A review of the National Vegetation Classification for the *Calthion* group of plant communities in England and Wales

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Ecological Surveys (Bangor) and Floodplain Meadows Partnership

This report is dedicated to the memory of Mike Prosser (1934-2016).

Mike sadly passed away shortly before this report was completed, but the work reflects his great contribution to the study and understanding of hay meadows from Northumberland to Somerset. He will be remembered for his great contributions to our appreciation of the landscape and its character over many years, and for his generous readiness to share his breadth of knowledge, his time and perception.

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Summary

Investigations conducted as part of the DEFRA-commissioned BD1310 project (Gowing and others 2002) which studied the water regime requirements of damp grassland communities, and the more recent work of the Floodplain Meadows Partnership, demonstrated that damp mesotrophic grasslands of floodplain meadows supported a range of plant communities, especially of the *Calthion* alliance, which required better definition than that provided in Volume 3 of British Plant Communities (Rodwell 1992). This work is an attempt to provide more detailed descriptions of such communities through the analysis of a large data set gathered from meadows and pastures across England and Wales. This work did not cover Scottish or Irish datasets, which could be included at a later date.

A data set comprising 4706 releves with 388 species was subjected to TWINSPAN analysis. A synoptic table was produced of the 42 endgroups and these were assessed for internal homogeneity using Sorensen-Bray-Curtis analysis. Clusters were progressively amalgamated based on a combination of statistical analysis and manual ordering till clearly defined groups of preferential and differential species were evident.

Twelve distinct noda (Poore 1955) were recognised and their intergrity was assessed through detrended correspondence analysis (DCA) and statistical tests of differences in Ellenberg scores for site fertility (N), soil moisture (F) and soil pH (R). Soil type and site management were also compared.

Two of the twelve noda could be placed within already existing communities described in the published account of the national vegetation classification (NVC) whilst the remainder represented either entirely new communities or new subcommunities within already described communities:

- The data provide an expanded definition of the *Agrostis stolonifera-Alopecurus geniculatus* inundation grassland (MG13).
- A nodum with affinities to the *Briza media-Trifolium spp.* subcommuntiy of *Juncus subnodulosus-Cirsium palustre* fen meadow (M22b) provides a revision of the less fen-like expression of this community.
- The *Agrostis-Carex-Senecio* grassland community of Cox and Leach (1995) was divided into two subcommunities.
- A new damp grassland, quite distinct from the published S19 *Eleocharis palustris* swamp, is proposed as the *Agrostis stolonifera -Eleocharis palustris* inundation grassland.
- A new subcommunity of *Lolium perenne-Cynosurus cristatus* grassland (MG6) is proposed in which *Filipendula ulmaria* is constant.
- A 'new' community, provisionally labelled *Alopecurus pratensis-Poa trivialis-Cardamine pratensis* grassland, has been defined. This was previously regarded as a species-rich form of MG7C, *Alopecurus pratensis-Festuca pratensis* grassland, but the expanded data set has allowed for a clear distinction to be made between this and the published MG7C. Two subcommunities are proposed.
- A new community, named *Cynosurus cristatus-Carex panicea-Caltha palustris* grassland, retaining the MG8 code. This is a new association which can be seen as a replacement for the original MG8 of the published NVC. It can be partitioned into four subcommunities.

Constancy tables for the twelve noda are presented together with distribution maps. Each nodum is discussed in terms of its characteristic species, management and distribution on different soil types and its affinities with other vegetation types.

Communities are segregated along a gradient of soil fertility with the species poor inundation communities (MG13 and the newly proposed *Agrostis stolonifera-Eleocharis palustris* inundation grassland) having significantly higher Ellenberg N scores than the species-rich subcommunities of the newly proposed *Cynosurus-Carex panicea-Caltha palustris* grassland. Segregation of subcommunities is associated with variation in soil moisture, as indicated by Ellenberg F-scores. Soil reaction appears to play only a minor role.

The relative richness of the noda are compared through the calculation of mean species number for each nodum.

An attempt has been made to place the 12 noda defined into a broader phytosociological context through a comparison between them and a selection of vegetation types from Continental Europe. The comparison was achieved through a DCA in which the first axis was strongly correlated with soil fertility. Axis 2 was related to soil moisture with Axis 3 being weakly associated with soil reaction. In broad terms the British noda of the *Calthion* are seen to occur on more fertile soils than their continental counterparts, but their median position on Axis 2 suggests them to be somewhat drier than is the norm for more continental noda.

Since the definition of communities from the *Calthion* have proved particularly difficult, the problems associated with achieving a unified set of characteristic species for the *Calthion* alliance are addressed.

The conservation value and status of the communities of the alliance is briefly discussed.

For this work to be easily accessible to end users, the revised communities and sub-communities have been incorporated into a software system known as Modular Analysis of Vegetation Information (MAVIS), in conjunction with Centre for Ecology and Hydrology (CEH). The authors have also updated the diagnostic table of MATCH software (Lancaster University) to accommodate these new vegetation units. This can be supplied to licenced users of this software on request.

An updated dichotomous key to mesotrophic grasslands is included as an appendix to this report (Appendix 4).

Acknowledgements

Early discussions with John Rodwell were invaluable in setting the parameters for the revision of the communities of the *Calthion* whilst David Gowing and Owen Mountford were unstinting in their help and advice on the early results of the scoping exercise.

Many other people have given freely of their time and expertise in assisting the scoping exercise. The following are especially deserving of mention.

Heather Procter	Bedfordshire, Cambridgeshire and Northamptonshire Wildlife Trust
Chris Bielby	Natural England, SSSI adviser, Norwich
Paul Candlin	Natural England, West Midland Region, Rural management team
Andrew Cooke	Natural England, Integrated Monitoring Team
Andrew Craven	Natural England, Yorkshire
Clare Cornish	The Cumbria Hay Day project
Caroline Comins	Yorkshire Wildlife Trust
Simon Curson	Natural England, Hampshire and Isle of Wight land management team
Matthew Davis	Norwich Fringe Countryside management project
Richard Dimon	Natural England, Yorkshire
Brian Edwards	Dorset Environmental Records office
Sally Fogden	The Euston Charities, Suffolk
Stephen Gilby	Natural England, Suffolk
Uta Hamzaoui	Leicestershire and Rutland Wildlife Trust
Robert Goodison	Natural England, Yorkshire Dales land management team
Jenny Hayward	Yorkshire Wildlife Trust
Sadie Hobson	Natural England, East Midlands
Martin Horlock	Natural England, Norfolk Biodiversity Information Service
Richard Jefferson	Natural England Senior Specialist-Grasslands
Michael Lilley	Worcestershire Wildlife Trust
Katie Lloyd	Natural England, SW Region
Dianne Matthews	Natural England, Glos and Wilts.
Bev Nicols	Natural England, Norfolk
Jess Pain	Hampshire Wildlife Trust
Clare Pinches	Natural England
John O'Reilly	Freelance botanist (Ptyxis ecology)
Ian Ralphs	Hampshire Biodiversity information centre
Ian Slater	Natural England, Landscape Scale Delivery Team, North
Stuart Smith	Grassland Ecologist, Natural Resources Wales
Susan Stone	Suffolk Wildlife Trust
Katherine Trehane	Natural England, Norfolk

We would also like to thank landowners and farmers who granted us permission to survey their land and anyone else we have overlooked who helped us in the process of data collection and sampling.

This work has been funded by the Floodplain Meadows Partnership, hosted by the Open University.

1. Introduction

Largely due to their being most commonly situated on lowland clays and loams of acid to neutral reaction in areas of concentrated agricultural improvement, the mesotrophic, or neutral, grasslands of the United Kingdom are very much the poor relation within the classification of plant communities. A brief examination of Rodwell (1992) reveals that 87 pages are devoted to the 13 mesotrophic grassland communities recognised at the time compared with 166 pages for the 14 calcicolous communities and a generous 224 pages to the combination of calcifugous grasslands and the montane communities which include the conservationally exciting communities of rush heath, moss heath and snow bed associations of the Scottish highlands.

Even within the mesotrophic grasslands themselves a marked disparity exists in the treatment of the dry and damp communities. The dry associations, MG1 to MG7, are described on the basis of 911 quadrat samples whilst the characterisation of their damper counterparts, MG8 to MG13, relies on just 253 records.

Investigations conducted as part of the DEFRA-commissioned BD1310 project (Gowing and others 2002) which studied the water-reqime requirements of damp grassland communities, and the more recent work of the Floodplain Meadow Partnership, demonstrated that damp mesotrophic grasslands, typified by those of floodplain meadows, supported a range of plant communities that required attention beyond the descriptions provided in Volume 3 of British Plant Communities.

A review of the NVC in 2000 concluded that "The description of the *Cynosurus cristatus-Caltha palustris* flood pasture (MG8) is one of the least satisfactory parts of the mesotrophic grassland section of the National Vegetation Classification" (Rodwell and others 2000).

The establishment of the Floodplain Meadows Partnership (hosted by the Open University) in 2007 continued the monitoring of floodplain meadows and expanded the already extensive database of releves of these damp grassland communities. The review of these damper grassland communities was commissioned by the Partnership in 2012 and, although aimed primarily at re-defining the MG8 community, inevitably involved the full revision of all grass-dominated communities on the floodplains studied.

This work is an attempt to provide a more fulsome description of these communities by analysing a large data set from meadows and pastures across England and Wales. Data came from a number of sources where vegetation referable to *Cynosurus cristatus-Caltha palustris (*coded MG8 in Rodwell 1992), *Agrostis-Carex-Senecio* grassland (Ag-Cx of Cox and Leach 1995), damp *Lolium perenne-Alopecurus pratensis-Festuca pratensis* grassland (MG7C), damp *Lolium perenne-Cynosurus cristatus* grassland (MG6) and vegetation of grassy inundation conditions transitional to *Agrostis stolonifera-Alopecurus geniculatus* grassland (MG13) and *Eleocharis palustris* swamp (S19) had been recorded. Floodplain meadow grassland referable to MG4 is the subject of a separate review and hence was excluded from the current analysis; swamp and ephemeral inundation communities included in the OV chapter of Rodwell (2000) were also excluded.

The data set comprising 4706 quadrats with 388 species was subject to TWINSPAN analysis. Twinspan was run using the Juice software package (Tichŷ and Holt 2006) in which the number of clusters can be predetermined. Five cut levels and 40 clusters were selected. Optimclass (Tichŷ and others 2010) was used to produce a hierarchical tree of clusters with a Fisher threshold of 0.0001. Clusters were amalgamated to produce groups considered to represent distinct vegetation

associations and sub-associations. The original analysis recognised eleven noda; further discussions and re-analysis of parts of the data set has resulted in twelve distinct noda being distinguished.

A description of each nodum is given following the format adopted in British Plant Communities. Floristic tables for each community, and associated subcommunities, are also presented.

The majority of the communities and subcommunities identified may be placed within the *Calthion* alliance which includes the NVC community MG8. Estimates of the total extent of MG8 vary between 300 and 800 ha (Rodwell and others 2000) – it is described as a scarce and locally distributed community yet the Natural England grassland inventory has 410 entries for England alone.

The *Calthion* alliance (*Calthion palustris* Tx. 1937, emend Balátová-Tuláčkova 1978) of which MG8 is part, has received relatively little attention from British plant ecologists. There are several reasons for this;

- The alliance has as its principal locus the wet, manured meadows and pastures of western and central Europe: its component communities are poorly developed in the British Isles. Braun-Blanquet and Tüxen (1952) go as far as suggesting that the *Calthion* is replaced in the Atlantic fringe by the *Juncion-acutiflori* alliance, which is represented in Britain only by the *Juncus effusus/acutiflorus-Galium palustre* rush pasture (M23) (Rodwell 1991).
- The lack of rare or scarce vascular species within the communities of the alliance (i.e. those either rated A in the Atlas of the British Flora, Perring and Walters 1962, Wiggington 1999 or occurring in <100 10 x 10 km squares in the British Isles, Stewart and others 1994) and of rare bryophytes (recorded in < 20 vice counties, Corley and Hill 1981).Of the four constituent communities, *Cynosurus cristatus-Caltha palustris (*MG8), *Holcus lanatus-Deschampsia cespitosa* coarse grassland (MG9) and *Holcus lanatus-Juncus effusus* (MG10) have no rarities, whilst *Juncus subnodulosus-Cirsium palustre* fen-meadow (M22) has one forb (*Peucedanum palustre*) and one moss (*Homolothecium nitens*). In contrast, CG3, the *Bromus erectus* community, a widespread calcareous grassland, has a list of eleven rarities (Rodwell 1992). The communities recognised do however support a number of species now considered as scarce or threatend (Stroh and others 2014) and these are discussed in later sections.
- The lack of robust baseline information on the component communities has resulted in MG9 and MG10 receiving little attention. They are considered to be communities of little or no conservation interest, percieved as communities degraded through agricultural improvement, drainage failure or conversely recolonising vegetation following abandonment of pasture/arable land on poorly drained soils,
- Even in its European heartland, the complex group of communities which make up the *Calthion* are floristically ill-defined. Thus, if one seeks to establish which species define the alliance, the outcome is inconsistent (Table 1).

Table 1. Species characteristic of the *Calthion* alliance.

Author	Country	Characteristic species
Westhoff and den Held 1969	Netherlands	*Caltha palustris, Lotus uliginosus, Scirpus sylvaticus, Crepis paludosa, Bromus racemosus, Lychnis flos-cuculi.*
Schaminée and others 1996	Netherlands	*Caltha palustris, Lotus uliginosus, Scirpus sylvaticus, Crepis paludosa, Lychnis flos-cuculi, Carex disticha, Rhinanthus angustifolius*
Tüxen 1937	Germany	*Caltha palustris, Scirpus sylvaticus, Bromus racemosus, Senecio aquaticus, Ranunculus repens, Polygonum bistorta, Cirsium oleraceum, Juncus filiformis*
Tüxen and Preising 1951	Germany	*Caltha palustris, Scirpus sylvaticus, Bromus racemosus, Crepis paludosa, Myosotis scorpioides, Cirsium helenioides, Fritillaria meleagris*.
Williams 1968	Switzerland	*Caltha palustris, Bromus racemosus, Crepis paludosa, Senecio aquaticus, Polygonum bistorta, Geum rivale, Myosotis scorpioides, Cirsium rivulare, Fritillaria meleagris, ^Polygonum hydropiper*
* Gehu 1961	France	*Caltha palustris, Lotus uliginosus, Scirpus sylvaticus, Bromus racemosus, Lychnis flos-cuculi, Myosotis scorpioides, Filipendula ulmaria, Achillea ptarmica, Deschampsia cespitosa, Juncus articulatus*
Le Brun and others 1949	Belgium	*Lychnis flos-cuculi, Filipendula ulmaria, Lysimachia vulgaris, Lythrum salicaria, Valeriana officinalis, Hypericum tetrapterum*

^ Added by Shimwell (1968) for the *Calthion* in the British Isles.

