum odoratum, Nardus stricta* and *Agrostis canina* can differ markedly from other types of U6 in containing an abundance of mesophytic or calcicole herbs such as *Ranunculus acris, R. flammula, Thalictrum alpinum, Alchemilla glabra, Taraxacum officinale* agg., *Crepis paludosa, Geum rivale, Parnassia palustris, Persicaria vivipara, Trollius europaeus, Carex pulicaris* and *Filipendula ulmaria*. This distinctive, species-rich vegetation has been found very locally in the Highlands, mainly in the Breadalbanes. It occurs as small stands in wet, flushed depressions at 400-700 m, mainly in complex mosaics with U4 *Festuca-Agrostis-Galium* grassland, U5 *Nardus-Galium* grassland, H18 *Vaccinium-Deschampsia* heath and other forms of U6. In terms of floristics and habitat it can be seen as a higher-altitude replacement of M23a *Juncus-Galium* rush pasture. On Ben Lui it is an important locus for the rare *Carex vaginata.* Relevés from the Breadalbanes (McVean & Ratcliffe 1962, Averis & Averis in preparation).

Short vegetation co-dominated by *Juncus squarrosus* and *Calluna vulgaris* is quite frequent in the western Highlands. Floristic details can show affinities with U6a, b or c, but some stands cannot be clearly assigned to a sub-community. Further sampling of this distinctive vegetation may suggest a new sub-community of U6. Relevés from Ben Lui (Averis & Averis in preparation).

CALLUNO-ULICETALIA Tüxen 1937

**Genisto-Callunion** Bocher 1943
Ling heaths on drought-prone soils at low to moderate altitudes in Continental and sub-Atlantic regions

H1 *Calluna vulgaris-Festuca ovina* heath

H9 *Calluna vulgaris-Deschampsia flexuosa* heath

**Ulicion minoris** Malcuit 1929
Gorse heaths on dry to fresh soils in the Atlantic region

H2 *Calluna vulgaris-Ulex minor* heath

H8 *Calluna vulgaris-Ulex gallii* heath

**Ulici-Ericion ciliaris** Géhu 1973
Gorse-Dorset heath communities of damper soils in the Atlantic region

H3 *Ulex minor-Agrostis curtisii* heath

H4 *Ulex gallii-Agrostis curtisii* heath (5)*
Beyond the geographic range of *Agrostis curtisii*, Prosser & Wallace (1996) have reported a 'humid heath' with frequent *Calluna vulgaris, Erica tetralix, Molinia caerulea* and *Ulex gallii*, essentially similar to H4 but perhaps best seen as a new sub-community.

H6 *Erica vagans-Ulex europaeus* heath

**Ericion cinereae** Böcher 1940
Bell-heather communities on dry to fresh soils in sub-Atlantic regions

H7 *Calluna vulgaris-Scilla verna* heath

H10 *Calluna vulgaris-Erica cinerea* heath (5)*
Transitions between calcicolous grasslands and heaths occur widely throughout the southern lowlands of Britain, and Rodwell (1991*b*) explains how some of the 'limestone heath' described by various authors can be accommodated in different NVC sub-communities or mosaics between vegetation types. Detailed reinvestigation of vegetation-soil sequences first described by Gittins (1965) and Rodwell (1974) in Stevens *et al*. (1995) may help characterise further intermediate heathy swards.

(5)*
Rarely in the western Highlands, prostrate *Juniperus communis* and/or *Arctostaphylos uva-ursi* are co-dominant with *Calluna vulgaris* and *Erica cinerea* in heaths which appear to represent small fragments of vegetation extensive before moor-burning took place. Relevés from Skye, Beinn Eighe and Sutherland from Averis (1997) and Averis & Averis (1998*a*, *d*) and from blown sand on Mull and Colonsay in Dargie (1999). Some other H10 heath in the western Highlands and Northern Ireland has a bryophyte layer containing frequent *Breutelia chrysocoma* and some *Sphagnum capillifolium* and represents a transition from H10a to H21a, but it occurs frequently enough and extensively enough that it might warrant a new sub-community of H10. No relevés in UKVDB.

H11 *Calluna vulgaris-Carex arenaria* heath

**Myrtillion boreale** Böcher 1943
Bilberrry heaths of moist soils in the sub-montane zone

H12 *Calluna vulgaris-Vaccinium myrtillus* heath (5)*
H12 containing abundant *Racomitrium lanuginosum* is rare in the Highlands. It is closest floristically to H12b, but unlike H10, H12 cannot comfortably accommodate forms of vegetation with with abundant *R. lanuginosum.* There may be a case for the creation of a *R. lanuginosum* sub-community of H12. 5 releves from Beinn Eighe (Averis & Averis 1998*a*).

H16 *Calluna vulgaris-Arctostaphylos uva-ursi* heath

H21 *Calluna vulgaris-Vaccinium myrtillus-Sphagnum capillifolium* heath (5)*
H21b with abundant prostrate *Juniperus communis* occurs rarely in the western Highlands. It appears to be a relatively natural type of heath which might have been more frequent before moor-burning took place. Given its extreme rarity it may not warrant recognition as a separate sub-community, but it forms part of the important series of relatively natural Scottish heaths containing abundant prostrate juniper (Averis & Averis 1998*d*). Most H21b south of the NW Highlands and Skye where this sub-community is extensive contains abundant *Herbertus aduncus* but lacks other montane Northern Atlantic leafy liverworts characteristic of more northern H21b. No relevés, although similar vegetation in Ireland has been sampled (Horsfield pers. comm.), and Averis (1994) sampled the full bryophyte component of Scottish heaths of this kind (Averis 1994).

# ROCK-CREVICE AND SCREE VEGETATION

**ASPLENIETEA TRICHOMANIS** (Br.-Bl. in Meier et Braun-Blanquet 1934) Oberdorfer 1977
Open vegetation with ferns and mosses in rock and wall crevices

POTENTILLETALIA CAULESCENTIS Br.-BL. in Braun-Blanquet et Jenny 1926

**Cystopteridion fragilis** Richard 1972
Communities of shaded calcareous rocks

OV40 *Asplenium viride-Cystopteris fragilis* community
*Asplenio-Cystopteridetum fragilis* (Kuhn 1939) Oberdorfer 1949

*Polypodium vulgare-Umbilicus rupestris* community (6)
Both *Polypodium interjectum* and *P. australe* occur among the wall crevice assemblages of the Cymbalario-Asplenion but the former fern, along with *P. vulgare sensu stricto,* is also a distinctive feature of the vegetation of hedgebanks and lanesides in western Britain with other ferns such as *Dryopteris filix-mas, D. borreri, D. dilatata, Polystichum setiferum, P. aculeatum, Phyllitis scolopendrium, Asplenium adiantum-nigrum, A. billotii* and various hybrid ferns, *Hedera helix, Umbilicus rupestris, Silene dioica, Teucrium scorodonia, Brachypodium sylvaticum* and overhanging shrubs such as *Crataegus monogyna* and *Ulex europaeus*. This sort of vegetation is at its most luxuriant in the deep lanes running down to the sea in south Devon but it is widespread and common all around the south-western seaboard, extending up on to moorland where there is local shelter. On more accessible hedgebanks, periodic cutting helps prevent closure of a scrubby cover. The vegetation has many features suggestive of shady Saum and is perhaps better placed among the Melampyrion assemblages but, apart from its contribution to distinctive landscapes, it provides an important locus for various rare and scarce ferns (Page 1982, 1988). There are no relevés available but the vegetation is easy to locate and sample.