* For his *Bromion racemosi* = *Calthion*

Apart from the Belgian interpretation, which clearly envisages a more fen-like group of communities, it would be reasonable in the British context to accept

Caltha palustris, Bromus racemosus, Lychnis flos-cuculi, Senecio aquaticus and *Lotus uliginosus* as characteristic of the *Calthion.*

Conservation Status

Communities of the *Calthion* are not currently included as an Annex I habitat either under Code 6510, Lowland Hay meadows, or Code 7210, Calcareous fens.

However, Section 41 of the NERC Act required the publication of a list of habitats and species that are of principal importance for the conservation of biodiversity in England. The list includes 56 habitats of principal importance. These are all the habitats which were identified as requiring action in the UK Biodiversity Action Plan and which continue to be regarded as conservation priorities in the UK-Post 2010 Biodiversity Framework (JNCC and Defra 2012).

The MG8 community was listed as a UK BAP Priority Habitat Type in the lowland meadows category; upland expressions are included in the Upland Hay Meadows Priority habitat along with MG3. Thus MG8 continues to be in the post-2010 list of habitats of principal importance. The conservation status of MG8 in the wider European framework is discussed by Rodwell and others (2007).

New European criteria for assessing scarce and vulnerable vascular species indicate that a number of the communities of the *Calthion* support species of conservation importance. The Vascular plant red data list for England (Stroh and others 2014) has been consulted and, for each community, species categorised as 'Vulnerable' or 'Near Threatened' are listed in the individual community descriptions.

Wet meadows of the *Calthion* type are regarded as endangered ecosystems in northern Germany due both to agricultural intensification and to abandonment (Schrautzer and others 1996) and the German Federal Agency for Nature Conservation (BfN 2011) has proposed that the *Calthion* alliance be added to Annex I and that Code 6510 be extended as “nutrient-poor lowland grassland (species-rich sites)”. In Switzerland the *Calthion* is listed in “Biotope Types deserving protection” in an ordnance on the protection of Nature and Cultural Heritage (FASC 1991). In Luxembourg, Schneider and Naumann (2013) are the authors of a protection plan for *Calthion* meadows – Plan National pour la Protection de la nature: prairies humides du *Calthion*.

The more species-rich elements of the British *Calthion* could well be included in an amended Annex 1.

The remaining units of the floodplain grasslands may be partitioned between two further alliances, the *Potentillion* and the *Alopecurion*.

Potentillion anserinae Von Rochow 1948: Syn. *Elymo-Rumicion crispi* Nordhagen 1940 emmend. Tűxen 1950, includes natural and anthropogenic communities of unstable habitats periodically wettened and dried out or alternating brackish and fresh (Rodwell 2000). Stands referable to the alliance are typified by the presence of *Potentilla anserina, Agrostis stolonifera, Rumex crispus, Alopecurus geniculatus* and *Trifolium repens*.

The *Alopecurion pratensis* Passarge 1964 is characterised by only two generally accepted species, *Alopecurus pratensis* and *Bromus racemosus*, a situation which has led some continental workers to place these relevees within the *Deschampsion cespitosae* Horvatič 1930. In the original description by Passarge, the characteristic species of the alliance are given as *Alopecurus pratensis, Phleum pratense* and *Phalaris arundinacea*. Aurelia and others 2008 add *Festuca pratensis* for stands in

Rumania whilst Chytrý and Tichý 2003 list *Sanguisorba officinalis, Holcus lanatus* and *Rumex acetosa* for these meadows in the Czech Republic.

2. Methods

Data collation

Botanical data were collated from five principal sources.

- Quadrats surveyed during the DEFRA funded BD1310 project (Gowing and others 2002) that had not been assigned to any of the newly proposed subcommunities of the MG4 community; the revision of which is summarised in Rothero and others 2016. These quadrats were arranged in grids or transect lines across clearly defined hydrological gradients; a total of 1500 quadrats from that work are included in this analysis.
- Quadrats from other monitoring programs, again involving grids or transect lines of quadrats from sites supporting MG8 and related vegetation communities
- NVC surveys conducted by the Open University and Ecological Surveys (Bangor) between 1996 and 2011 where any form of MG8, MG6, MG7C, MG13, the *Agrostis-Carex* unit or a grassy expression of S19 had been recorded.
- Data gathered as part of the current scoping exercise from other surveys on sites known to support MG8 and allied vegetation communities. The main sources of data were from northern hay meadows (collated by O'Reilly, pers.comm.), and detailed surveys of the larger Hampshire floodplains including the Itchen (Collingridge 2002) and Lower Avon (Wilson and others 2004); a total of 725 quadrat records.
- Finally, additional quadrats from sites visited during the 2012 field season to 'fill in the gaps' in geographical coverage; a further 527 quadrats.
- The total data set from these five sources was 4706 quadrats.

Figure 1 shows the geographic spread of all sites from which quadrat data were available. For some areas where a large number of fields were recorded on a single farm, the locations have been plotted to a resolution of 10 km.

In most cases a 1 m x 1 m quadrat had been used for the recording of species lists, with species abundance recorded as percentage cover (using visual estimates). In a few cases cover had been recorded using the DOMIN scale of relative abundance. These data were converted to percentage cover on entry into the database (Currall 1987). In a very few cases, data collected using a 2m x 2 m quadrat have been included.

Nomenclature follows Tutin and others (1964) for vascular plants in order to maintain consistency with the British Plant Communities. A table of nomenclature changes is included as Appendix 3 to this report for those species which have new names in Stace's New Flora of the British Isles (Stace 2010)

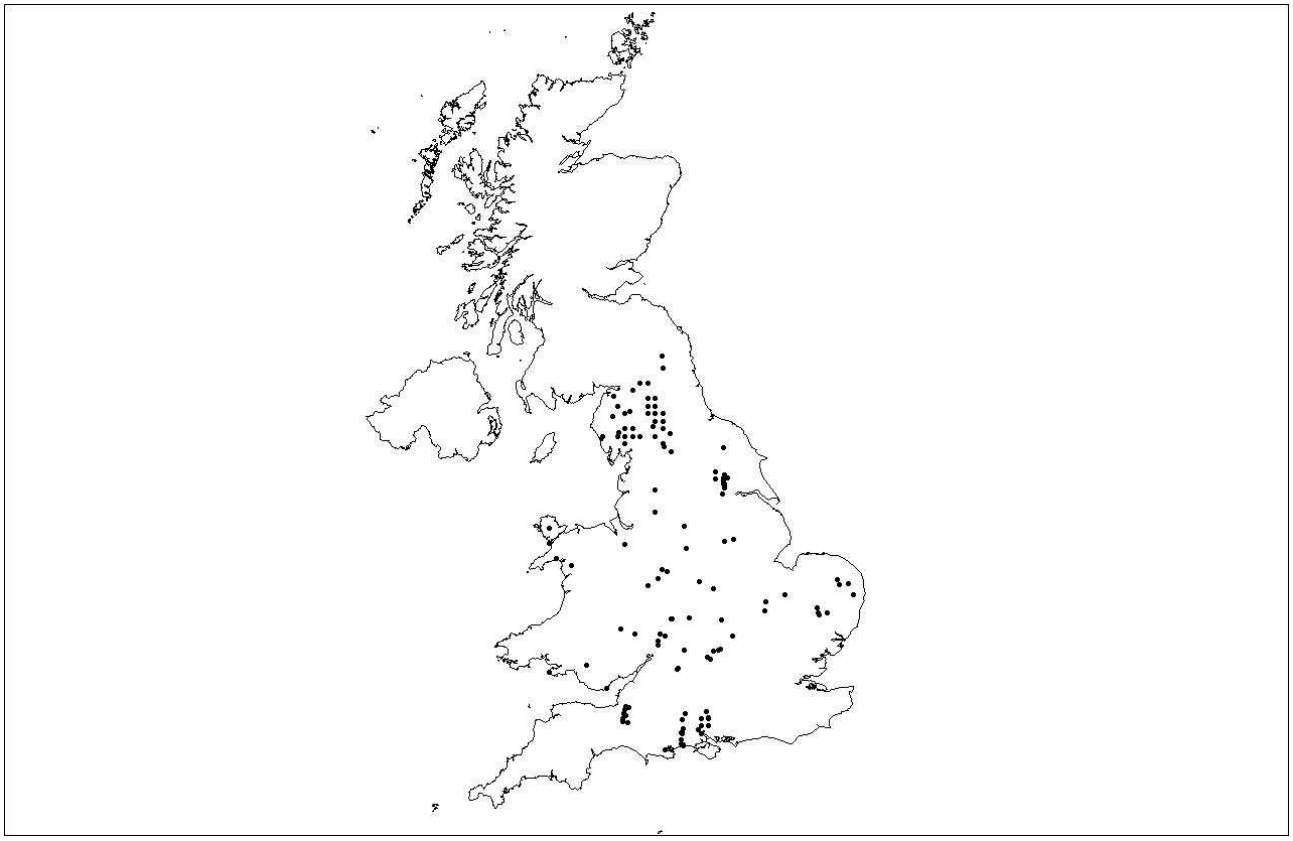


Figure 1. Location of all sites included in the full analysis.

Ellenberg indicator values

Mean Ellenberg scores were calculated for each quadrat using the original scores of Ellenberg (1988) as a surrogate for soil hydrology and soil chemistry.

Soil Type

Where possible a broad soil category has been allocated to the individual quadrat records using a simple classification: deep peat, shallow peat, humic mineral, mineral and clay over peat

Site management

For each record, a note was made as to whether a site is regularly managed as hay meadow or as permanent pasture or is in a state of neglect.

Data analysis

The full data set, comprising 4706 quadrats and 388 species, was subject to TWINSPAN analysis.

A modified version of the original TWINSPAN was used in which the number of clusters is determined prior to analysis (Juice v.6.3 Tichý and Holt 2006). This approach is considered to be more reliable where more than one gradient is thought to be operating on the data set.

The analysis was run with 5 cut levels (0, 1, 2, 5 and 33%), minimum group size of 5 and 40 clusters.

Optimclass (Tichý and others 2010), also available in the Juice software package, was used to produce a hierarchical tree of the divisions with a Fisher threshold of 0.0001, and flexible beta set at -0.25.

The endgroup clusters[1] were then assessed for internal homogeneity using Sorensen-Bray-Curtis analysis and tested individually against units of the NVC using the Czekanowski coefficient of similarity (Malloch 1998). A modified version of MATCH produced during a previous analysis of MG4 and MG8 data was used, which includes a provisional revision of the MG8 community.

A synoptic table (based on the percentage frequency of species in each endgroup cluster) was produced for the 40 clusters and these were manually ordered based on a combination of statistical similarity coefficients and visual observation of the tables leading to recognition of clearly defined groups of preferential and differential species following the guidelines of Mueller Dombois and Ellenberg (1974).

Some clusters were clearly differentiated early in the hierarchy, whilst others required progressive aggregation. A series of large endgroup clusters at one extreme of the TWINSPAN were considered to be too heterogeneous to be recognised as single vegetation units and a further TWINSPAN analysis was carried out on a subset of these groups (clusters 38-42) in order to arrive at satisfactory homogeneity of groupings.

The final aggregation of endgroup clusters was based on visual ordering of synoptic tables within each section of the TWINSPAN two-way table.

A DCA was carried out using PcOrd software (McCune and Mefford 1999) to aid interpretation of the main gradients of variation within the data; the analysis was run with rare species down weighted and axes re-scaled. The distinctness of the Twinspan endgroup clusters was then assessed through plotting of Euclidian ellipses against the DCA axis scores.

Mean Ellenberg scores were calculated for each quadrat using the original scores of Ellenberg (1988) and biplots used to help interpret the principal environmental gradients. Differences between endgroup clusters were tested using ANOVA and Tukey pairwise comparisons.

Data presentation

The final endgroup clusters (noda; Poore 1955) have been grouped at the 'community' level for the production of floristic tables and summaries of environmental variables.

General gradients across the whole dataset are discussed and new communities and subcommunities described.

Each community description follows that adopted by Rodwell (1992):

[1] Endgroup: the lowest level of division in a hierarchical twinspan analysis
Cluster: computer generated grouping of endgroups based on predetermined mathematical criteria
Nodum: groups of endgroups or clusters representing abstract vegetation units before they are linked to pre-existing vegetation communities.

- Community name, synonymy, constant species, rare and scarce species (Wiggington 1999, Stewart and others 1994, Corley and Hill 1981), and additionally vulnerable and near threatened species (Stroh and others 2014).
- Text - including general introduction to the physiognomy of the community, a description of the floristic variation between the subcommunities (where applicable), the habitat conditions and the interrelations between other communities in relation to zonation and succession (both natural and management induced).
- Floristic tables - the botanical data for the quadrats are presented using absolute values for percentage frequency of occurrence in preference to the five constancy classes adopted in British Plant Communities. This approach was favoured as being that more commonly used in the continental literature
- Maps of the distribution of samples for each recognised community are also presented.

Wider European perspective

An attempt has been made to place the 12 noda segregated in the present work into a broader phytosociological context by comparing them with a selection of vegetation units drawn from Ireland to Bulgaria to produce a broader European framework *via* a DCA analysis.

The main matrix comprised 73 noda drawn from the available literature with a total species complement of 340 species. Since the data were gathered from a wide range of publications, the original data were presented as both percentage frequency and as constancy classes; for the present analysis all frequency data has been expressed using the five constancy classes employed in the NVC and elsewhere in Europe.

A second matrix of four proxy environmental variables included mean Ellenberg indicator values (Ellenberg 1988) for reaction (R), fertility (N) and moisture tolerance (F), and a categorical variable for the published alliance of each nodum.

DCA analysis was carried out using PcOrd software, axes were rescaled and rare species down weighted, the DCA plots were then overlain with the Ellenberg scores as biplots.

3. Results

Twinspan

TWINSPAN analysis produced 42 endgroups clusters (two having only a solitary quadrat). The hierarchical clustering and community allocations of the clusters are given in Figure 2 and Table 2.

Endgroups clusters on the left hand side of the hierarchy (1-20) were generally species poor, averaging less than 15 species/relevé (with a range of 8.9 to 17.69) compared to those on the right hand side (clusters 21-42) which averaged >15 species/cluster (range 15.15 – 24.1).

It is inevitable with data restricted to a single habitat that there will be a large number of species that are common to most of the vegetation units; the manual tabulation and re-ordering of endgroups based on species that were obviously diagnostic of single, or groups of, endgroups was therefore a crucial part of the interpretation. Thus, in the MG6 and MG8 end of the analysis, even following a re-analysis of the final clusters (38-42) there was considerable 'shuffling' of the endgoups before homogeneity was achieved.

An initial amalgamation of endgroups produced 16 noda. These were plotted using DCA and bivariate ellipses, and their synoptic tables compared. A Bray-Curtis similarity matrix was also calculated. These analyses identified considerable overlap of some of the proposed noda. This resulted in amalgamation of some groups but further subdivision of others (Wallace and Prosser 2014).

These further refinements resulted in 12 noda which were considered sufficiently dissimilar to be considered as genuinely distinct types within the damp *Calthion* and allied vegetation units.

A summary of the cluster amalgamations, their closest NVC allocation and the proposed name for newly described types are presented in Table 2.