*Asplenium marinum* community (6)*
*Asplenium marinum* figures occasionally among the maritime crevice vegetation of MC1 *Crithmo-Spergularietum* but this fern also occurs, sometimes with great local abundance and luxuriance, in shaded crevices, beneath overhangs and in caves cut in hard rock coasts, particularly of our Atlantic seaboard, where constant drenching with spray from Gulf Stream waters in an oceanic climate creates a humid, frost-free atmosphere. The moss *Schistidium maritimum* is often the only companion. According to Page (1982), stands are much less common and luxuriant now compared with last century, perhaps partly because of sea water pollution. The nationally scarce *Asplenium billotii* tends to occur more frequently in crevices a little higher up cliffs but the *A. marinum* community is itself important as part of the sequence of sea-cliff vegetation. 8 relevés from Malloch (unpublished) are in the UKVDB and additional samples would be relatively easy to collect from more accessible cliffs.

TORTULO-CYMBALARIETALIA Segal 1969
Wall crevice vegetation of sunny situations

**Centrantho-Parietarion** Rivas-Martínez 1960 nom. invers. propos.
Wall crevice vegetation of sunny situations

OV41 *Parietaria diffusa* community
*Parietarietum judaicae* (Arènes 1928) Oberd. 1977

**Cymbalario-Asplenion** Segal 1969
Communities of calcareous rocks in sunny situations

OV39 *Asplenium trichomanes-Asplenium ruta-muraria* community
*Asplenietum trichomano-rutae murariae* R.Tx. 1937

OV42 *Cymbalaria muralis* community
*Cymbalarietum muralis* Görs 1966

**THLASPIETEA ROTUNDIFOLII** Br.-Bl. 1948
Vegetation of scree, rubble and spoil

GALIO-PARIETARIETALIA Boscaiu *et al*. 1966

**Stipion calamagrostis** Jenny-Lips ex Br.-Bl. *et al*. 1952
Communities of calcareous screes

OV38 *Gymnocarpium robertianum-Arrhenatherum elatius* community
*Gymnocarpietum robertianum* (Kuhn 1937) R.Tx. 1937

ANDROSACETALIA ALPINAE Br.-Bl. 1926

**Androsacion alpinae** Br.-Bl. 1926
Communities of acid screes

U21 *Cryptogramma crispa-Deschampsia flexuosa* community
*Cryptogrammetum crispae* Jenny-Lips 1930

VIOLETALIA CALAMINARIAE Br.-Bl. et R.Tx. 1943
Swards on soils rich in heavy metals derived from natural ore outcrops or from mining and industrial activities

**Thlaspion calaminariae** Ernst 1965
Mainly in western Europe

OV37 *Festuca ovina-Minuartia verna* community
*Minuartio-Thlaspietum alpestris* Koch 1932

## MONTANE HEATHS, TALL-HERB COMMUNITIES AND SNOW-BEDS

**JUNCETEA TRIFIDAE** Hadac 1946
Pastures, rush-heaths and fell-field on lime-poor soils in alpine and sub-alpine zones

CARICETALIA CURVULAE Br.-Bl. in Braun-Blanquet et Jenny 1926
Unproductive swards on lime-poor, impoverished humic soils in cloud-ridden and snowy sub-alpine and alpine zones

**Nardo-Caricion bigelowii** Nordhagen 1927
Moderately chionophilous sedge-, rush- and moss-dominated communities kept moist by snow-lie and melt waters

U7 *Nardus stricta-Carex bigelowii* grass-heath (5)*
Some U7 *Nardus* snowbed vegetation on N-facing slopes at 600-950 m on Beinn Eighe contains a distinctive abundance of the nationally scarce Northern Atlantic leafy liverworts *Anastrophyllum donnianum, A. joergensenii, Scapania ornithopodioides, S. nimbosa,*

*Bazzania pearsonii* and *Plagiochila carringtonii*. This vegetation may warrant separation as a new sub-community if it proves to be widespread. Relevés from Averis & Averis (1998*a*).

U8 *Carex bigelowii-Polytrichum alpinum* sedge-heath (5)*
U8 vegetation containing a distinctive abundance of *Barbilophozia floerkei* occurs locally on moist N-facing slopes at 1030-1230 m in the Highlands. 19 releves from Rothero (1991), who considered it worthy of separation as a *B. floerkei* sub-community.

U9 *Juncus trifidus-Racomitrium lanuginosum* rush-heath

U10 *Carex bigelowii-Racomitrium lanuginosum* moss-heath (5)*
U10c includes two distinctly different types of vegetation which may warrant separation into separate sub-communities. One type is much like U10b but with frequent scattered *Silene acaulis* and *Armeria maritima* (13 relevés from Beinn Eighe; Averis & Averis 1998*a*). The other type, which is species-rich and very distinctive, contains several montane herbs such as *Saussurea alpina, Thalictrum alpinum, Luzula spicata, Sedum rosea, Minuartia sedoides, Cerastium arcticum* and *Cochlearia pyrenaica* ssp. *alpina* (relevés from Beinn Eighe; Averis & Averis 1998*a*).

*Festuca vivipara-Oligotrichum hercynicum* fell-field community (6)
This very short and sparse vegetation occurs on moist, bare, gravelly, flat to moderately sloping ground in very exposed places over 300 m in northern and western Scotland. The total vegetation cover is typically less than 10%. Scattered plants of *Festuca vivipara, Agrostis canina* and the mosses *Oligotrichum hercynicum* and *Racomitrium lanuginosum* are generally abundant. Fell-fields are particularly well-developed on basalt in Skye, Mull and Morvern and provide a strong link with the basalt environment in the Faroe Islands especially where, in some basalt fell-fields of this type in the western Highlands, the flora is distinctive in containing base-demanding species such as *Thymus praecox, Sedum villosum, Juncus triglumis, Luzula spicata, Koenigia islandica* and the oceanic moss *Racomitrium ellipticum.* Basalt fell-fields in Skye and Mull represent one of the main habitats of the rare *Koenigia islandica* in the British Isles. Other fell-fields on basalt, granite, schist and other rock types in the western Highlands and Shetland are evidently more acidic. They support a flora including frequent *Vaccinium myrtillus, V. vitis-idaea, Campanula rotundifolia, Deschampsia flexuosa, Solidago virgaurea, Polytrichum alpinum* and *Jasione montana.* The vegetation of some of the more acidic fell-fields on Mull contains a distinctive abundance of *Sedum anglicum* and *Saxifraga stellaris.* Appraisal of relevés from Averis (1997) and Averis & Averis (1997a) and any new data could characterise two sub-communities reflecting the variation from basic to acidic rock types.

**Deschampsieto-Anthoxanthion** Dahl 1956
Grass- and herb- communities on slopes irrigated by frigid melt waters

U13 *Deschampsia cespitosa-Galium saxatile* grassland

**LOISELEURIO-VACCINIETEA** Eggler 1952 em. Schubert 1960
Dwarfed sub-shrub heaths with mosses and lichens on windswept and snowbound slopes at high altitudes in Northern Europe

RHODODENDRO-VACCINIETALIA Br.-Bl. in Br.-Bl. et Jenny 1926

**Loiseleurio-Vaccinion** Br.-Bl. in Br.-Bl. et Jenny 1926
Less chinonophilous communities of windswept slopes and summits

H13 *Calluna vulgaris-Cladonia arbuscula* heath

H14 *Calluna vulgaris-Racomitrium lanuginosum* heath

H15 *Calluna vulgaris-Juniperus communis* spp. *nana* heath

H17 *Calluna vulgaris-Arctostaphylos alpinus* heath

H19 *Vaccinium myrtillus-Cladonia arbuscula* heath

H20 *Vaccinium myrtillus-Racomitrium lanuginosum* heath

**Phyllodoco-Vaccinion** Nordhagen 1943
Moderately chionophilous communities of snow-bound slopes

H18 *Vaccinium myrtillus-Deschampsia flexuosa* heath

H22 *Vaccinium myrtillus-Rubus chamaemorus* heath

**CARICI RUPESTRIS-KOBRESIETEA BELLARDII** Ohba 1974
Subalpine and alpine grasslands and dwarf-shrub heaths on lime-rich soils

KOBRESIO-DRYADETALIA Ohba 1974

**Kobresio-Dryadion** Nordhagen (1936) 1943
Chionophobous grassy and dwarf-shrub heaths on well-drained soils

CG13 *Dryas octopetala-Carex flacca* heath

CG14 *Dryas octopetala-Silene acaulis* ledge community

**Potentillo-Polygonion** Nordhagen 1928
Moderately chionophilous communities dominated by small herbs

CG12 *Festuca ovina-Alchemilla alpina-Silene acaulis* dwarf-herb community

**MULGEDIO-ACONITETEA** Hadac et Klika in Klika 1948
Luxuriant scrub and tall-herb vegetation on ungrazed ledges, hollows and gulleys in the subalpine and alpine zones, with soils kept moist and fertile by percolating waters

ADENOSTYLETALIA ALLIARIAE G. & J. Br.-Bl. 1931
Tall herb and scrub on more fertile and lime-rich soils

**Adenostylion alliariae** Br.-Bl. 1926
Tall-herb communities

U17 *Luzula sylvatica-Geum rivale* tall-herb community

*Pteridium aquillinum-Cirsium helenioides* fern-community (6)
Bracken-dominated vegetation with rather low-grown, moderately grazed associates including *Filipendula ulmaria, Ranunculus repens, Cirsium palustre, C.helenioides, Lysimachia nemorum, Prunella vulgaris, Primula vulgaris* and *Ajuga reptans* occurs locally on moist, deep soils on gently sloping ground at low altitudes in the western Highlands. This does not fit comfortably into U20 or W25 and may represent a new community in this alliance. No relevés are available.

**Alnion viridis** Aichinger 1933
*Salicion arbusculae Ellenberg 1978*
Subalpine willow scrub

W20 *Salix lapponum-Luzula sylvatica* scrub

CALAMAGROSTIETALIA VILLOSAE Pawlowski *et al*. 1928
Tall-herb and fern communities of acidic and more impoverished soils

**Calamagrostion villosae** Pawlowski in Pawtowski, Sokotwski et Walisch 1928

U16 *Luzula sylvatica-Vaccinium myrtillus* tall-herb community

U18 *Cryptogramma crispa-Athyrium distentifolium* snow-bed

U19 *Thelypteris limbosperma-Blechnum spicant* community

*Dryopteris borreri* community (6)
Local dominance of ferns can be a striking feature of U16 *Luzula-Vaccinium* tall-herb vegetation but, more widely, *Dryopteris borreri* (=*D. affinis*) occurs abundantly in sometimes quite extensive stands with Nardo-Galion associates over the lower slopes of hills in western Scotland and sheltered valleys in the drier east. This may warrant a new community in this alliance. No relevés in UKVDB.

**SALICETEA HERBACEAE** Br.-Bl. 1949
Vegetation of more long-lasting snow-beds and slopes irrigated by melt waters

SALICETALIA HERBACEAE Br.-Bl. in Braun-Blanquet et Jenny 1926

**Salicion herbaceae** Br.-Bl. in Braun-Blanquet et Jenny 1926
Dwarf-willow and moss-dominated communities of snow-beds on lime-poor rocks and soils

Rothero (1991) recorded 141 releves in late snowbed vegetation in the Scottish Highlands with only 14 releves fitting clearly into U13 and M33, but his classification of the remaining 127 releves suggests the following additions:

U11 *Polytrichum sexangulare-Kiaeria starkei* snow-bed (5)
The three sub-communities recognised by Rothero (1991) are a Typical form, a hepatic-rich type with abundant *Barbilophozia floerkei, Nardia scalaris, Cephalozia bicuspidata* and *Pleurocladula albescens* and a *Racomitrium* variant with abundant *Racomitrium heterostichum.* 58 relevés from Rothero (1991).

U12 *Salix herbacea-Racomitrium heterostichum* snow-bed

*Deschampsia flexuosa* snow-bed (6)
*Deschampsia flexuosa* occurs generally at no more than moderate abundance in U12 snow-bed vegetation, but it is abundant to dominant in several snowbeds on steep north-facing slopes in the Cairngorms. Some of these stands are quite extensive. Associated species occur only at low cover and include abundant *Huperzia selago, Galium saxatile, Juncus trifidus,* the mosses *Polytrichum alpinum, Dicranum fuscescens* and *Rhytidiadelphus loreus,* and the liverwort *Barbilophozia floerkei*. This vegetation is probably distinctive enough for at least a new sub-community of U12. It marks a floristic link with some Scandinavian snowbed grassland, especially the type T1b Smyle-fjellgulaks-utforming described by Fremstad (1997). Relevés from Coire an Lochain in the Cairngorms from Horsfield (unpublished).

*Marsupella brevissima-Anthelia juratzkana* snow-bed (6)
An abundance of *Marsupella brevissima, Anthelia juratzkana, Lophozia sudetica, Polytrichum sexangulare* and *Racomitrium heterostichum* suggest this new community as an expansion of U12c (Rothero 1991). He proposes a Typical sub-community with abundant *Kiaeria falcata,* a *Salix herbacea* sub-community with abundant *S. herbacea* and *Ditrichum zonatum*; and a *Cephalozia bicuspidata* ssp. *bicuspidata* sub-community with *Kiaeria starkei, Cephalozia bicuspidata, Nardia scalaris* and *Pleurocladula albescens*. 41 relevés from Rothero (1991).

**Ranunculo-Anthoxanthion** Gjaerevoll 1956
Montane herb communities of irrigated slopes

U14 *Alchemilla alpina-Sibbaldia procumbens* dwarf-herb community

U15 *Saxifraga aizoides-Alchemilla glabra* banks

## FRINGE, SCRUB AND BROADLEAF WOODLAND COMMUNITIES

**TRIFOLIO-GERANIETEA SANGUINEI** Th. Müller 1961
Thermophilous fringe vegetation around woodlands and scrub

ORIGANETALIA VULGARIS Th. Müller 1961
Herabceous vegetation of woodland rides and margins on calcareous soils

**Geranion sanguinei** Tüxen in Th. Müller 1961
Drought-tolerant communities of sunny woodland edges on calcareous soils

*Agrimonia eupatorium-Origanum vulgare* community (6)*
*Rubo-Origanetum* Van Gils et Huits 1978
Something approaching thermophilous Saum appears in the NVC among the dune communities as part of the SD9 *Ammophila-Arrhenatherum* grassland and Willems (1978) described swards from the English chalk that had some Geranion species. There is no place at present, however, for the patchily rank assemblage of *Agrimonia eupatoria, Origanum vulgare, Hypericum perforatum, Brachypodium pinnatum* and *Rubus caesius,* developed in open, sunny places in and around W8 *Fraxinus-Acer-Mercurialis* and W12 *Fagus-Mercurialis* woodlands. Young *Crataegus monogyna, Cornus sanguinea* and *Viburnum lantana* are commonly present, often with *Fraxinus* saplings, and there can be untidy sprawls of *Clematis vitalba* and *Tamus communis* over the young woody growth of W21d *Crataegus-Hedera* scrub that may encroach where invasion is not set back by browsing or scrub clearance. This vegetation is a local and dynamic feature of the limestone soils of the warm and dry south-east and of significance for butterflies, providing shelter and food plants. There are no relevés in the UKVDB and further survey is a priority.