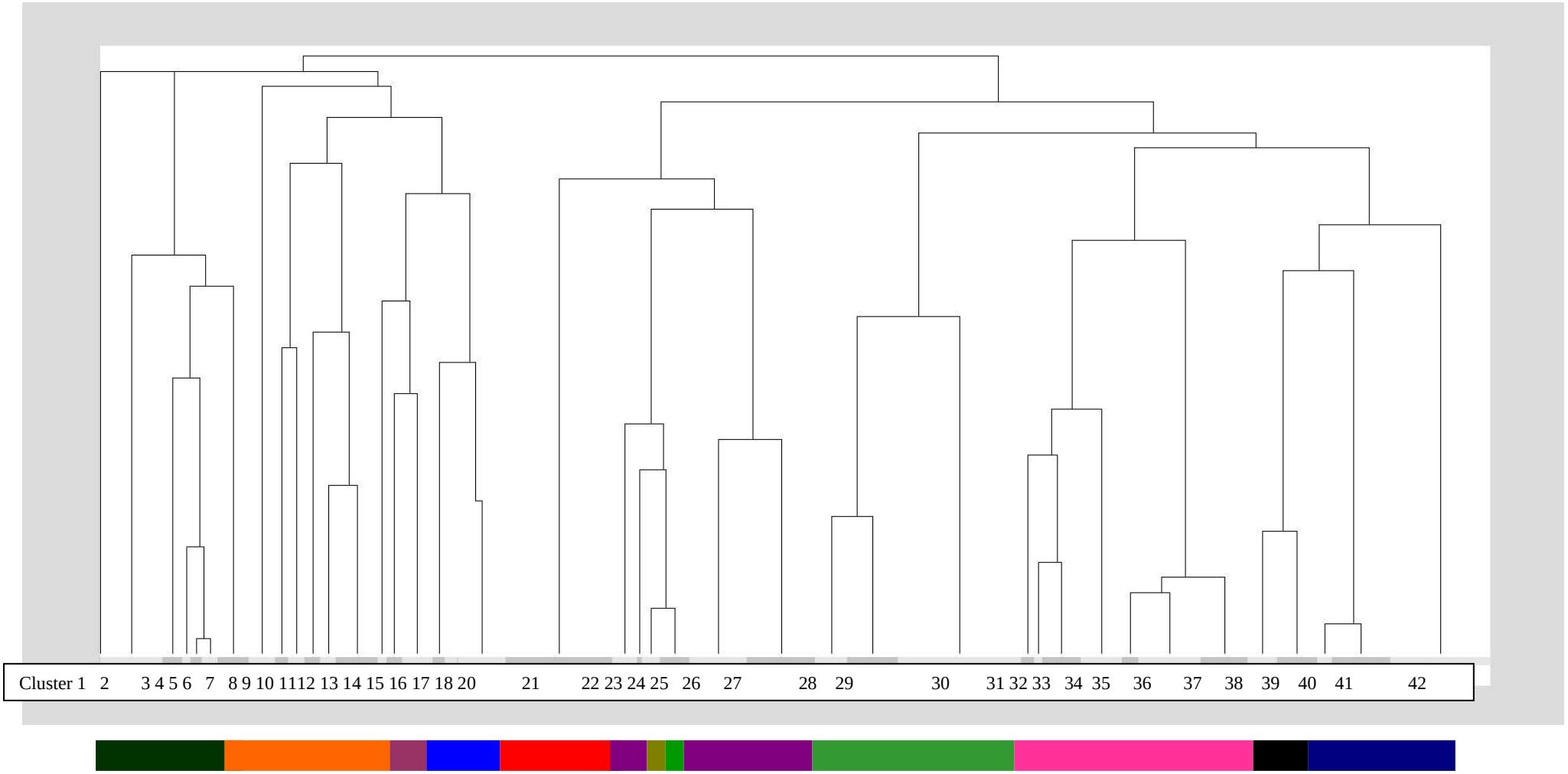


Figure 2. Hierarchical tree from the TWINSPAN classification.
Coloured bands under the cluster numbers indicate their amalgamation into homogeneous units (noda) used for the production of floristic tables. See Table 2 below for details**.**

Table 2. Endgroup cluster amalgamations and proposed community naming. Endgroups 1 and 19 had only a single quadrat and are omitted. The nodum number colours relate to those in Figure 2 above.

Nodum	Endgroup cluster	Number of samples	Proposed name	Alliance	Closest NVC	Abbr.
1	2 - 7	503	*Alopecurus pratensis-Poa trivialis-Cardamine pratensis* grassland. *Agrostis stolonifera* subcommunity	*Alopecurion*	MG7 C Gowing and others 2002	MG15 a
2	8 (in part), 10,11,12,13,14	356	*Agrostis stolonifera-Eleocharis palustris* inundation grassland	*Potentillion*	S19	MG16
3	15, 16	177	*Agrostis stolonifera-Alopecurus pratensis* grassland	*Potentillion*	MG13	MG13
4	17, 18, 20	246	*Carex-Agrostis-Senecio* grassland, Typical subunit	*Calthion*	*Carex-Agrostis* Cox and Leach	MG14 a
5	21	359	*Cynosurus cristatus-Carex panicea-Caltha palustris* grassland, *Carex nigra-Ranunculus flammula* subcommunity	*Calthion*	MG8	MG8 c
6	9 (in part) 22, 23	100	*Juncus subnodulosus-Cirsium palustre* fen-meadow	*Calthion*	M22	M22 b
7	24	323	*Carex-Agrostis-Senecio* grassland *Anthoxanthum odoratum-Trifolium repens* subcommunity	*Calthion*	*Carex-Agrostis*. Cox and Leach	MG14 b
8	26 and 27 (in part)	401	*Cynosurus cristatus –Carex panicea-Caltha palustris* grassland, *Sanguisorba officinalis* subcommunity	*Calthion*	MG8	MG8 a
9	25, 28, 29 30 (in part)	597	*Cynosurus cristatus-Carex panicea-Caltha palustris* grassland, Typical subcommunity	*Calthion*	MG8	MG8 b
10	31 – 37	766	*Alopecurus pratensis-Poa trivialis-Cardamine pratensis* grassland. *Lolium perenne-Ranunculus acris* subcommunity	*Alopecurion*	MG7 C Gowing and others 2002	MG15 b

11	38 – 42 (in part)	163	*Cynosurus cristatus-Carex panicea-Caltha palustri*s grassland, *Caltha palustris-Bellis perennis* subcommunity	Calthion	MG8	MG8 d
12	38 - 42 (in part)	553	*Lolium perenne-Cynosurus cristatus* grassland; *Filipendula ulmaria* subcommunity	Calthion	MG6	MG6 d

Environmental Drivers

DCA was used to aid the interpretation of the relative distribution of the vegetation units. Overall the amount of variance in the data explained by the first three axes was relatively low at 35.1% (Axis 1 =18.5%, Axis 2=10.3% and Axis 3=5.1%). Soil fertility (N) showed the strongest correlation with axis 1 (0.62) whilst moisture (F) showed its strongest correlation with axis 2 (0.596). However, soil fertility and soil moisture both increased with increasing Axis 1 scores. This linking of soil moisture and soil fertility is common in flooded sites where long duration of flooding tends to result in higher sediment deposition, which in turn is often linked to higher available phosphorus levels in soils. Increasing axis 2 scores are related to increasing soil moisture and declining soil fertility and separate the peaty substrates of low fertility from mineral substrates of higher fertility.

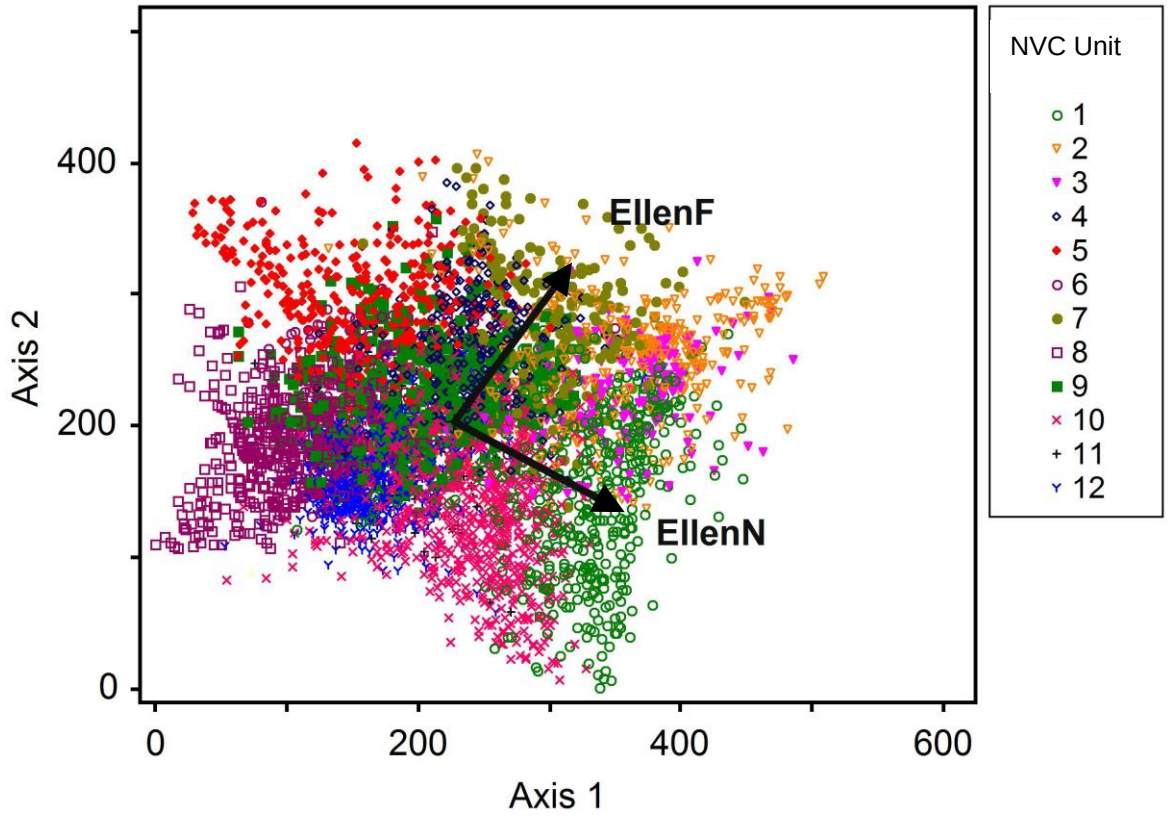


Figure 3. Plot showing the distribution of all quadrats against Axis 1 and Axis 2 scores of the DCA ordination**.** Different vegetation units indicated by different coloured symbols; numbers as given in Table 2. The overlain biplot of Ellenberg scores indicates that the first axis is strongly correlated with soil fertility (as indicated by the length and direction of the 'N' line), whilst axis 2 is more strongly correlated with soil moisture (as indicated by the direction and length of the 'F' line).

Anova showed a significant difference in axis scores between the communities, with Axis 1 explaining c.70% of the variance between communities. Most vegetation units had significantly different mean scores on axis 1 with the exception of the following pairs; M22 versus MG6d, MG8b versus MG8d, MG13 versus MG16 and MG14b versus MG15b (see Abbr. column in Table 2).

The segregation on axis 2 was less strong, and although Anova was still significant seven pairs showed no significant difference.

These differences and overlaps are more clearly seen using bivariate ellipses (Figure 4).

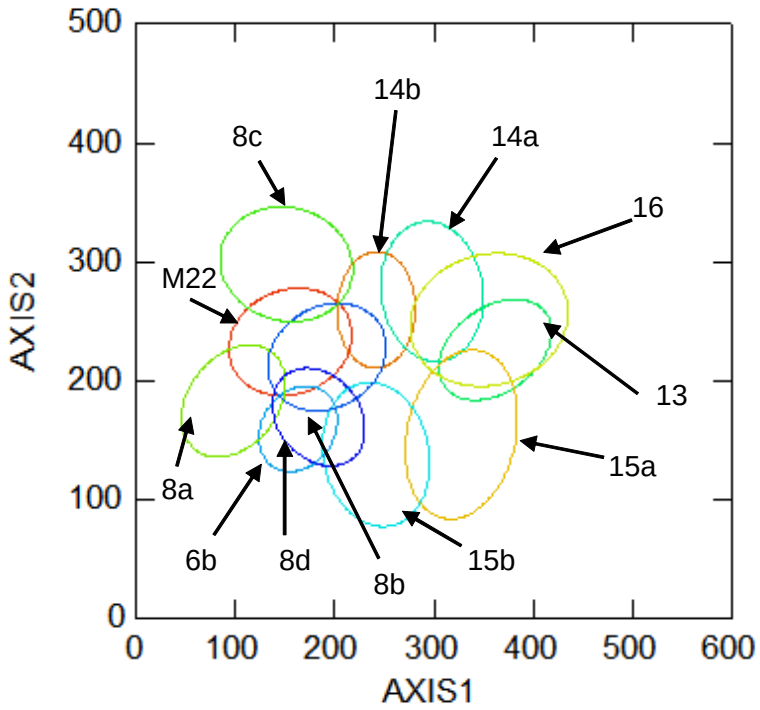


Figure 4. Bivariate ellipses for the 12 vegetation units defined**.** Ellipses are centred on the sample means of the two axis scores. The axes of the ellipses are determined by the sample standard deviation and orientation by sample covariance. Probability level set at 0.55 for determining size of ellipses.

Separation of the species poor units (MG13, MG15 and MG16) on the first axis illustrates the higher fertility of these vegetation communities compared to those of higher conservation value (MG8, M22) which have generally lower fertility values. Communities associated with generally damper soil profiles (MG14, M22 and MG8c) are separated from those of drier soils (MG8a, MG8b, MG8d and MG6d) on axis 2.