*Corylus avellana-Geranium sanguineum* community (6)*
*Geranio-Coryletum* Shimwell 1968
Shimwell's (1968*a*) survey of the Derbyshire Dales (data also incorporated into Shimwell 1968*b*) characterised a form of open scrub which he considered equivalent to the 'retrogressive scrub' of Moss (1913) and part of the Geranion. In *British Plant Communities,* this was subsumed into W21 *Crataegus-Hedera* scrub but what has been lost is the more open Saum aspect of this assemblage in which sunny areas among colonising *Corylus avellana* (and in other locations *Juniperus communis* and *Taxus baccata*) have plants like *Origanum vulgare, Viola hirta, Hypericum perforatum, Verbascum thapsus, Polypodium australe* (Page 1982, 1988) and, most notably, *Geranium sanguineum. Epipactis atrorubens, Convallaria majalis* and *Thalictrum minus* probably all have some stations here. *Rosa pimpinellifolia* can also figure and, locally, species of *Berberis* or *Cotoneaster* can invade from nearby gardens. This kind of Saum is limited to rubbly

rendzinas on rocky slopes over limestones of the north and west of Britain, particularly North Wales, Derbyshire, the Morecambe Bay area and parts of the Yorkshire Dales, where southern and western aspects give sun and warmth, and to some calcareous dune systems in the region. Except where extreme rockiness inhibits closure of a canopy, this vegetation type requires action to control woody invaders. Even here, ornamental shrubs can be a menace. Relevés exist from Shimwell (1968*a*, *b*) but more data are needed. Figure 27 in Appendix 1 shows a potential distribution map for this vegetation type which has been created by coincidence mapping chatacteristic species.

MELAMPYRO-HOLCETALIA MOLLIS Passarge 1979
Herbaceous vegetation of woodland margins and rides on impoverished acid sands

**Melampyrion pratensis** Passarge 1967
Marginal and ride vegetation in drier situations

*Holcus mollis-Melampyrum pratensis* community (6)
Hyperico pulchri-Melampyretum pratensis De Foucault et Frileux 1983
In *British Plant Communities*, some vegetation like this association described, for example, from the Netherlands (Schaminée *et al*. 1996), was included as open stands of W16 *Quercus-Betula-Deschampsia* woodland. With further sampling, it may be possible to characterise a distinct community in which the cover of *Quercus* (usually *robur*) and *Betula* (usually *pendula*) are low and field layer plants like *Holcus mollis*, *Deschampsia flexuosa* and *Melampyrum pratense* are accompanied by *Teucrium scorodonia*, *Solidago virgaurea*, *Hypericum pulchrum*, *Carex pilulifera* and large Hieracia at greater frequencies than under closed Quercion canopies. Such assemblages are typical of shady clearings, rides and woodland margins on free-draining, acidic soils over siliceous bedrocks throughout the lowlands and upland fringes. Periodic mowing or clearance of shrubs and trees may be necessary to maintain open conditions. This vegetation is rarely floristically exciting but it comprises graded transitions from woodland to heath or pasture which are valuable for invertebrates and passerines, as well as a landscape element. More relevés are needed from relatively unwooded situations and would be easy to collect.

**Potentillo erectae-Holcion mollis** Passarge 1979
Marginal and ride vegetation in damper situations

**RHAMNO-PRUNETEA** Rivas Goday et Borja Carbonell 1961
Sub-scrub and scrub vegetation, seral to natural broadleaved woodland or along margins of woods and hedges

PRUNETALIA SPINOSAE Tüxen 1952

**Prunion fruticosae** Tx. 1952
Shrub communities on moister, loamy soils in central Europe

W22 *Prunus spinosa-Rubus fruticosus* scrub

**Berberidion vulgaris** Br.-Bl. 1950
Thermophilous scrub on sunny, stony slopes in southern Europe

W21 *Crataegus monogyna-Hedera helix* scrub

**Salicion repentis arenariae** Tüxen 1952
Willow and buckthorn scrub communities of dune slacks and ridges

SD16 *Salix repens-Holcus lanatus* dune-slack

SD18 *Hippophae rhamnoides* scrub

**Ulici-Sarothamnion** Doing 1962
Broom and gorse scrub

W23 *Ulex europaeus-Rubus fruticosus* scrub

**Rubion subatlanticum** R.Tx. 1952
Bramble communities of wood margins, clearings, hedgerows and neglected pastures

W24 *Rubus fruticosus-Holcus lanatus* underscrub

W25 *Pteridium aquilinum-Rubus fruticosus* underscrub

SAMBUCETALIA RACEMOSAE Oberdorfer ex Passarge in Scamoni 1963

**Sambuco-Salicion capreae** Tüxen et Neumann in Tüxen 1950
Seral elder and willow scrub of nutrient-rich mull soils

*Sambucus nigra-Urtica dioica* scrub (6)
*Sambucus nigra* figures occasionally as a locally prominent shrub in various types of eutrophic (often disturbed) woodland. It can also dominate (with or without *Salix caprea*, *Acer pseudoplatanus* and naturalised *Buddleia davidii*) in scrub with associates like *Rubus idaeus*, *R. fruticosus* agg., *Urtica dioica*, *Holcus lanatus*, and *Epilobium angustifolium* on damp, nutrient-rich soils on disturbed waysides, in woodland clearings, railway embankments, industrial wasteland, canal banks and derelict back yards, gardens and outside lavatories. Green shrubbery in otherwise devastated landscapes and all too easy to find and sample.

**QUERCO-FAGETEA** Br.-Bl. et Vlieger in Vlieger 1937
Broadleaved temperate woodland of the West European lowlands

(4)
*Luzula sylvatica* can be so dominant in ungrazed or very lightly grazed stands of W9, W10, W11, W16 and W17 woodlands and *Pteridium aquilinum* so abundant in W11 that associates are reduced sufficiently to make it difficult to characterise existing sub-communities. It may be sensible to recognise new species-poor sub-communities distinguished by these plants.

QUERCETALIA ROBORI-PETRAEAE Tüxen 1931
Oak and mixed oak-birch woodland communities of acid soils in central and western Europe

**Quercion robori-petraeae** (Malcuit 1929) Br.-Bl.

W11 *Quercus petraea-Betula pubescens-Oxalis acetosella* woodland (4)
The grasses *Holcus mollis*, *Agrostis capillaris* and *Anthoxanthum odoratum* are often overwhelmingly dominant in a species-poor field layer in grazed or young stands of W11 woodland in various parts of the British uplands. The scarcity or lack of sub-community preferentials is such that the vegetation cannot be clearly assigned to any existing sub-community of W11, and may warrant a new type. Relevés from Wales (Averis & Averis 1998*b*, *c*) and Somerset (Averis unpublished).