On the species ordination (Figure 5) four main segments can be identified:

- low fertility, wet soils in the top LH quarter. *Cirsium dissectum, Danthonia decumbens, Carex panicea, Hydrocotyle vulgaris*
- low fertility, relatively dry soils in the lower LH corner; *Galium verum, Avenula pubescens, Leucanthemum vulgare, Trisetum flavescens.*
- high fertility, wet soils in the top RH corner; *Eleocharis palustris, Bidens tripartita, Rorippa spp, Callictriche stagnalis*
- high fertility but drier soils in the lower RH corner ; *Alopecurus pratensis, Elytrigia repens, Capsella bursa-pastoris.*

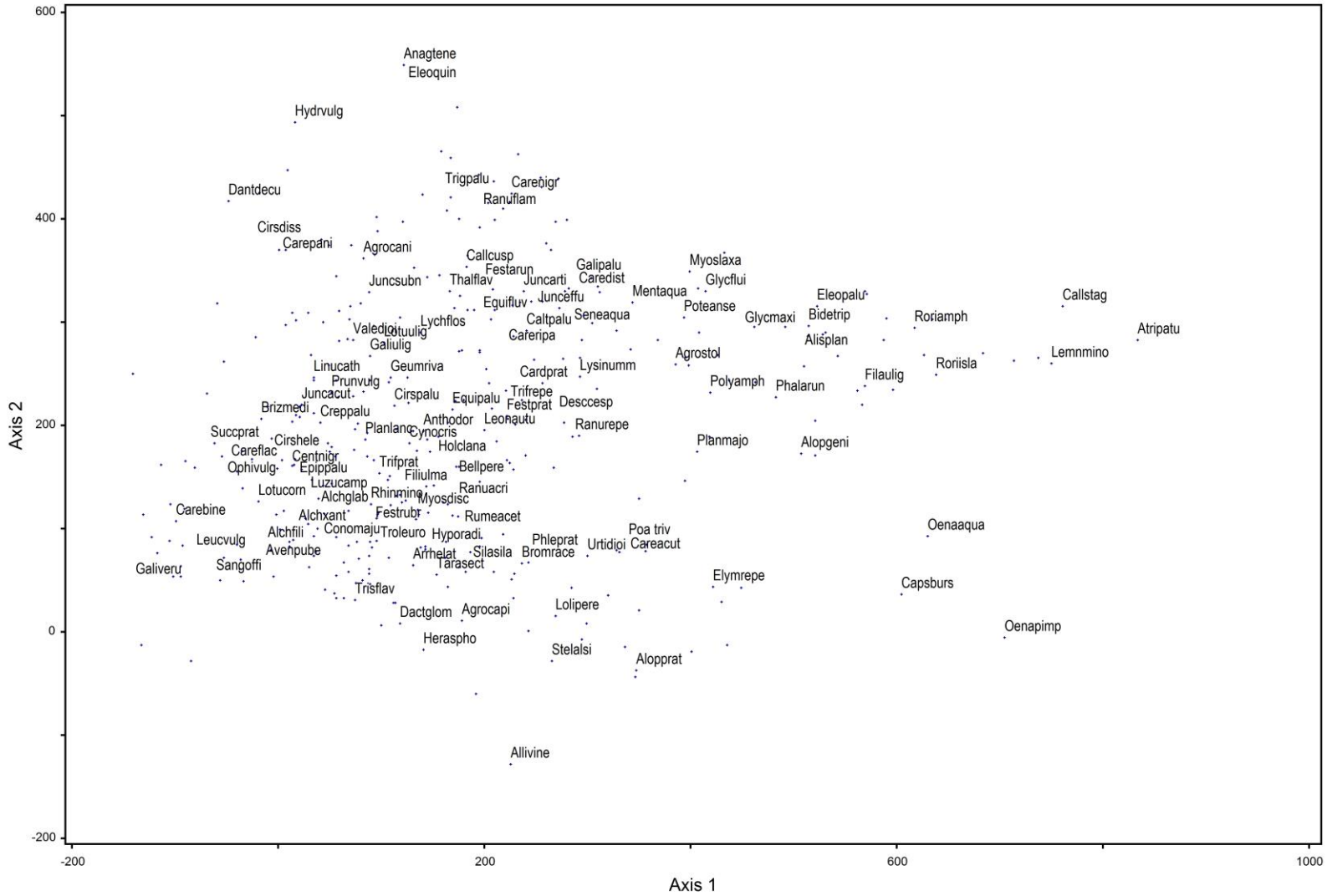


Figure 5. Distribution of selected species against axis 1 and axis 2 of the DCA ordination. Full species names for the abbreviations are given in Appendix 3, along with nomenclature changes since Rodwell 1992.

Ellenberg indicators

The biplots on the DCA indicated that soil fertility and soil moisture are both important drivers in the segregation of NVC units. When the mean Ellenberg indicator scores for each NVC unit are compared using Anova most units are significantly different from one other in terms of both Ellenberg N (*p <0.001,* explained variance 58%) and Ellenberg F (*p<0.001,* explained variance 66%). Tukey pairwise comparisons were used to test for differences between the 12 vegetation units; for Ellenberg N, the only units that were not significantly different from each other were M22 *versus* MG8a and MG13 *versus* MG15a. For Ellenberg F, there were three couplets that were not different; M22 *versus* MG8c, MG15a *versus* MG8b and MG13 *versus* MG14b.

Median values and ranges are shown in a series of Box and whisker plots (Figures 6-8). In these figures the horizontal line within each box marks the median of the samples, the length of the box shows the range within which the central 50% of values fall, the whiskers show the range within which 75% of values fall whilst the * indicate far outliers.

Variation in Ellenberg R is not so clear cut; although Anova indicated a significant difference between units (*p<0.001),* the explained variance was only 32% and 10 pairwise comparisons were not significantly different using Tukey pairwise comparisons. Highest reaction values were for M22, MG15a and MG16 whilst the lowest was for MG8c.

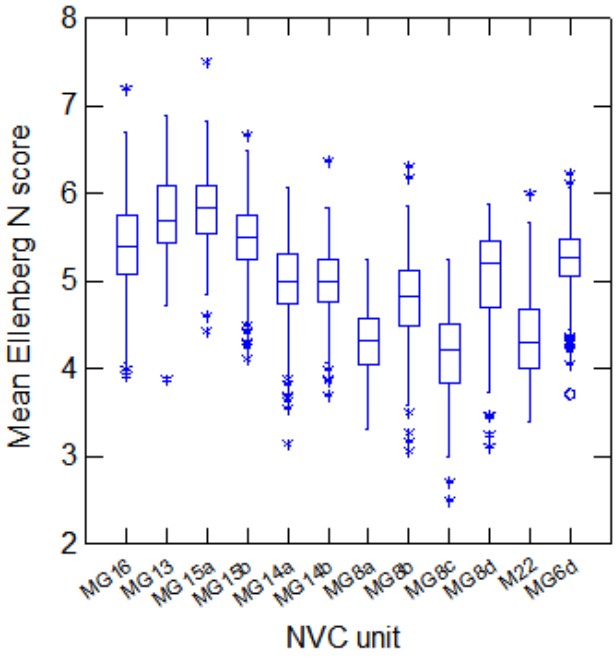


Figure 6. Box and whisker plots showing variation in Ellenberg N scores across the NVC units. The communities are ordered according to their descriptions in Section 4 which broadly follows the fertility gradient of the classification analysis.

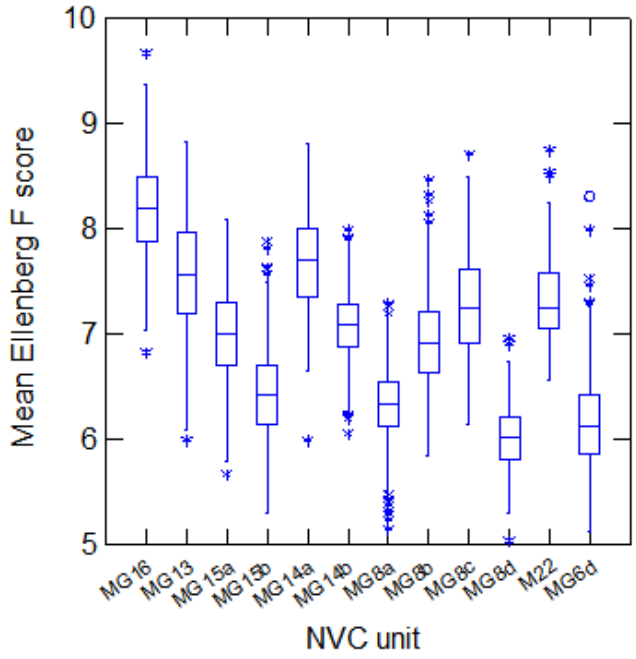


Figure 7. Box and whisker plots showing variation in Ellenberg F scores across the NVC units. The communities are ordered following the sequence of descriptions in Section 4.

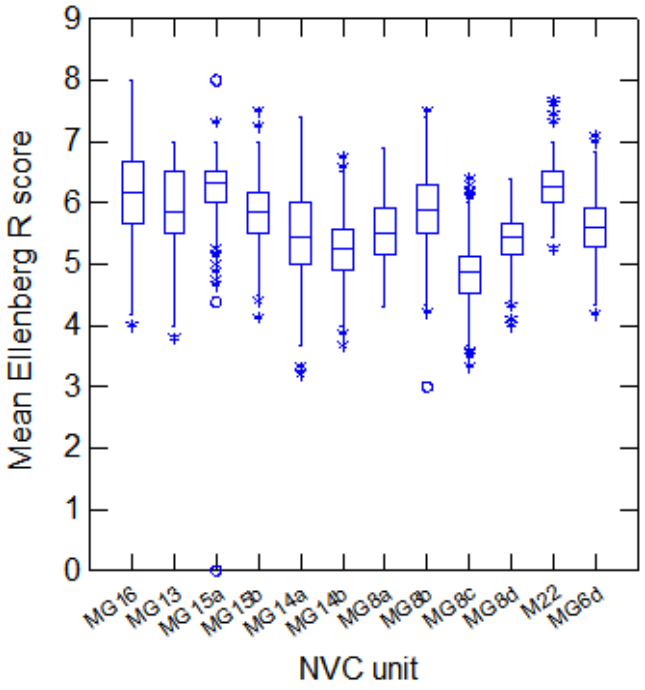


Figure 8. Box and whisker plots showing variation in Ellenberg R scores across the NVC units. The communities are ordered following the sequence of descriptions in Section 4.

Soil type and site management

Soil type and site management can play major roles in determining the species composition of a sward and it is clear that some of the units recognised are more commonly encountered on mineral soils; most notably the damper expression of the newly proposed MG15 and the *Sanguisorba officinalis* subcommunity of MG8, whilst M22 and the newly proposed *Carex nigra- Ranunculus flammula* subcommunity of MG8 are much more frequent on peaty substrates.

Similarly, site management appears to vary across the vegetation units. This may in part reflect the soil moisture status of the sites which will, in some instances, restrict the frequency of hay cutting. The damper, Typical subcommunity of *Carex-Agrostis-Senecio* grassland (MG14a), *Agrostis stolonifera-Alopecurus geniculatus* grassland (MG13) and the Typical expression of MG8 (MG8b) appear to be equally managed as meadow or pasture, whilst overall the majority of the units are cut for hay.

Table 3. Distribution of vegetation units across different soil types. Data are expressed as the percentage (%) occurrence of samples of each vegetation unit (community or subcommunity) on different soil types.

	Mineral	Clay on peat	Humic	Skeletat peat	Deep peat	No data	N
Unit							
MG16	62.9	6.5	2.0	1.4	19.7	7.6	356
MG13	27.0	11.0	0.6	0.0	49.7	11.7	163
MG15a	82.1	3.6	0.8	0.0	11.3	2.2	503
MG15b	49.1	21.5	1.3	0.3	24.9	2.9	766
MG14a	12.2	31.7	7.3	3.7	37.8	7.3	246
MG14b	7.1	29.4	0.9	1.2	55.7	5.6	323
MG8a	91.3	0.2	0.5	0.0	3.7	4.2	404
MG8b	23.1	0.3	12.3	9.9	43.2	11.1	593
MG8c	0.6	0.0	0.0	0.0	94.4	5.0	359
MG8d	63.2	0.0	9.6	0.0	0.7	26.5	136
M22	1.8	0.0	2.6	5.3	83.3	7.0	111
MG6d	30.0	0.2	3.9	1.7	* 60.9	3.4	593

***** The high value for MG6d on peaty soils is misleading and is due to a disproportionate number of samples from the deep peats of Tadham Moor, Somerset.

Table 4. Management of different vegetation units.

Data expressed as % occurrence of quadrats within a vegetation unit receiving regular hay cutting or managed exclusively as pasture. Unmanaged refers to abandoned sites where no management is currently active. Unknown indicates no information available for the site. N = total number of quadrats allocated to each NVC unit

	Hay	Pasture	None	Unknown	N
Unit					
MG16	66.6	27.8	0.0	5.6	356
MG13	46.0	38.0	0.0	16.0	163
MG15a	90.9	6.4	0.0	2.8	503
MG15b	85.4	12.3	0.1	2.2	766
MG14a	40.7	52.4	0.4	6.5	246
MG14b	63.8	25.4	0.3	10.5	323
MG8a	95.0	2.2	0.0	2.7	404
MG8b	49.6	46.7	0.2	3.5	593
MG8c	78.3	17.0	0.3	4.5	359
MG8d	82.4	2.2	0.0	15.4	136
M22	86.0	14.0	0.0	0.0	111
MG6d	90.4	8.4	0.2	1.0	593

4. Community descriptions

Rare and scarce species (Wiggington 1999, Stewart and others 1994, Corley and Hill 1981) are listed for each community. In addition, the vascular plant red data list for England (Stroh and others 2014) has been consulted and species categorised as 'Vulnerable' or 'Near Threatened' are also listed. The communities are listed in the order presented in the tables and figures in Section 3; moving from highest fertility, wetter communities to lower fertility, drier vegetation units.

MG16 (provisional) Agrostis stolonifera-Eleocharis palustris inundation grassland. Ass. Nov[2]. Nodum 2.

Synonymy

Spike-rush wet-meadow community (USA) Faber-Langendoen

Eleocharitetum palustris Schennikow 1919

Also used as a synonym for S19 *Eleocharis palustris* swamp in Rodwell 1995.

Constant species.

Eleocharis palustris, Agrostis stolonifera, Persicaria amphibia.

Rare /scarce species.

Oenanthe silaifolia.

Vulnerable species

Carex vesicaria, Oenanthe fistulosa, Ranunculus flammula, Stellaria palustris.

Near Threatened species

Hydrocotyle vulgaris, Lychnis flos-cuculi (Silene flos-cuculi), Potentilla palustris (Comarum palustre), Triglochin palustris, Valeriana officinalis, Veronica scutellata.

Foreword

This is a proposed new community which has yet to gain general acceptance since the members of the workshop set up to review progress on the FMP work on the communites were divided: some accepted its reality whilst others felt that it should be retained as a new subcommunity of MG13 or that it form the basis of a new OV community. It has been

[2] Ass. Nov: association nouveau: a relatively recent community or sub-community which has not previously been defined in the literature.

retained here as a provisional new grassland community, MG16 (provisional); *Agrostis stolonifera - Eleocharis palustris* inundation grassland.

Physiognomy

Eleocharis palustris is a mat-forming perennial with far creeping rhizomes. It produces single stems in the first season then many small tufts develop which can reach a height of 60 cm though stands are more usually about 30 cm tall. The spike-rush mat is intertwined with a felt of *Agrostis stolonifera* and is often punctuated by prominent clumps of *Phalaris arundinacea* and *Carex acuta*. Any gaps in what is often a closed sward support frequent *Galium palustre, Cardamine pratensis* and *Lysimachia nummularia*. *Ranunculus repens* and *Alopecurus geniculatus* often increase the variability of the sward. *Caltha palustris, Carex disticha, Myosotis laxa, Mentha aquatica* and *Rumex crispus* all occur occasionally in longer established stands.

Habitat

The community is typically found on substrates subject to periods of seasonal inundation, which are more prolonged than those supporting the related MG13 community. It is associated with wet soils, which, though on average less fertile than those on which MG13 develops, have some degree of both base and nitrogen enrichment. The community is largely restricted to alluvial mineral soils with an extensive example on Wheldrake Ings on the Derwent (Yorkshire): there are only occasional instances of its development over humic profiles as seen for instance on West Sedgemoor, on the Somerset Levels and at Strumpshaw Fen in Norfolk.

Where stands are well developed they are often mown along with stands of drier vegetation on more elevated areas adjacent to them. Some are cattle grazed in late summer whilst as autumn becomes winter and prior to the seasonal re-wetting the community is much utilised by geese and other wildfowl, both resident and over wintering.

Zonation and succession

Areas experiencing marked seasonal changes in the degree of inundation from year to year tend to support unstable plant communities, which themselves change from year to year. As one progresses up the hydrological gradient to zones of increasingly infrequent inundation these unstable associations are replaced by closed swards of more stable communities culminating in the drier hay meadows of the *Cynosurion*. Such zonations may be disturbed through events such as late spring or summer flooding or by severe poaching due to overgrazing. On the floodplains studied the simplest transition along a gradient of decreasing inundation is one where the retreat of the flood water leaves a bare surface colonised principally by *Persicaria amphibia* (the A10 aquatic community). This is rapidly colonised by, largely, nitrophilous forbs such as *Bidens tripartita* and *Rorippa spp.* to constitute one or more of a trio of *Bidention* communities (OV30-OV32, Rodwell 2000). It is usually into such empheral eutrophicated stands that the *Agrostis stolonifera-Eleocharis palustris* inundation grassland becomes established. Further progression along the inundation gradient appears to be governed by soil fertility: on richer substrates succession is often to the even more closed swards of the *Agrostis stolonifera-Alopecurus geniculatus* community (MG13,) which in turn is succeeded by *Alopecurion* grasslands. Where soil fertility is only modest, succession is likely to be towards a *Calthion* community, usually MG8.

Distribution

The proposed community is widely distrubuted over the wetter zones of floodplain meadows, but is particularly well represented on the Derwent Ings (Yorkshire), the Somerset Levels and along the Hampshire/Dorest Avon.

Affinities

In the dominance of *Eleocharis palustris,* the proposed community is clearly related to *Eleocharis palustris* swamp (S19,) but the new association is a grassland with a largely continuous sward rather than a more or less permanently flooded swamp. As such its closest associates encompass other communities of the *Potentillion* rich in *Agrostis stolonifera,* particularly MG13 and the *Festuca rubra-Agrostis stolonifera-Potentilla anserina* vegetation (MG11) communities. On the near continent the community has some affinity with the *Agrostis stolonifera* unit of Schaminée and others (1996) though here *Eleocharis palustris* only achieves a constancy of II. The *Alopecuretum geniculati* of Géhu (1961) from France is usually regarded as close to MG13, but has constant *Eleocharis palustris, Persicaria amphibia* and *Agrostis stolonifera* with *Alopecurus geniculatus* only at constancy II and is thus more similar to the proposed *Agrostis stolonifera-Eleocharis palustris* inundation grassland. Further afield Stančić (2008a) distinguishes a nodum from the Mediterranean region of Croatia that has constant *Eleocharis palustris* and *Agrostis stolonifera* and *Oenanthe silaifolia* as an occasional, quite separate from the more swamp-like *Eleocharis palustris* nodum from elsewhere in southeastern Europe.

Floristic table for *Agrostis stolonifera-Eleocharis palustris* inundation grassland (MG16 provisional)

Values are % frequency of occurence and, in parathesis, the maximum % cover achieved in the sampled quadrats, using visual estimates of percentage cover.

Community constants	% frequency	Maximum % cover
Agrostis stolonifera	**93**	(90)
Polygonum amphibium	**68**	(60)
Eleocharis palustris	**67**	(80)
Constancy II and III species		
Phalaris arundinacea	**51**	(99)
Cardamine pratensis	**48**	(5)
Ranunculus repens	**48**	(80)
Galium palustre	**47**	(40)
Caltha palustris	**43**	(65)
Poa trivialis	**40**	(50)
Myosotis laxa caespitosa	**39**	(25)
Carex acuta	**37**	(70)
Alopecurus geniculatus	**36**	(70)
Carex disticha	**32**	(75)
Lysimachia nummularia	**29**	(15)
Rumex crispus	**27**	(30)
Mentha aquatica	**26**	(35)
Glyceria maxima	**24**	(80)
Associated species		
Filipendula ulmaria	**20**	(95)
Oenanthe fistulosa	**20**	(25)
Senecio aquaticus	**20**	(20)
Ranunculus flammula	**18**	(5)
Glyceria fluitans	**16**	(65)
Carex nigra	**16**	(85)
Potentilla anserina	**14**	(80)
Juncus articulatus	**13**	(35)
Deschampsia cespitosa	**12**	(40)
Juncus effusus	**11**	(20)
Alopecurus pratensis	**10**	(25)
Calliergon cuspidatum	**9**	(80)
Leontodon autumnalis	**9**	(3)
Rumex acetosa	**7**	(5)
Myosotis scorpioides	**7**	(12)
Trifolium repens	**7**	(5)
Achillea ptarmica	**7**	(40)
Bidens tripartita	**6**	(12)
Equisetum palustre	**6**	(4)
Festuca pratensis	**6**	(15)
Stellaria palustris	**6**	(5)

Holcus lanatus	**6**	(25)
Elymus repens	**6**	(60)
Rorippa islandica	**6**	(40)
Thalictrum flavum	**6**	(30)
Rorippa sylvestris	**6**	(40)
Scirpus maritimus	**6**	(20)
Juncus acutiflorus	**5**	(40)
Ranunculus acris	**5**	(15)
Sanguisorba officinalis	**5**	(45)
Carex riparia	**5**	(30)
Iris pseudacorus	**5**	(18)
Carex vesicaria	**5**	(50)
Lolium perenne	**5**	(25)
Taraxacum officinale agg.	**5**	(1)

Number of samples	**354**
Mean species/sample	**11.64**

Additional species recorded in <5% of quadrat samples; species with a single occurrence omitted.

Agrostis canina	*Anthoxanthum odoratum*	*Atriplex prostrata*	*Bromus hordeaceus*	*Carex acutiformis*
Carex elata	*Carex hirta*	*Carex panicea*	*Carex rostrata*	*Cerastium fontanum*
Cirsium arvense	*Cirsium palustre*	*Cynosurus cristatus*	*Drepanocladus aduncus*	*Drepanocladus fluitans*
Eleocharis uniglumis	*Equisetum fluviatile*	*Eriophorum angustifolium*	*Festuca arundinacea*	*Festuca rubra*
Festulolium loliaceum	*Geum rivale*	*Glyceria declinata*	*Hydrocotyle vulgaris*	*Juncus inflexus*
Juncus subnodulosus	*Lathyrus palustris*	*Lathyrus pratensis*	*Lychnis flos-cuculi*	*Lycopus europaeus*
Lythrum salicaria	*Myosotis seedling/sp*	*Oenanthe silaifolia*	*Phleum pratense*	*Plantago lanceolata*
Plantago major	*Poa pratensis*	*Potentilla palustris*	*Potentilla reptans*	*Ranunculus ficaria*
Rorippa amphibia	*Rumex hydrolapathum*	*Rumex obtusifolius*	*Scirpus lacustris tabernaemontani*	*Silaum silaus*
Trifolium pratense	*Triglochin palustre*	*Valeriana officinalis*	*Veronica catenata*	*Veronica scutellata*
Vicia cracca				

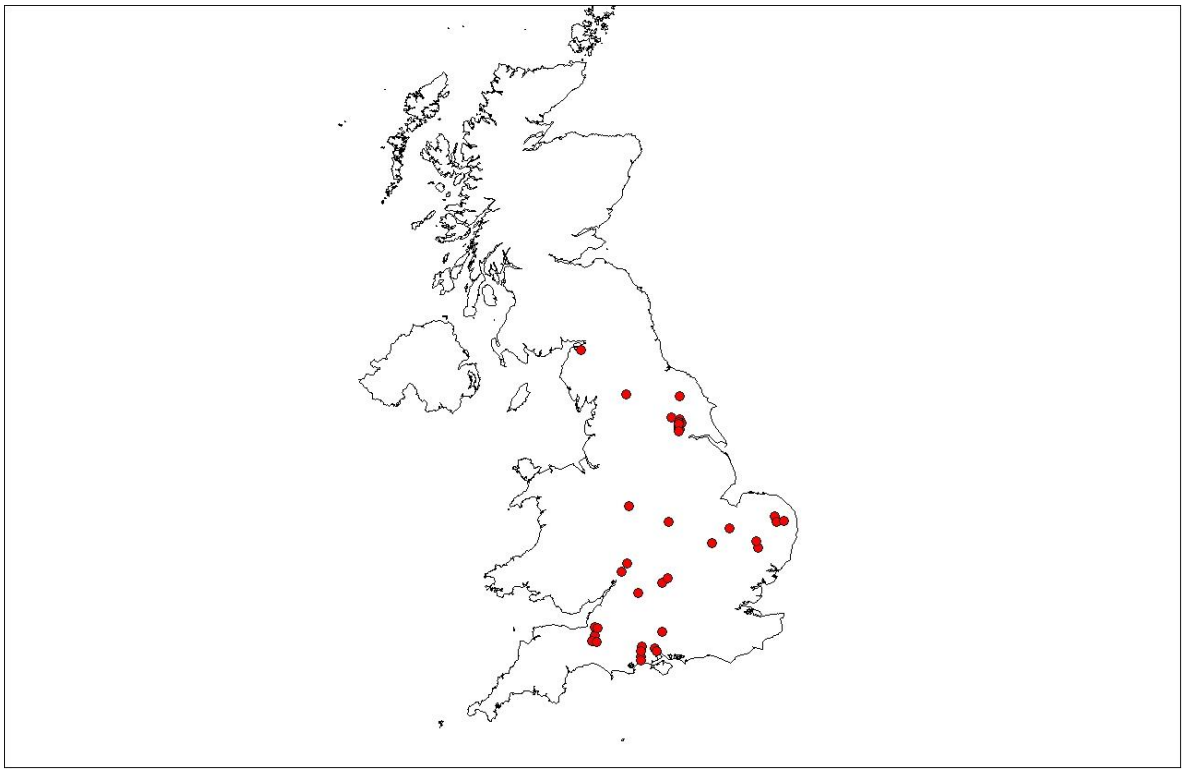


Figure 9. Distribution of *Agrostis stolonifera-Eleocharis palustris* inundation grassland (MG16 provisional).

Plate 1. *Agrostis stolonifera-Eleocharis palustris* inundation grassland at Wheldrake Ings, Yorkshire.

MG13 Agrostis stolonifera-Alopecurus geniculatus inundation grassland (nodum 3).

Synonomy

Ranunculo-Alopecuretum geniculati Typicum Schaminée and others 1996

Ranunculus repens-Alopecurus geniculates Tűxen 1937

Basal community of *Agrostis stolonifera Juncus effusus-Holcus lanatus* type Sýkora 1982b

Foxtail plash (Rodwell 2006)

Alopecurus geniculatus vegetation Lee 1977

Constant species

Agrostis stolonifera, Alopecurus geniculatus, Glyceria fluitans, Poa trivialis, Ranunculus repens.

Rare/scarce species

Oenanthe silaifolia

Vulnerable species

Oenanthe fistulosa, Ranunculus flammula, Stellaria palustris.

Near Threatened species.

Senecio aquaticus

Foreword

The community is represented in the published British Plant Communities by the very modest number of 17 samples. The current work has identified over 100 relevees which may be referred to the *Agrostis stolonifera-Alopecurus geniculatus* grassland and thus enables a revision of the original constancy table to provide a more balanced overview of the community over a wider range of sites. It must be stressed that the nodum presented here represents MG13 as it occurs on floodplain meadows. As such it will differ slightly from the published version which contains records for *Juncus gerardii*, *Atriplex prostrata* and *Triglochin maritima*. These are evidently from grazing marsh at the upper end of saltmarshes, a habitat outwith that studied in the Floodplain meadows work and may indicate the potential for the recognition of a halophytic subcommunity.

Physiognomy

The community comprises a, usually, closed sward which is grass dominated though the dominance of the pair of nominate species is less in the revised version of the community due to enhanced frequencies and cover of *Glyceria fluitans* and *Poa trivialis*. *Ranunculus repens* is also substantially more abundant. The sward is generally short but this low carpet is interrupted by occasional taller species such as *Rumex crispus, Senecio aquaticus* and *Phalaris arundinacea.* Ten of the species noted as occasional in the

published text have a similar representation in the revised version: these include *Holcus lanatus, Juncus articulatus, Ranunculus flammula* and *Oenanthe fistulosa.*

The revised constancy table differs most markedly from the original of Rodwell (1992) in the high frequencies of *Polygonum amphibium, Cardamine pratensis, Eleocharis palustris* and *Trifolium repens,* all previously absent.

Habitat

The community occurs typically on silty circumneutral soils periodically waterlogged through inundation by fresh water. It can also develop over fertile humic substrates. Often it is found as fragmentary stands alongside sluggish streams and rivers and around pools in lowland pastures, especially where there is moderate poaching by stock (Rodwell 1992). Much more extensive stands occur on river floodplains such as those of the Somerset Levels and Ouse washes (Prosser and Wallace 2002). On West Sedgemoor for instance substantial areas of MG13 provide valuable summer grazing extending from nearby improved and semi-improved grasslands. The sward is frequently cut for hay, or more usually, silage.

Zonation and succession

The *Agrostis-Alopecurus* community is one of the more stable inundation communities. It can develop from two very different starting points. Where a relatively steep gradient of degree of inundation occurs, as at the margins of large water bodies managed for winter wildfowl, MG13 may arise through the colonisation of wetter inundation communities such as the *Agrostis stolonifera-Eleocharis palustris* inundation grassland through establishment by *Alopecurus geniculatus, Poa trivailis, Cardamine pratensis* and *Holcus lanatus.* At the drier end of the hydrological gradient failure of drainage in *Lolium* or *Lolium-Cynosurus* swards can lead to the establishment of lenses of MG13 often through an intermediate stage provided by the *Alopecurus geniculatus* variant of the Typical subcommunity of the *Lolio-Cynosuretum* (MG6). Similar lenses may form in these grasslands around pools where areas are puddled by stock. An extensive conversion of *Calthion* swards to MG13 is evident at Upham meadow on the Severn/ Avon through the spraying of the original swards with herbicide followed by heavy grazing.

Distribution

The distribution map shows the widespread distribution of the community through the English lowlands with concentrations of sites on the Lower Derwent Ings, the Severn/Avon valley and the Somerset Levels.

Affinities

The *Agrostis-Alopecurus geniculatus* community is one of a group of vegetation types included in the *Potentillion* (or *Elymo-rumicion crispi*) alliance developing on fine alluvial silt or fertile humic substrates. In Britain its most close connection is with the *Festuca rubra-Agrostis stolonifera-Potentilla anserina* grassland (MG11) and the more ruderal *Alopecurus geniculatus-Rorippa palustris* community (OV29). Similar suites of these inundation communities occur on the Shannon Callows in Ireland (Sýkora 1982b; Heery 1991) whilst comparable communities on even more fertile substrates are recorded from the Netherlands (Schaminée and others 1996; Sýkora 1982a) and Belgium (Sýkora 1982c).