W16 *Quercus ssp.-Betula ssp.-Deschampsia flexuosa* woodland

W17 *Quercus petraea-Betula pubescens-Dicranum majus* woodland

*Rhododendron ponticum* community (6)
*Rhododendron ponticum* is a vigorous invader of W17 *Quercus-Betula-Dicranum* woodland and some W10 *Quercus-Pteridium-Rubus*, W11 *Quercus-Betula-Oxalis* and W16 *Quercus-Betula-Deschampsia* woodland at low altitudes in western Britain and locally further east. It can also invade open habitats such as heathland and bog. The cover can thicken up over a few years to form a virtually impenetrable thicket some 3-6 m tall. The heavy shade cast by the dense evergreen foliage, combined with the thick acidic leaf litter which smothers the ground, causes marked impoverishment in the field and ground layer vegetation and the epiphytic vegetation on native trees and shrubs. The effect is similar to that within conifer plantations, namely a reduction in species-richness, loss of light-demanding species and survival of little other than a sparse, species-poor assemblage of mainly common calcifuge, shade-tolerant bryophytes such as *Isopterygium elegans* and *Mnium hornum*. *Rhododendron* poses a serious threat to the rich oceanic bryophyte and lichen floras in many W17 woods in north Wales, the Lake District, the western Highlands and western Ireland. Clearance of *Rhododendron* has taken place in many western woods; methods vary from manual cutting and subsequent treatment of stumps to clearance using a mechanical flail. Observations suggest that following clearance, recovery of the woodland vegetation is a very slow process, and that some of the rarer bryophytes and lichens might never return.

U20 *Pteridium aquilinum-Rubus fruticosus* community

FAGETALIA SYLVATICAE Pawlowski in Pawlowski, Sokotowski et Wallisch 1928
Broadleaved woodland and scrub communities of more fertile soils

**Fagion sylvaticae** Luquet 1926
Beech and mixed beech woodland communities of sub-alpine regions of Europe

W15 *Fagus sylvatica-Deschampsia flexuosa* woodland

W14 *Fagus sylvatica-Rubus fruticosus* woodland

W12 *Fagus sylvatica-Mercurialis perennis* woodland

W13 *Taxus baccata* woodland

**Carpinion betuli** Issler 1931
Broadleaved woodland communities rich in hornbeam on lime-rich and neutral mull soils

W8 *Fraxinus excelsior-Acer campestre-Mercurialis* perennis woodland

W10 *Quercus robur-Pteridium aquilinum-Rubus fruticosus* woodland

**Alnion incanae** Pawlowski in Pawlowski & Wallisch 1928
*Alno-Ulmion Br.-Bl. et Tüxen ex Tschou 1948 em. Müller et Görs 1958*
Ash and alder woodland communities of flushed and impeded lime-rich soils

W7 *Alnus glutinosa-Fraxinus excelsior-Lysimachia nemorum* woodland (5)
Scrub dominated by *Salix aurita* (with or without *S. cinerea*) has been widely reported from Scotland, especially the Western Highlands. However, where the composition of the field layer has been examined, the vegetation looks essentially the same as W7 *Alnus-Fraxinus-Lysimachia* or W4 *Betula-Molinia* woodland so a new community may not be necessary, just distinctive types of two existing communities with striking canopies.

W9 *Fraxinus excelsior-Sorbus aucuparia-Mercurialis perennis* woodland

**SALICETEA PURPUREAE** Moor 1958
Willow scrub and woodland of flood-plains in mountain and lowland rivers

SALICETALIA PURPUREAE Moor 1958

**Salicion albae** Soó 1930
Willow scrub and woodland of sub-montane and lowland river shoals and terraces

W6 *Alnus glutinosa-Urtica dioica* woodland

**ALNETEA GLUTINOSAE** Br.-Bl. et Tüxen 1943
Alder and willow woodlands of swamps, fens and wet pastures

ALNETALIA GLUTINOSAE Tüxen 1937
Alder woodlands of swamps, fens and wet pastures

**Alnion glutinosae** Malcuit 1929

W1 *Salix cinerea-Galium palustre* woodland

W5 *Alnus glutinosa-Carex paniculata* woodland

SALICETALIA AURITAE Doing 1962
Willow scrub and woodland of mires

**Salicion cinereae** Th. Müller et Görs ex Passarge 1961

W2 *Salix cinerea-Betula pubescens-Phragmites australis* woodland

W3 *Salix pentandra-Carex rostrata* woodland

## CONIFEROUS WOODLAND COMMUNITIES

**VACCINIO-PICEETEA** Br.-Bl. in Braun-Blanquet, Sissingh et Vlieger 1939
Coniferous forest communities of more acidic soils

PICEETALIA EXCELSAE Pawlowski in Pawlowski, Sokolowski & Wallisch 1928
European coniferous communities

**Dicrano-Pinion** (Libbert 1933) Matuszkiewicz 1962
Pine and juniper woodland communities of acid soils

W18 *Pinus sylvestris-Hylocomium splendens* woodland (5)*
Pinewood with abundant *Molinia* is occasional in the Highlands. It may warrant a new sub-community of W18. Relevés from Glen Affric (Averis 1994) and Loch Torridon (Tidswell 1995).

*Pinus sylvestris-Cladonia* woodland (6)*
*Cladonio-Pinetum sylvestris* Watson & Birse 1990
Lichens figure only occasionally and with little prominence in W18 *Pinus-Hylocomium* woodland but locally, in open, sunny and windy stands of *Pinus sylvestris*, Watson & Birse (1990) recorded a very distinct kind of vegetation with *Erica cinerea* and an extensive ground carpet of C*ladonia impexa, C. furcata, C. gracilis, C. ciliata, C. arbuscula* and *C. uncialis*. It is impossible to accommodate this within W18 and it bears some resemblance to

lichen-rich pine woodland described from Scandinavia and Eastern Europe (Rodwell & Cooper 1995), so recognition at community level is probably more appropriate. There are relevés from Watson & Birse (1990) and Dargie (1994b) but further searches may reveal other stands.

W19 *Juniperus communis-Oxalis acetosella* woodland (5)*
Wetter juniper scrub from Morrish More (Dargie 1993) can probably be accommodated with SD15 but the drier forms, more extensive geographically with records from Dalchalm on Brora to Nigg and Culbin are more enigmatic. More relevés are required to examine the relationship of this vegetation to W19.

Conifer plantations (6)
The NVC approach to classifying stands of woodland dominated by non-native conifers was to regard them as coniferised versions of native broadleaved woodlands or replacements for native Scot's pine woodland. This is quite informative for understanding the impact of afforestation on the woodland flora but, when plantations are very extensive, seems a little odd. It may therefore be sensible to recognise distinct communities of *Picea sitchensis*, *Pinus sylvestris*, *P. nigra* var. *maritima* and *Pseudotsuga menziesii* (plus any other extensive coniferous dominants) where there is usually just a very sparse field layer of puny *Deschampsia flexuosa*, *Oxalis acetosella* and *Dryopteris dilatata* and only scattered patches of *Isopterygium elegans*, *Mnium hornum* and *Plagiothecium undulatum* with a deep layer of conifer needles. These plantations are widespread and extensive, especially in upland Britain and are usually replacements for Quercion or Dicrano-Pinion woodland, more locally for Betulion woodland. They are an important landscape element and sometimes help sustain a distinctive fauna. Sampling should also help understand the impact of deciduous conifers like *Larix* spp. which can have a richer field and ground flora and, the distinctiveness of old-growth stands.

**Vaccinio-Piceion** Br.-Bl. 1938 em. Koch 1954
Spruce and birch related woodland communities

W4 *Betula pubescens-Molinia caerulea* woodland (5)
Scrub dominated by *Salix aurita* (with or without *S. cinerea*) has been widely reported from Scotland, especially the Western Highlands. However, where the composition of the field layer has been examined, the vegetation looks essentially the same as W4 *Betula-Molinia* woodland or W7 *Alnus-Fraxinus-Lysimachia* so a new community may not be necessary, just distinctive types of two existing communities with striking canopies.