Floristic table for MG13 *Agrostis stolonifera-Alopecurus geniculatus* inundation grassland (nodum 3).

Values are % frequency of occurence and, in parathesis, the maximum % cover achieved in the sampled quadrats, using visual estimates of percentage cover.

	% frequency	Maximum % cover
Community constants		
Agrostis stolonifera	98	(95)
Glyceria fluitans	89	(70)
Alopecurus geniculatus	89	(65)
Ranunculus repens	83	(85)
Poa trivialis	79	(60)
Species at Constancy II and III		
Polygonum amphibium	59	(60)
Cardamine pratensis	43	(5)
Juncus effusus	34	(40)
Eleocharis palustris	33	(80)
Trifolium repens	33	(20)
Juncus articulatus	26	(25)
Lolium perenne	24	(40)
Holcus lanatus	24	(40)
Senecio aquaticus	21	(14)
Associate species		
Rumex crispus	20	(8)
Carex hirta	18	(75)
Phleum pratense	17	(5)
Potentilla anserina	16	(18)
Galium palustre	14	(8)
Phalaris arundinacea	14	(25)
Deschampsia cespitosa	13	(30)
Ranunculus flammula	13	(12)
Caltha palustris	11	(20)
Anthoxanthum odoratum	11	(25)
Leontodon autumnalis	10	(5)
Oenanthe fistulosa	10	(20)
Carex disticha	9	(40)
Festuca pratensis	9	(10)
Carex nigra	8	(40)
Ranunculus acris	8	(5)
Cynosurus cristatus	8	(18)
Alopecurus pratensis	7	(3)
Myosotis laxa caespitosa	6	(3)
Rumex acetosa	6	(2)
Calliergon cuspidatum	6	(25)
Trifolium pratense	6	(2)
Bromus racemosus	5	(8)
Number of samples	160	
Mean species/sample	10.8	

Additional species recorded in <5% of quadrat samples but omitting those with a single occurrence.

Agrostis canina	*Bromus commutatus*	*Bromus hordeaceus*	*Carex acuta*	*Carex acutiformis*
Carex riparia	*Cerastium fontanum*	*Eleocharis uniglumis*	*Elymus repens*	*Festuca arundinacea*
Festuca rubra	*Filipendula ulmaria*	*Glyceria maxima*	*Juncus acutiflorus*	*Juncus inflexus*
Lysimachia nummularia	*Myosotis scorpioides*	*Plantago lanceolata*	*Plantago major*	*Rhinanthus minor*
Rorippa islandica	*Rumex conglomeratus*	*Rumex obtusifolius*	*Stellaria palustris*	*Taraxacum officinale agg.*
Trifolium dubium	*Veronica catenata*			

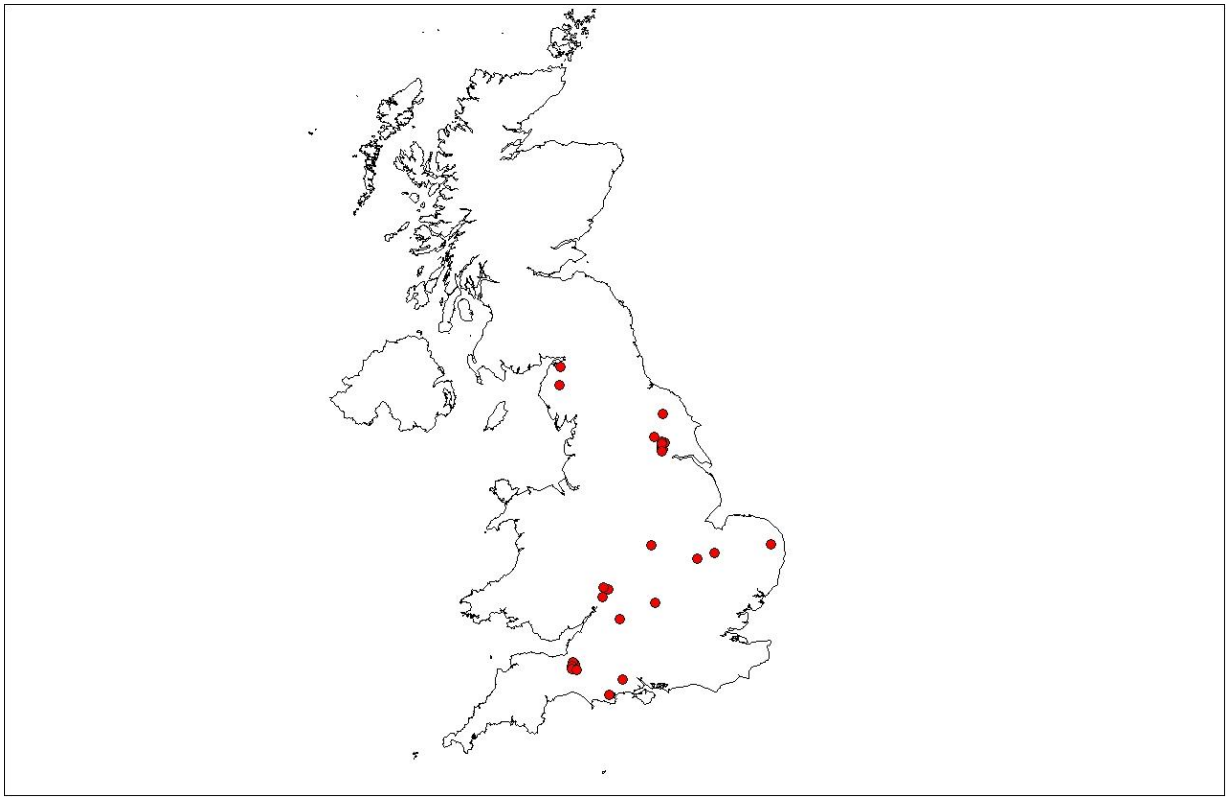


Figure 10. Distribution of MG13 *Agrostis stolonifera-Alopecurus geniculatus* inundation grassland

Plate 2. MG13 *Agrostis stolonifera-Alopecurus geniculatus* inundation grassland at Wheldrake Ings, Yorkshire.

MG15 Alopecurus pratensis-Poa trivialis-Cardamine pratensis grassland (Noda 1 and 10)

Synonomy

Cuckoo flower grassland (Rodwell 2006).

Constant species

Alopecurus pratensis, Poa trivialis, Cardamine pratensis, Agrostis stolonifera, Ranunculus repens.

Rare/scarce species

Oenanthe silaifolia.

Vulnerable species

Oenanthe fistulosa, Ranunculus flammula, Stellaria palustris.

Near Threatened species

Lychnis flos-cuculi (Silene flos-cuculi), Senecio aquaticus, Succisa pratensis, Triglochin palustris, Valeriana officinalis.

Foreword

Even though there is general agreement that the noda represent a new and distinctive vegetation type this proposed new community has yet to be formally accepted by the FMP working group and the standing committee. Various views have been expressed as to its correct placement. Some think that it should be incorporated into MG6 despite neither *Lolium* nor *Cynosurus* being constants. The problem would be simplified were there to be a more general acceptance of the reality that *Lolium perenne-Alopecurus pratensis-Festuca pratensis* grassland (MG7C) is a community in its own right and not part of the unwieldly compendium of MG7.

This community was first recognised by Gowing and others 2002 as a *Filipendula*-rich expression of MG7C and has been more recently included as a potential vegetation type of conservation value by Jefferson and others 2014.

Physiognomy

The community comprises swards of moderate species richness which are dominated by robust grasses of which *Alopecurus pratensis* is the most prominent with *Phleum pratense, Festuca pratensis, Deschampsia cespitosa* and *Bromus racemosus* making varied, but often substantial, contributions. The sward is usually dense with a lower storey of *Agrostis stolonifera* and *Ranunculus repens*. Tall forbs, of which the most prevalent are *Ranunculus acris* and *Filipendula ulmaria,* also feature together with high frequencies of *Cardamine pratensis, Leontodon autumnalis* and *Silaum silaus* whilst the normally rare *Oenanthe silaifolia* is occasionally frequent. Analysis of the available data suggest that the community be partitioned into a pair of subcommunities.

Subcommunities

1). Agrostis stolonifera subcommunity (MG15a)

Species characteristic of the subcommunity; *Elytrigia repens* and *Alopecurus geniculatus*.

This is the more flood tolerant unit occurring on the more fertile substrates.
In addition to the subcommunity constants, preferential species include *Rumex crispus, Phalaris arundinacea* and *Oenanthe silaifolia*. Some species more commonly associated with *Caltha* meadows (MG8) also occur occasionally, including *Caltha palustris, Lysimachia nummularia, Carex disticha* and *Carex acuta.*

This sub-community is a prominent component of the vegetation of such diverse sites as Clifton Ings (Yorkshire), Upton Ham (Worcestershire), Upham Meadow (Gloucestershire), Ashleworth Ham (Gloucestershire) and the more inundation prone parts of Portholme (Cambridgeshire). It occupies soils frequently inundated for long periods, placing it hydrologically closer to MG8 than MG4 floodplain meadow, which it can replace, at least temporarily, following periods of prolonged spring and summer flooding. It also has affinities with MG13 inundation grassland.

2). Lolium perenne-Ranunculus acris subcommunity (MG15b)

Species characteristic of the subcommunity; *Lolium perenne, Festuca pratensis, Ranunculus acris, Filipendula ulmaria*.

This is a more typical *Alopecurion* sward and the newly recognised nodum resembles closely that originally described by Gowing and others 2002. It appears to be a more permanent unit than is the *Agrostis stolonifera* subcommunity and forms a long-term component of the floodplain meadow assemblage.

This subcommunity is more common than the *Agrostis stolonifera* subcommunity. It is heavily grass dominated with, in addition to *Lolium perenne* and *Festuca pratensis, Cynosurus cristatus, Holcus lanatus, Anthoxanthum odoratum* and *Phleum pratense* all constant. MG4 species such as *Silaum silaus* and *Sanguisorba officinalis* occur occasionally. It is particularly well developed on the Somerset Levels at Southlake, King's Sedgemoor and West Sedgemoor; in the Midlands, for instance on the Lugg Meadows in Herefordshire and, to the north, on East Cottingwith Ings in Yorkshire.
Both subcommunities favour mineral soils and both are typically cut for hay rather than pastured.

Habitat

The *Agrostis stolonifera* subcommunity is the more flood-tolerant unit. It occurs on more fertile substrates than does the *Lolium perenne* subcommunity and is almost totally restricted to alluvial mineral soils. The *Lolium perenne-Ranunculus acris* subcommunity is more widespread occurring on deep peat and alluvium over peat as well as on alluvial mineral profiles.

The community occupies drier zones of the hydrological gradient than does the original MG7C of Rodwell 1992 or typical swards of the *Cynosurion* as typified by MG6.

Zonation and succession

Gowing and others 2002 recognised a nodum which represented swards strongly dominated by the robust grasses *Alopecurus pratensis* and *Festuca pratensis* often with *Bromus racemosus, Phleum pratense* and some *Deschampsia cespitosa.* This new nodum was provisionally labelled 'MG7C, species-rich variant' but it was felt that it was worthy of elevation to community level as an association of the *Alopecurion* alliance. The current analysis has recorded similar vegetation at more than 50 sites.

This *Alopecurus* community occurs on substrates of similar fertility to those supporting the *Agrostis-Carex* community (MG14) but which are less frequently inundated. There appears to be no inter-relationship between the two vegetation types. The proposed MG15 is however closely associated with the less species rich forms of MG4 *Alopecurus pratensis-Sanguisorba officinalis* grassland and the two form a pair of 'accordian' communities tending to replace one another on suitable sites during alternating series of wetter and drier seasons. This interplay is particularly apparent on North Meadow, Cricklade and East Cottingwith Ings on the Derwent, Yorkshire.

Affinities

The proposed MG15 is clearly associated with other *Alopecurion* swards from the Netherlands Schaminée 1996 though tending to occur on more fertile soils.

Floristic table for MG15 *Alopecurus pratensis-Poa trivialis-Cardamine pratensis* grassland.

(a) *Agrostis stolonifera* subcommunity *(b) Lolium perenne-Ranunculus acris* subcommunity, MG15 (combined data for a and b).

Values are % frequency of occurence and, in parathesis, the maximum % cover achieved in the sampled quadrats, using visual estimates of percentage cover.

	a		**b**		**MG15**	
Community constants						
Poa trivialis	**88**	(70)	**82**	(60)	**84**	(70)
Agrostis stolonifera	**93**	(85)	**72**	(99)	**80**	(99)
Alopecurus pratensis	**85**	(80)	**76**	(70)	**79**	(80)
Lolium perenne	**56**	(60)	**84**	(80)	**73**	(80)
Cardamine pratensis	**63**	(6)	**66**	(10)	**65**	(10)
Ranunculus repens	**65**	(90)	**63**	(70)	**64**	(90)
Ranunculus acris	**33**	(18)	**83**	(65)	**64**	(65)
Subcommunity a preferentials						
Polygonum amphibium	**57**	(22)	**42**	(30)	**48**	(30)
Alopecurus geniculatus	**49**	(60)	**9**	(20)	**25**	(60)
Rumex crispus	**36**	(25)	**7**	(6)	**18**	(25)
Elymus repens	**31**	(85)	**8**	(55)	**17**	(85)
Carex disticha	**21**	(65)	**16**	(65)	**18**	(65)
Subcommunity b preferentials						
Anthoxanthum odoratum	**7**	(12)	**76**	(30)	**49**	(30)
Rumex acetosa	**30**	(12)	**76**	(91)	**58**	(91)
Trifolium repens	**25**	(40)	**54**	(35)	**43**	(40)

Taraxacum officinale agg.	**22**	(5)	**55**	(15)	**42**	(15)
Holcus lanatus	**11**	(48)	**50**	(60)	**35**	(60)
Cynosurus cristatus	**6**	(10)	**45**	(35)	**30**	(35)
Phleum pratense	**26**	(40)	**44**	(48)	**37**	(48)
Filipendula ulmaria	**24**	(80)	**44**	(85)	**37**	(85)
Festuca pratensis	**25**	(40)	**42**	(25)	**35**	(40)
Plantago lanceolata	**9**	(35)	**39**	(27)	**27**	(35)
Festuca rubra	**7**	(25)	**37**	(40)	**25**	(40)
Deschampsia cespitosa	**18**	(30)	**29**	(55)	**25**	(55)
Trifolium pratense	**2**	(4)	**30**	(28)	**19**	(28)
Bromus racemosus	**5**	(8)	**27**	(35)	**18**	(35)
Agrostis capillaris	**4**	(75)	**27**	(70)	**18**	(75)