# 7 References


Ausden, M, & Harding, M 1991 *NVC survey of Market Weston Fen, Suffolk, 1991.* Unpublished report to English Nature & Suffolk Wildlife Trust, Saxmundham

Averis, ABG 1991 *A survey of the bryophytes of 448 woods in the Scottish Highlands.* Edinburgh, Nature Conservancy Council (Scottish Field Survey Unit Report, No. S54)

Averis, ABG 1994 *Vegetation survey of Glen Affric, Inverness District, Scotland.* Unpublished report to Scottish Natural Heritage, Inverness

Averis, ABG 1996 *Vegetation survey of Wester Craiglockhart Hill, Edinburgh.* Unpublished report to Scottish Natural Heritage, Edinburgh (Contract report, No. BE 00394)

Averis, ABG 1997 *The vegetation of Druim Chuibhe, Invernaver, Sutherland.* Unpublished report to Scottish Natural Heritage, Edinburgh (Contract report, No. JE 00825)

Averis, ABG 1998 *Vegetation survey of Rhidorroch SSSI, Wester Ross, 1997*. Unpublished report to Scottish Natural Heritage, Edinburgh (Contract report, No. HT/97/98/28)

Averis, ABG, & Averis, AM 1995 *The vegetation of north Mull.* Unpublished report to Scottish Natural Heritage, Edinburgh (Contract report No. 5/F2B/650)

Averis, ABG, & Averis, AM 1996 *The vegetation of the Ardmeanach coast, Mull, Scotland.* Unpublished report to Scottish Natural Heritage, Edinburgh (Contract report, No. RASD/068/96 N2K)

Averis, ABG, & Averis, AM 1997*a* *The vegetation of the Trotternish Ridge, Skye.* Unpublished report to Scottish Natural Heritage, Edinburgh (Contract report, No. RASD/072/97 N2K(3))

Averis, ABG, & Averis, AM 1997*b* *The vegetation of Cranstackie, Sutherland.* Unpublished report to Scottish Natural Heritage, Edinburgh (Contract report, No. RASD/072/97 N2K(1))

Averis, ABG, & Averis, AM 1997*c* *The vegetation of Sgurr Dubh, Wester Ross.* Unpublished report to Scottish Natural Heritage, Edinburgh (Contract report, No. RASD/072/97 N2K(2))

Averis, ABG, & Averis, AM 1997d *The vegetation of the Sgurr na Stri-Druim Hain area, Skye.* Unpublished report for the John Muir Trust

Averis, ABG, & Averis, AM 1998*a* *Vegetation survey of Beinn Eighe, Wester Ross, 1997.* Unpublished report to Scottish Natural Heritage, Edinburgh (Contract report, No. HT/97/98/13)

Averis, ABG, & Averis, AM 1998*b* *Vegetation survey of Nant Irfon, Powys, Wales, 1997.* Unpublished report to the Countryside Council for Wales, Bangor (Contract report, No. MS 01057)

Averis, ABG, & Averis, AM 1998*c* *Vegetation survey of Allt Rhyd y Groes, Dyfed, Wales, 1997.* Unpublished report to the Countryside Council for Wales, Bangor (Contract report, No. MS 01057)

Averis, ABG, & Averis, AM 1998*d* *Vegetation survey of Sconser Estate, Skye, 1998.* Unpublished report for the John Muir Trust

Averis, ABG, & Averis, AM (in preparation) *Vegetation survey of Ben Lui, 1998.* Report for Scottish Natural Heritage

Birse, EL 1980 *Plant Communities of Scotland*: *A preliminary Phytocoenonia.* Aberdeen, Macaulay Institute for Soil Research

Birse, EL 1984 *The Phytocoenonia of Scotland*: *Additions and Revisions.* Aberdeen, The Macaulay Institute for Soil Research

Blackstock, TH, Stevens, DP, Mockridge CP, & Yeo MJM 1998 Edaphic relationships among *Cirsio-Molinietum* and realted wet grassland communities in lowland Wales. *Journal of Vegetaion Science, 9*: 431-444

Braun-Blanquet, J, & Tüxen, R 1952 Irische Pflanzengesellschaften. *Veröffentlichungen des Geobotanischen Institutes Rübel in Zurich, 25*: 224-415

Brown, A, Horsfield, D, & Thompson, DBA 1993*a* A new biogeographical classification of the Scottish Uplands. I Descriptions of vegetation blocks and their spatial variation. *Journal of Ecology, 81*: 207-230

Brown, A, Birks, HJB, & Thompson, DBA 1993*b* A new biogeographical classification of the Scottish Uplands. II Vegetation-environment relationships. *Journal of Ecology, 81*: 231-252

Cooch, S & Rodwell, JS 1996 Habitat quality and value in the countryside: preliminary study of key issues in relation to Northern hay meadows. (Contractor: Unit of Vegetation Science) Unpublished report to WWF (UK), Godalming

Coombe, DE 1961 *Trifolium occidentale*, a new species related to *T. repens* L. *Watsonia, 5*, 68-67

Cooper, EA 1993 *Vegetation Survey of Malham Tarn NNR* (Contractor: Unit of Vegetation Science, Lancaster University). Unpublished report to the National Trust

Cooper, EA, & MacKintosh, J 1996 NVC review of Scottish grassland surveys. *SNH Review*, No. 65

Cooper, EA, Crawford, I, Malloch, AJC, & Rodwell, JS 1992 *Coastal Vegetation Survey of Northern Ireland* (Contractor: Unit of Vegetation Science, Lancaster University). Unpublished report to the Department of Environment (Northern Ireland), Belfast

Cox, WP, & Leach, SJ 1995 *Agrostis stolonifera-Carex* spp. grassland: a new plant community described from the Somerset Levels. *Ecology in Somerset, 4*: 221-6

Dargie, TCD 1993 *Sand dune vegetation survey of Great Britain, a national inventory Part 2: Scotland.* Peterborough, Joint Nature Conservation Committee

Dargie, TCD 1994*a* *The sand dune vegetation survey of Scotland Cuthill, Dornoch and Embo (Dornoch Firth pSAC).* Unpublished report to Scottish Natural Heritage, Edinburgh

Dargie, TCD 1994*b* *The sand dune vegetation survey of Scotland. Coull Links to Golspie (Loch Fleet cSAC).* Unpublished report to Scottish Natural Heritage, Edinburgh

Dargie, TCD 1994*c* *Phase 1/NVC vegetation survey of Tiree.* Unpublished report to Scottish Natural Heritage, Clydebank

Dargie, TCD 1995 *Sand dune vegetation survey of Great Britain, a national inventory Part 3: Wales.* Peterborough, Joint Nature Conservation Committee

Dargie, TCD 1998a The sand dune vegetation survey of Scotland: Western Isles. Volume 1: Main Report. *SNH Research, Survey and Monitoring Report, No. 96* (Volume 1 of 3.)