Associates

Leontodon autumnalis	**23**	(25)	**37**	(18)	**32**	(25)
Lathyrus pratensis	**15**	(45)	**31**	(15)	**24**	(45)
Hordeum secalinum	**24**	(50)	**24**	(40)	**24**	(50)
Carex acuta	**22**	(80)	**19**	(60)	**20**	(80)
Senecio aquaticus	**10**	(38)	**18**	(10)	**15**	(38)
Calliergon cuspidatum	**6**	(20)	**18**	(65)	**13**	(65)
Silaum silaus	**10**	(20)	**14**	(18)	**13**	(20)
Centaurea nigra	**1**	(3)	**18**	(30)	**11**	(30)
Bromus commutatus	**6**	(10)	**14**	(12)	**11**	(12)
Lysimachia nummularia	**18**	(30)	**6**	(18)	**11**	(30)
Phalaris arundinacea	**20**	(70)	**5**	(8)	**11**	(70)
Vicia cracca	**8**	(45)	**13**	(25)	**11**	(45)
Sanguisorba officinalis	**9**	(70)	**11**	(78)	**10**	(78)
Carex nigra	**6**	(18)	**13**	(55)	**10**	(55)
Oenanthe silaifolia	**19**	(35)	**5**	(8)	**10**	(35)
Glyceria fluitans	**12**	(50)	**8**	(25)	**9**	(50)
Juncus effusus	**5**	(30)	**12**	(30)	**9**	(30)
Cerastium fontanum	**3**	(2)	**13**	(5)	**9**	(5)
Carex hirta	**6**	(12)	**10**	(15)	**9**	(15)
Brachythecium rutabulum	**1**	(3)	**13**	(30)	**8**	(30)
Caltha palustris	**11**	(50)	**6**	(40)	**8**	(50)
Oenanthe fistulosa	**12**	(6)	**6**	(12)	**8**	(12)
Galium palustre	**11**	(12)	**4**	(15)	**7**	(15)
Myosotis laxa caespitosa	**12**	(3)	**3**	(4)	**7**	(4)
Agrostis canina	**3**	(16)	**8**	(45)	**6**	(45)
Trifolium dubium	**2**	(5)	**9**	(10)	**6**	(10)
Eleocharis palustris	**11**	(65)	**3**	(68)	**6**	(68)
Cirsium arvense	**3**	(5)	**7**	(25)	**6**	(25)
Rhinanthus minor	**3**	(2)	**6**	(25)	**5**	(25)
Equisetum palustre	**7**	(20)	**4**	(10)	**5**	(20)
Achillea ptarmica	**6**	(40)	**2**	(5)	**4**	(40)
Carex riparia	**1**	(20)	**5**	(45)	**3**	(45)
Bellis perennis	**.**	.	**6**	(4)	**4**	(4)

Number of samples	**482**		**758**
Mean species/sample	**12.6**		**17.8**

Additional species recorded in <5% of quadrat samples, species with only a single occurrence omitted.

Achillea ptarmica	*Ajuga reptans*	*Allium vineale*	*Arrhenatherum elatius*	*Bellis perennis*
Bidens tripartita	*Bromus hordeaceus*	*Calystegia sepium*	*Carex acutiformis*	*Carex demissa*
Carex distans	*Carex flacca*	*Carex otrubae*	*Carex ovalis*	*Carex panicea*
Carex riparia	*Cirsium dissectum*	*Cirsium palustre*	*Cirsium vulgare*	*Dactylis glomerata*
Drepanocladus aduncus	*Eleocharis uniglumis*	*Epilobium hirsutum*	*Equisetum arvense*	*Equisetum fluviatile*
Eurhynchium praelongum	*Festuca arundinacea*	*Festulolium loliaceum*	*Fritillaria meleagris*	*Galium aparine*
Geranium dissectum	*Geranium molle*	*Geum rivale*	*Glechoma hederacea*	*Glyceria maxima*
Heracleum sphondylium	*Hypochoeris radicata*	*Iris pseudacorus*	*Juncus acutiflorus*	*Juncus articulatus*
Juncus conglomeratus	*Juncus inflexus*	*Juncus subnodulosus*	*Leontodon hispidus*	*Leontodon taraxacoides*
Lotus corniculatus	*Lotus uliginosus*	*Lychnis flos-cuculi*	*Lythrum salicaria*	*Mentha aquatica*
Myosotis arvensis	*Myosotis scorpioides*	*Myosotis seedling/sp*	*Ophioglossum vulgatum*	*Phleum bertolonii*
Phragmites australis	*Plantago major*	*Poa annua*	*Poa pratensis*	*Polygonum bistorta*
Polygonum persicaria	*Potentilla anserina*	*Potentilla reptans*	*Prunella vulgaris*	*Ranunculus bulbosus*
Ranunculus ficaria	*Ranunculus flammula*	*Ranunculus sceleratus*	*Rhynchostegium confertum*	*Rorippa islandica*
Rorippa sylvestris	*Rumex conglomeratus*	*Rumex obtusifolius*	*Stellaria graminea*	*Stellaria palustris*
Succisa pratensis	*Symphytum officinale*	*Thalictrum flavum*	*Trifolium fragiferum*	*Triglochin palustre*
Trisetum flavescens	*Urtica dioica*	*Valeriana officinalis*	*Veronica serpyllifolia*	*Vulpia bromoides*

Figure 11a. MG15a *Alopecurus pratensis-Poa trivialis-Cardamine pratensis* grassland, *Agrostis stolonifera* subcommunity

Plate 3. *Oenanthe silaifolia* is a rare/scarce species found in MG15a.

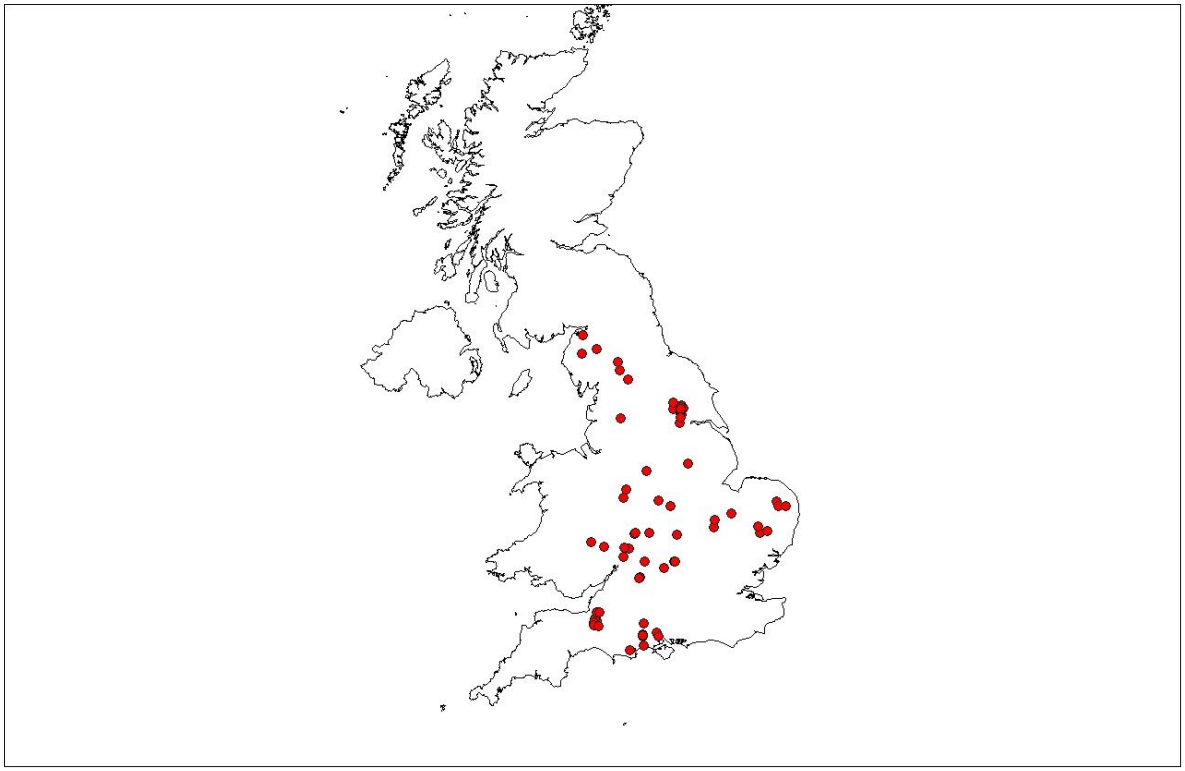


Figure 11 b. MG15b *Alopecurus pratensis-Poa trivialis-Cardamine pratensis* grassland, *Lolium perenne-Ranunculus acris* subcommunity.

Plate 4. MG15b *Alopecurus pratensis-Poa trivialis-Cardamine pratensis* grassland, *Lolium perenne-Ranunculus acris* subcommunity.

MG14 Carex nigra-Agrostis stolonifera-Senecio aquaticus grassland (noda 4 and 7).

Synonomy

Agrostis stolonifera-Carex spp. grassland (Cox and Leach 1996).

Ranunculo-Senecionetum aquatici s.a. *juncetosum articulati* Schaminée and Weeda 1996

Constant Species

Agrostis stolonifera, Carex nigra, Senecio aquaticus, Ranunculus repens, Cardamine pratensis, Polygonum amphibium, Poa trivialis.

Rare/Scarce species

None

Vulnerable species

Oenanthe fistulosa, Ranunculus flammula, Stellaria palustris.

Near Threatened species

Lychnis flos-cuculi (Silene flos-cuculi), Senecio aquaticus, Hydrocotyle vulgaris

Foreword

Extensive surveys of the Somerset Levels and Moors in the early 1990's provided quadrat data that could not be accommodated into any of the grassland, mire or swamp communities of the published NVC (Cox 1995; Prosser and Wallace 1993). Collation of the data from two sites on the Levels and Moors resulted in the recognition of a new community which was given the working title of *Agrostis stolonifera-Carex spp.* grassland, Ag-Cx for short (Cox and Leach 1996). This work identified 13.7 ha (c.5%) of the Somerset Levels and Moors NNR as being of the Ag-Cx community and a further 37.9ha as intermediate between it and other communities, most notably MG8.

Work by Prosser and Wallace (1996, 2006) at West Sedgemoor on the Somerset Levels mapped extensive areas that could be placed into this new Ag-Cx unit and also showed an increase in its extent from c 25 ha in 1996 to over 50 ha in 2006.

The first sites to be identified were concentrated on the peatlands of the Somerset Level and Moors. As the NVC became more widely applied to sites of conservation importance, more data started to appear and the question arose as to whether the Ag-Cx should be placed within an expanded MG8 or remain as its own unit. To resolve this question, a larger sample was required from a wider geographic range. The fact that Ag-Cx usually scores highest in MATCH for the SD17 dune slack community assisted in the selection of sites and quadrats to be included in this expanded analysis.

Work by Gowing and others (2002) identified a nodum with close affinities to the Ag-Cx unit, which was placed at the wettest end of the hydrological gradient for sites that still supported grassland communities, rather than mires or swamps. These data formed the

starting point for the reappraisal of the community, supplemented by data collated from other surveys, most notably on the Hampshire Avon, and the current scoping exercise.

Physiognomy

In its physiognomy and floristics the *Agrostis-Carex* grassland appears to have elements drawn from several of the communities included in the existing NVC scheme, in particular *Cynosurus-Caltha* (MG8), *Agrostis-Alopecurus geniculatus* inundation grassland (MG13) and vegetation dominated by mixtures of small grasses and herbs along the banks of streams and ditches, the S22, *Glyceria fluitans* water-margin vegetation (Rodwell 1995).

Stands from the wetter end of the hydrological gradient in which *Agrostis-Carex* is positioned resemble a species-rich form of MG13 in the frequency of *Polygonum amphibium, Eleocharis palustris* and *Glyceria fluitans,* but differ in the prevalence of *Cardamine pratensis.* A more general distinguishing feature which separates the community from both MG13 and S22 is the constancy of *Carex nigra* and the frequent occurrence of a number of other sedge species including *Carex disticha, Carex hirta, Carex panicea* and, occasionally *Carex riparia* and *Carex acuta.* This prevalence of sedges together with a poor representation of *Cynosurus cristatus, Festuca rubra* and *Holcus lanatus* also serves to separate *Agrostis -Carex* grassland in general from the subcommunities of *Cynosurus-Carex panicea-Caltha* grassland (MG8).

Habitat

The work of Gowing and others (2002) placed Ag-Cx grassland, mainly from the Somerset Levels, at the wettest end of the hydrological gradient found on floodplain grasslands, being more or less confined to sites that experienced virtually no soil-drying stress, but which were subject to prolonged periods of aeration stress. The community is not tolerant of prolonged periods of flooding, the high aeration stress being largely due to consistently high water table levels throughout the year. The aeration stress of the Ag-Cx unit is higher than any of the other grassland communities described from the floodplain-meadow habitat. Only the swamps, notably S22, and the newly proposed MG16, exceed it.

Other work on the Somerset Levels (Wallace and Prosser 2006) confirmed its distribution to be limited to areas where the water table is consistently close to the surface.

Soils are generally infertile, especially compared to the other communities at the wetter end of the hydrological gradient which receive high levels of nutrients through sediment deposition from river flood waters. The MG13 and MG16 communities, also species poor associations, tend to occupy such sites of higher soil fertility. The MG14 community is rarely found on alluvial profiles, being most common on the ditch drained peats of the Somerset Levels and other sites with humic profiles that are kept permanently moist through shallow water tables rather than inundation from river floodwaters; this may in part account for the generally lower soil fertility values recorded in the Ag-Cx community.

Since soils are wet throughout much of the year, whether the site is cut for hay or grazed varies on an annual basis dependent on variation in the rainfall patterns from year to year.

The damper, Typical subcommunity (MG14a), is more usually managed as pasture, whilst the drier, *Anthoxanthum odoratum* subcommunity (MG14b) is more frequently managed for hay.

Subcommunities

1). Typical subcommunity (MG14a).

Damper stands were described by Cox and Leach (1996) as having the appearance of species-rich MG13 or S22. They were low, grass-dominated, swards with occasionally frequent small sedges.

The Typical subcommunity has all the community constants well represented though *Carex nigra, Cardamine pratensis* and *Poa trivialis* are generally less frequent than in the drier *Anthoxanthum odoratum* subcommunity. The Typical subcommunity is characterised by a higher frequency of more flood tolerant species, most notably *Glyceria fluitans* and *Eleocharis palustris* which are joined by occassional *Ranunculus flammula, Juncus articulatus* and *Oenanthe fistulosa.* In previous mapping exercises stands were sometimes referred to as an *Eleocharis palustris* variant of the MG8 community. In the early spring patches of *Caltha palustris* are not uncommon.

2). Anthoxanthum odoratum-Trifolium repens subcommunity (MG14b).

All the community constants are well represented in the *Anthoxanthum odoratum-Trifolium repens* subcommunity. The damp species charcterising the*Typical* subcommunity are genreally scarce but the species richness of the unit is enhanced by a suite of species less tolerant of prolonged waterlogging. These include, in addition to *Anthoxanthum odoratum*, the grasses *Cynosurus cristatus, Lolium perenne, Holcus lanatus, Alopecurus pratensis* and *Festuca pratensis.* A suite of characteristic herbs add to the diversity of what, in mid-summer, may resembles a damp hay meadow. In addition to *Trifolium repens* there is often some *Ranunculus acris, Plantago lanceolata, Rumex acetosa, Lychnis flos-cuculi, Leontodon autumnalis* and *Taraxacum officinale.* Taller forbs occasionally add to the 'hay meadow' appearance with *Filipendula ulmaria* frequent and *Centaurea nigra* occasional. There is often an understorey of the moss *Calliergonella cuspidata.*

Zonation and succession

The position of the *Agrostis-Carex* community at the wettest end of the hydrological gradient for floodplain meadow grassland communities often places it at the end point of grassland vegetation succession within the floodplain meadows.