Dargie, TCD 1998b The sand dune vegetation survey of Scotland: Shetland. Volume 1: Main Report. *SNH Research, Survey and Monitoring Report, No. 122* (Volume 1 of 3)

Dargie, TCD 1998c The sand dune vegetation survey of Scotland: Orkney. Volume 1: Main Report. *SNH Research, Survey and Monitoring Report, No. 123* (Volume 1 of 3)

Dargie, TCD 1998d The sand dune vegetation survey of Scotland: Southwest Scotland. Volume 1 Main Report. *SNH Research, Survey and Monitoring Report, No. 125* (Volume 1 of 3)

Dargie, TCD 1998*e* The sand dune vegetation survey of Scotland: Northwest Scotland. Volume 1: Main Report. *SNH Research, Survey and Monitoring Report, No 126.* (Volume 1 of 3)

Dargie, TCD 1999 The sand dune vegetation survey of Scotland: Inner Hebrides. Volume 1: Main Report. *SNH Research, Survey and Monitoring Report, No. 124.* (Volume 1 of 3)

Dierschke, H, Nowak, B, & Verbucheln, G 1997 *Ubersichtstabelle der Gesellschaften der Molinio-Arrhenatheretea der Bunderepublik Deutschland.* Manuscript

ECUS 1995 *Survey of Fens in Down and Armagh.* (Contractor: ECUS, Sheffield University) Unpublished report to the Department of the Environment (Northern Ireland), Belfast

European Commission 1999 Interpretation manual of European Union habitats (Eur15 - Version 2). Brussels, DG Environment, European Commission

Fojt, W 1994 *The Cumbria Mire Survey*. Peterborough, English Nature

Fremstad, E 1997 *Vegetasjonstyper i Norge*. Trondheim, Norsk institutt for naturforskning

Géhu, J-M, & Delzenne, C 1975 Apport à la connaissance phytosociologique des prairies salées de l'Angleterre. *Colloques Phytosociologiques, IV*: 227-47

Gibbons, N 1996 *Hurst Fen and howlett Hills: NVC Survey*. Ashbocking, Suffolk Wildlife Trust

Gittins, RT 1965 Multivariate approaches to a limestone grassland community. I A stand ordination. *Journal of Ecology, 53*: 385-401

Graham, GG 1988 *The flora and vegetation of County Durham* Sunderland. The Durham Flora Committee and the Durham County Conservation Trust

Hall, J 1997 An analysis of National Vegetation Classification survey data. *JNCC Report No. 272*

Halliday, GH 1998 *A Flora of Cumbria.* Lancaster University, Centre for North West Regional Studies

Harding, M 1991 *Newbourne Springs Nature Reserve: botanical survey 1991*. Unpublished report to the Suffolk Wildlife Trust, Saxmundham

Harding, M 1993*a* *North Cove NVC Survey 1993.* Unpublished report to the Suffolk Wildlife Trust, Ashbocking

Harding, M 1993*b* *Blakenham Chalk Pit NVC survey 1993.* Unpublished report to the Suffolk Wildlife Trust, Ashbocking

Harding, M 1993*c* *An ecological survey of Sizewell Belts.* Unpublished report to the Suffollk Wildlife Trust, Ashbocking

Harding, M 1994 *Bonny Wood NVC survey 1994.* Unpublished report to the Suffolk Wildlife Trust, Ashbocking

Harding, M, & Kay, S 1992*a* *Simpsons Saltings: NVC survey 1992.* Unpublished report to the Suffolk Wildlife Trust, Saxmundham

Harding, M, & Kay, S 1992*b* *Lakenheath Poors Fen: NVC survey 1992.* Unpublished report to the Suffolk Wildlife Trust, Saxmundham

Harding, M, Hooton, S, & Ashburn, J 1993 *Coombs Wood NVC survey 1993.* Unpublished report to the Suffolk Wildlife Trust, Asbocking

Heritage Environmental Ltd (in preparation) *Isle of Rum pSAC; Vegetation and Habitat Condition Survey.* Scottish Natural Heritage contract report

Holmes, NTH 1983 *Typing British rivers according to their flora.* Shrewsbury, Nature Conservancy Council (Focus on Nature Conservation, No. 4)

Holmes, N, Boon, P, & Rowell, T 1999 *Vegetation communities of British rivers: a revised classification.* Peterborough, Joint Nature Conservation Committee

Hopkins, JJ 1983 *Studies of the historical ecology, vegetation and flora of the Lizard District, Cornwall with particular reference to heathland.* PhD thesis, Bristol University

Hughes, S 1995 *The Haven, Thorpeness: NVC Survey 1995.* Unpublished report to the Suffolk Wildlife Trust, Ashbocking

Institute of Environmental Assessment 1995 *Guidelines for baseline ecological assessment.* London, E & F N Spon

Ivimey-Cook, RB, & Proctor, MCF 1966 The plant communities of the Burren, Co.Clare. *Proceedings of the Royal Irish Academy B, 64*: 211-301

Johnson, T 1636 *Gerard's Herbal.* London

Julve, P 1993 *Synopsis Phytosociologique de la France (Communautés de Plantes Vasculaires).* Liège, Les Editions de Lejeunia, No. 140

Kopecký, K & Hejny, S 1974 A new approach to the classification of anthropogenic plant communities. *Vegetatio, 29*: 17-20

Lavin, JC, & Wilmore, GTD, *eds* 1996 *West Yorkshire plant atlas.* Bradford, Bradford Metropolitan Council

Lee, JA 1977 The vegetation of British inland saltmarshes. *Journal of Ecology, 65,*: 673-698

Lemaire, AJJ, & Weeda, EJ 1994 Over de indeling van het nanocyperion flavescentis in Nederland. *Stratiotes, 9*: 22-38

Lindsay, R 1995 *Bogs: the ecology, classification and conservation of ombrotrophic mires.* Edinburgh, Scottish Natural Heritage

Lunn, J 1998 *Ecological and nature conservation aspects of land affected by mining in the Yorkshire Coalfield* Thesis submitted for PhD, Sheffield Hallam University

Lusby, P 1992 Survey of selected lowland grasslands in the borders. Unpublished report to Scottish Natural Heritage, Edinburgh

Malloch, AJC 1988 *VESPAN II.* Lancaster, Lancaster University

Malloch, AJC, & Rodwell, JS 1990 *A computerised NVC database.* Unpublished report to the Joint Nature Conservation Committee, Peterborough

McVean, DN, & Ratcliffe, DA 1962 *Plant Communities of the Scottish Highlands.* London, HMSO

Moore, JA 1986 *Charophytes of Great Britain and Ireland.* London, Botanical Society of the British Isles

Moss, CE 1913 *Vegetation of the Peak District.* Cambridge, Cambridge University Press

Mucina, L 1997 Conspectus of classes of European vegetation. *Folia Geobotanica et Phytotaxonomica, 32*: 117-72

Ó'Críodáin, C, & Doyle, GJ 1994 An Overview of Irish small-sedge vegetation: syntaxonomy and a key to communities belonging to the Scheuchzerio-caricetea nigrae (Nordh. 1936) Tx. 1937. *Proceedings of the Royal Irish Academy, 94B/2*: 127-144

Page, CN 1982 *The Ferns of Britain and Ireland.* Cambridge, Cambridge University Press

Page, CN 1988 *Ferns.* London, Collins

Palmer, M 1989 *A botanical classification of standing waters in Great Britain.* Peterborough: Nature Conservancy Council (Research and survey in nature conservation, No. 19)

Parmenter, J 1996 *Roydon Fen LNR: NVC and peat stratigraphy survey*. Unpublished report to the Suffolk Wildlife Trust, Ashbocking.

Perring, FH, & Farrell, L 1977 *British Red Data Book 1: Vascular plants.* Nettleham, Society for the Promotion of Nature Conservation

Perring, FH, & Walters, SM 1962 *Atlas of the British flora.* London & Edinburgh, Nelson

Pott, R 1994 *Die Pflanzengesellschaften Deutschlands.* Stuttgart, Ulmer

Preston, CD 1995 *Pondweeds of Great Britain and Ireland*. London, Botanical Society of the British Isles. (BSBI Handbook No. 8)

Proctor, MCF 1975 Notes on the vegetation of Alderney. *Phytocoenologia*, *2*: 301-11

Prosser, MV 1990*a* *A botanical survey of hay meadows in Teesdale, Lunedale and Baldersdale, 1986-1988.* Unpublished report to the Nature Conservancy Council, Peterborough

Prosser, MV 1990*b* *A botanical survey of hay meadows in West Allendale and South Tyndale, Northumberland, 1986-1988.* Unpublished report to the Nature Conservancy Council, Peterborough

Prosser, MV, & Wallace, HL 1992 *Vegetation changes at West Sedgemoor, 1988-1992.* Unpublished report to the Royal Society for the Protection of Birds, Sandy

Prosser, MV, & Wallace, HL 1993 *Vegetation monitoring at West Sedgemoor 1993*. Unpublished report to the Royal Society for the Protection of Birds, Sandy

Prosser, MV, & Wallace, HL 1995*a* *The status of flood pasture vegetation at West Sedgemoor following changes in hydrological management.* Unpublished report to the Royal Society for the Protection of Birds, Sandy

Prosser, MV, & Wallace, HL 1995*b* *West Sedgemoor: vegetation and hydrological monitoring 1993-1994*. Unpublished report to the Royal Society for the Protection of Birds, Sandy

Prosser, MV, & Wallace, HL 1996 *National Vegetation Classification Survey of West Sedgemoor*. Unpublished report to the Royal Society for the Protection of Birds, Sandy

Radley, G 1994 *Sand dune vegetation survey of Great Britain, a national inventory Part 1: England.* Peterborough, Joint Nature Conservation Committee

Rodwell, JS 1974 *The vegetation of the British Carboniferous Limestone in relation to topography and soils.* PhD thesis, Southampton University

Rodwell, JS, *ed* 1991*a* *British plant communities Volume 1: Woodlands and scrub.* Cambridge, Cambridge University Press

Rodwell, JS, *ed* 1991*b* *British plant communities Volume 2: Mires and heaths.* Cambridge, Cambridge University Press

Rodwell, JS, *ed* 1992 *British plant communities Volume 3: Grasslands and montane communities.* Cambridge, Cambridge University Press

Rodwell, JS, *ed* 1995 *British plant communities Volume 4: Aquatic communities, swamps and tall-herb Fens.* Cambridge, Cambridge University Press

Rodwell, JS, *ed* 2000 *British plant communities:* Volume 5: Maritime communities and vegetation of open habitats. Cambridge, Cambridge University Press

Rodwell, JS, 1997 *A phytosociological conspectus of British plant communities.* (Contractor: Unit of Vegetation Science, Lancaster University) Unpublished report to the Joint Nature Conservation Committee, Peterborough

Rodwell, JS, & Dring, J 1996 *Assessing coverage of the National Vegetation Classification.* Unpublished report to the Joint Nature Conservation Committee, Peterborough

Rodwell, JS, Malloch, AJC, & Winstanley, D 1993 *The UK Vegetation Database.* Unpublished report to the Joint Nature Conservation Committee, Peterborough

Rodwell, JS, Dring, J, Pignatti, S, Schaminée, JHJ, & Mucina, L 1998 *The scientific basis of the EUNIS habitat classification.* (Contractor: Unit of Vegetation Science, Lancaster University) Unpublished report to European Topic Centre on Nature Conservation, Paris

Rothero, GP 1991 *Bryophyte-dominated snow-beds in the Scottish Highlands.* MSc thesis, University of Glasgow

Schaminée, JHJ, Stortelder, AHF, & Westhoff, V *eds* 1995 *Inleiding tot de plantensociologie - grondslagen, methoden en toepassingen.* Uppsala & Leiden, Opulus Press

Schaminée, JHJ, Stortelder, AHF, & Westhoff, V *eds* 1995 *Wateren moerassen natte heiden.* Uppsala & Leiden, Opulus Press

Schaminée, JHJ, Stortelder, AHF, & Weeda EJ *eds* 1996 *Graslanden zomen droge heiden.* Uppsala & Leiden, Opulus Press

Schoof-van Pelt, MM 1973 *Littorelletea A study of the vegetation of some amphiphytic communities of Western Europe.* PhD thesis, University of Nijmegen

Shaw, S, & Wheeler, B 1991 *A review of the habitat conditions and management characteristics of herbaceous fen vegetation types in lowland Britain.* Unpublished report to English Nature, Peterborough

Shimwell, DW 1968*a* *The phytosociology of calcareous grasslands in the British Isles.* PhD thesis, University of Durham

Shimwell, DW 1968*b* *The vegetation of the Derbyshire Dales.* Unpublished report to the Nature Conservancy, Shrewsbury

Sneddon, P, & Randall, RE 1993*a* *Coastal vegetated shingle structures of Great Britain.* Main report Peterborough, Joint Nature Conservation Committee

Sneddon, P, & Randall, RE 1993*b* *Coastal vegetated shingle structures of Great Britain Appendix 1: Wales.* Peterborough, Joint Nature Conservation Committee

Sneddon, P, & Randall, RE 1994*a* *Coastal vegetated shingle structures of Great Britain Appendix 2: Scotland.* Peterborough, Joint Nature Conservation Committee

Sneddon, P, & Randall, RE 1994*b* *Coastal vegetated shingle structures of Great Britain Appendix 3: England.* Peterborough, Joint Nature Conservation Committee

Stevens, PA, Bell, SA, Brittain, SA, Hughes, S, & Lowe, JAH 1995 *Soil/plant interactions in Lowland Grassalnds - Great Orme Study, Final Report.* Bangor, Institute of Terrestrial Ecology

Stewart, NF, & Church, JM 1992 *Red Data Book of Britain and Ireland: Stoneworts.* Peterborough, Joint Nature Conservation Committee

Stewart, A, Pearman, DA, & Preston, CD 1994 *Scarce plants in Britain.* Peterborough, Joint Nature Conservation Committee

Tidswell, RJ 1995 *Botanical survey of Shieldaig pinewood, Loch Torridon.* Unpublished report for Scottish Natural Heritage, Edinburgh

Watson, A, & Birse, EL 1990 Lichen-rich pinewood, *Cladonia ciliata-Pinus sylvestris* community in North-eastern Scotland. *Botanical Journal of Scotland, 46 (1)*: 73-88

Webb, N 1986 *Heathlands.* London, Collins

Wheeler, BD 1975 Phytosociological studies on rich fen systems in England & Wales. PhD thesis, University of Durham

Wheeler, BD 1978 The wetland plant communities of the River Ant valley, Norfolk. *Transactions of the Norfolk and Norwich Naturalists' Society, 24:* 153-87

Wheeler, BD 1980 Plant communities of rich-fen systems in England & Wales I Introduction Tall sedge- and reed communities. *Journal of Ecology, 68*: 368-95

Wheeler, BD 1986 *Carum verticillatum in Britain.* Peterborough, Nature Conservancy Council

White, J, & Doyle, G 1982 The vegetation of Ireland: a catalogue raisonné. *Royal Dublin Society Journal of Life Science, 3*: 289-368

Willems, JH 1978 Observations on north-west European limestone grassland communities: phytosociological and ecological notes on chalk grasslands of southern England. *Vegetatio, 37*: 141-50

Wigginton, M *ed* 1999 *Red Data Book of the British flora.* Peterborough, Joint Nature Conservation Committee

Wrightham, M 1996 *The Vegetation of Strathaird Farm, Isle of Skye*. MSc Thesis, Lancaster University