It naturally occupies damper ground than any of the subcommunities of MG8 and transitions to it from the drier MG8b, often via the sedge-dominated MG8c, have been recorded from West Sedgemoor on the Somerset Levels (Wallace and Prosser 2007). Less frequently it may arise through raised water levels in other mesotrophic grassland communties, most notably MG9 and, less frequently, MG13 on less fertile soil profiles. There is evidence of an oscillation between the Ag-Cx grassland and M23a on the Somerset Levels (Prosser and Wallace 2008); if prolonged flooding and poaching prevent hay cutting or rush topping the resultant spread of rushes may cause shading and litter accumulation and an associated loss of species diversity. Often the low-growing forbs associated with the MG8c unit persist at low density such that a return to more favourable hydrological conditions and rush control can result in recovery to a more species rich sward of MG14.

On more fertile soil profiles there is evidence of damp, species poor MG6b being transformed into MG14 with the subcommunities of MG8 as intermediate stages (Prosser and Wallace 2008).

On the most fertile soil profiles prolonged inundation tends to result in different successional stages. The drier grassland associations, notably MG7 and the new MG15, tend towards MG13 and the newly proposed MG16. If inundation continues long into the

spring then inundation communities, mainly of the Bidention (OV29-32) may establish, this sequence is rare on sites supporting the MG14 community due to its generally less fertile soils.

Distribution

The heartland of the *Carex nigra-Agrostis stolonifera-Senecio aquaticus* community is still to be seen on the Somerset Levels and Moors, with substantial areas recorded at West Sedgemoor, Kings Sedgemoor, Moorlinch, Southlake, Tadham and Tealham Moors. The other major concentration of sites are along the Hampshire /Dorset Avon, and on the Wareham Meadows.

Smaller, more fragmented, stands occur principally in the west of England, with a few outliers in the east in Suffolk and in Yorkshire along the Derwent Ings.

Affinities

The *Agrostis -Carex* community clearly belongs within the *Calthion* alliance and has close affinities with the revised MG8 though it differs in its occupancy of generally more fertile substrates. In terms of its position on the hydrological gradient, the drier *Anthoxanthum odoratum* subcommunity is very close to both the Typical and the *Carex nigra-Ranunculus flammula* units of the proposed *Cynosurus cristatus-Carex panicea-Caltha palustris* community. The wetter, Typical subcommunity is closer to MG13 in the fertility of substrates that support it and is allied to the Dutch counterparts of MG8 in terms of its Ellenberg F values. In their original description of *Agrostis-Carex* grassland Cox and Leach (1996) note the similarity of their community to the *Senecioni-Brometum racemosi* described from the Netherlands and Germany by Tűxen and Preising (1951). Modern nomenlature has changed and this community is now recognised as the *Ranunculo-Seneconetum aquatici* Van Schaik ex. Schaminée and Weeda 1996. The Dutch authors recognise two subcommunities of which the *Carex panicea* unit is closest to the *Agrostis-Carex community* though the driest stands of *Agrostis-Carex* in the series have some affinities with the *Juncus articulatus* subcommunity of Schaminee and others 1996.

These communities appear to share a western, Altantic, heartland. Similar *Agrostis stolonifera* dominated swards from inland flood meadows in Continental Europe appear to be more closely allied to communities of the *Potentillion* alliance and in particular to an equivalent of the British *Agrostis stolonifera-Festuca rubra-Potentilla anserina* inundation grassland (MG11).

Floristic table for MG14: *Carex nigra-Agrostis stolonifera-Senecio aquaticus* grassland.

(a) Typical subcommunity, (b) *Anthoxanthum odoratum-Trifolium repens* subcommunity, MG14 (a and b combined).

Values are % frequency of occurence and, in parathesis, the maximum % cover achieved in the sampled quadrats, using visual estimates of percentage cover.

	a		**b**		**MG14**	
Community constants						
Agrostis stolonifera	**92**	*(95)*	**87**	*(70)*	**89**	*(95)*
Ranunculus repens	**87**	*(55)*	**88**	*(70)*	**87**	*(70)*
Cardamine pratensis	**68**	*(4)*	**83**	*(7)*	**77**	*(7)*
Carex nigra	**66**	*(85)*	**82**	*(65)*	**75**	*(85)*
Senecio aquaticus	**59**	*(20)*	**63**	*(15)*	**62**	*(20)*

Poa trivialis	**51**	*(40)*	**64**	*(45)*	**58**	*(45)*
Polygonum amphibium	**60**	*(10)*	**51**	*(6)*	**55**	*(10)*
Species preferential to subcommunity a						
Glyceria fluitans	**67**	*(35)*	**39**	*(28)*	**51**	*(35)*
Eleocharis palustris	**51**	*(60)*	**18**	*(30)*	**32**	*(60)*
Ranunculus flammula	**47**	*(25)*	**32**	*(10)*	**39**	*(25)*
Juncus articulatus	**36**	*(50)*	**19**	*(22)*	**26**	*(50)*
Oenanthe fistulosa	**30**	*(20)*	**11**	*(8)*	**19**	*(20)*
Species preferential to Subcommunity b						
Anthoxanthum odoratum	**22**	*(10)*	**95**	*(40)*	**64**	*(40)*
Trifolium repens	**38**	*(25)*	**71**	*(25)*	**57**	*(25)*
Calliergon cuspidatum	**43**	*(50)*	**71**	*(65)*	**59**	*(65)*
Cynosurus cristatus	**18**	*(15)*	**54**	*(30)*	**38**	*(30)*
Ranunculus acris	**17**	*(8)*	**50**	*(15)*	**36**	*(15)*
Rumex acetosa	**10**	*(8)*	**43**	*(5)*	**28**	*(8)*
Holcus lanatus	**34**	*(18)*	**52**	*(30)*	**44**	*(30)*
Plantago lanceolata	**9**	*(15)*	**39**	*(16)*	**26**	*(16)*
Filipendula ulmaria	**15**	*(20)*	**38**	*(40)*	**28**	*(40)*
Lolium perenne	**13**	*(20)*	**33**	*(20)*	**24**	*(20)*
Leontodon autumnalis	**20**	*(7)*	**52**	*(18)*	**38**	*(18)*
Festuca pratensis	**21**	*(16)*	**47**	*(25)*	**36**	*(25)*
Deschampsia cespitosa	**16**	*(35)*	**29**	*(30)*	**23**	*(35)*
Phleum pratense	**9**	*(15)*	**30**	*(12)*	**21**	*(15)*
Alopecurus pratensis	**9**	*(8)*	**29**	*(15)*	**21**	*(15)*
Taraxacum officinale agg.	**7**	*(3)*	**27**	*(5)*	**18**	*(5)*
Lychnis flos-cuculi	**7**	*(5)*	**29**	*(6)*	**19**	*(6)*
Centaurea nigra	**.**	*(1)*	**12**	*(20)*	**7**	*(20)*
Associate species						
Carex disticha	**37**	*(60)*	**41**	*(60)*	**39**	*(60)*
Juncus effusus	**25**	*(40)*	**41**	*(85)*	**34**	*(85)*
Galium palustre	**29**	*(15)*	**35**	*(10)*	**33**	*(15)*
Caltha palustris	**38**	*(30)*	**28**	*(65)*	**32**	*(65)*
Myosotis laxa caespitosa	**24**	*(25)*	**20**	*(12)*	**22**	*(25)*
Alopecurus geniculatus	**17**	*(65)*	**22**	*(18)*	**20**	*(65)*
Carex panicea	**9**	*(22)*	**19**	*(30)*	**15**	*(30)*
Festuca rubra	**14**	*(20)*	**13**	*(40)*	**14**	*(40)*
Carex hirta	**15**	*(20)*	**11**	*(20)*	**13**	*(20)*
Potentilla anserina	**18**	*(18)*	**7**	*(22)*	**12**	*(22)*
Trifolium pratense	**6**	*(4)*	**17**	*(25)*	**12**	*(25)*
Festuca arundinacea	**12**	*(65)*	**7**	*(7)*	**9**	*(65)*
Rumex crispus	**14**	*(5)*	**4**	*(2)*	**8**	*(5)*
Bromus racemosus	**6**	*(12)*	**10**	*(10)*	**8**	*(12)*
Cerastium fontanum	**9**	*(1)*	**8**	*(2)*	**8**	*(2)*
Lysimachia nummularia	**8**	*(45)*	**8**	*(35)*	**8**	*(45)*
Agrostis capillaris	**1**	*(3)*	**13**	*(18)*	**8**	*(18)*
Carex riparia	**6**	*(20)*	**8**	*(20)*	**7**	*(20)*
Mentha aquatica	**11**	*(40)*	**4**	*(5)*	**7**	*(40)*
Juncus acutiflorus	**7**	*(20)*	**7**	*(92)*	**7**	*(92)*

Glyceria maxima	**11**	*(12)*	**3**	*(17)*	**7**	*(17)*
Agrostis canina	**5**	*(35)*	**8**	*(35)*	**7**	*(35)*
Phalaris arundinacea	**12**	*(55)*	**2**	*(4)*	**6**	*(55)*
Thalictrum flavum	**3**	*(18)*	**8**	*(28)*	**6**	*(28)*
Carex acuta	**11**	*(65)*	**2**	*(15)*	**6**	*(65)*
Triglochin palustre	**4**	*(2)*	**6**	*(5)*	**5**	*(5)*
Eleocharis uniglumis	**4**	*(20)*	**5**	*(15)*	**5**	*(20)*
Cirsium dissectum	**1**	*(28)*	**7**	*(30)*	**4**	*(30)*
Juncus inflexus	**7**	*(18)*	**2**	*(10)*	**4**	*(18)*
Equisetum palustre	**5**	*(5)*	**3**	*(4)*	**4**	*(5)*
Lotus uliginosus	**6**	*(15)*	**2**	*(3)*	**4**	*(15)*
Myosotis scorpioides	**6**	*(5)*	**2**	*(5)*	**4**	*(5)*
Number of samples	**245**		**320**			
Mean species/sample	**14.8**		**18.2**			

Additional species recorded in <5% of quadrat samples, species with only a single occurrence omitted.

Bellis perennis	*Brachythecium rutabulum*	*Bromus commutatus*	*Bromus hordeaceus*	*Carex acutiformis*
Carex flacca	*Carex otrubae*	*Carex ovalis*	*Cirsium palustre*	*Climacium dendroides*
Dactylorhiza praetermissa	*Drepanocladus aduncus*	*Epilobium parviflorum*	*Equisetum fluviatile*	*Euphrasia nemorosa*
Festulolium loliaceum	*Galium uliginosum*	*Glyceria declinata*	*Hordeum secalinum*	*Hydrocotyle vulgaris*
Hypericum tetrapterum	*Iris pseudacorus*	*Juncus bufonius*	*Juncus bulbosus*	*Juncus conglomeratus*
Juncus subnodulosus	*Lathyrus pratensis*	*Lycopus europaeus*	*Montia fontana*	*Myosotis discolor*
Phragmites australis	*Plantago major*	*Poa pratensis*	*Polygonum hydropiper*	*Potentilla reptans*
Rhinanthus minor	*Rumex conglomeratus*	*Rumex sanguineus*	*Sagina procumbens*	*Sanguisorba officinalis*
Silaum silaus	*Stellaria alsine*	*Stellaria palustris*	*Taraxacum sect. vulgaria*	*Trifolium dubium*
Trifolium fragiferum	*Trifolium medium*	*Veronica beccabunga*	*Veronica serpyllifolia*	*Vicia cracca*

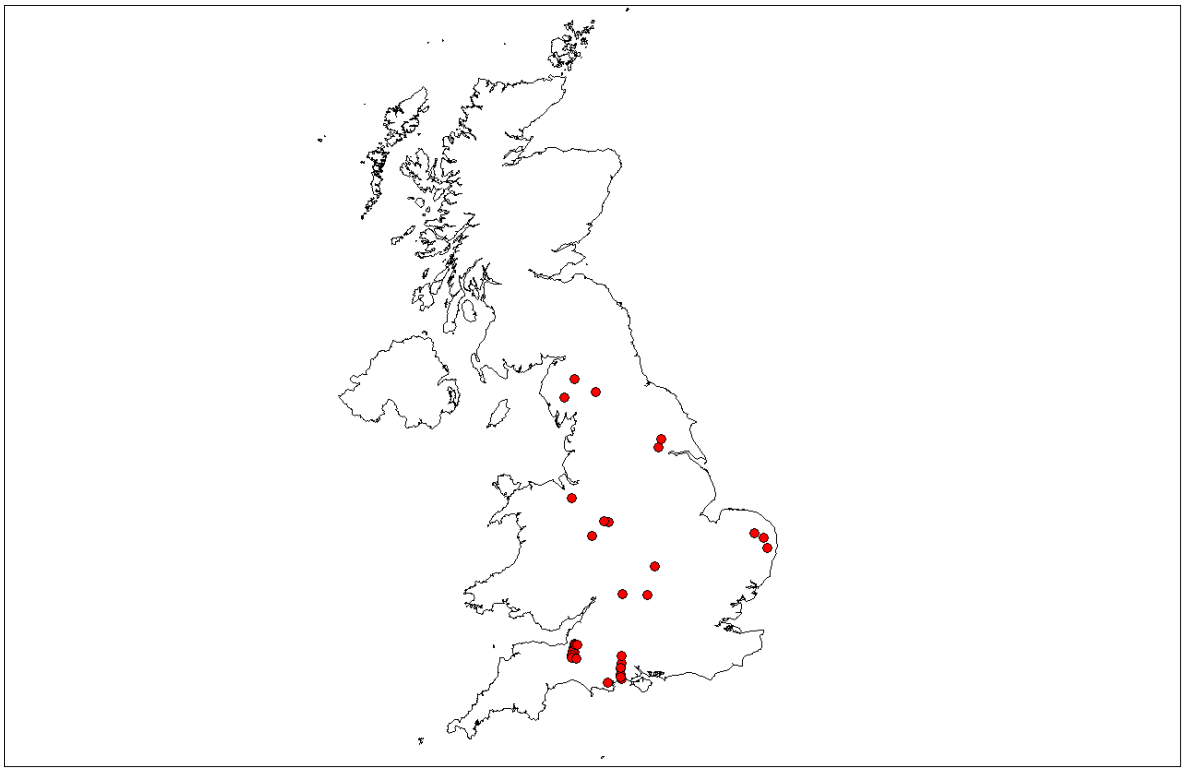


Figure 12 a. MG14a *Carex nigra-Agrostis stolonifera-Senecio aquaticus* grassland, Typical subcommunity

Plate 5. MG14a *Carex nigra-Agrostis stolonifera-Senecio aquaticus* grassland, Typical subcommunity. West Sedgemoor, Somerset.

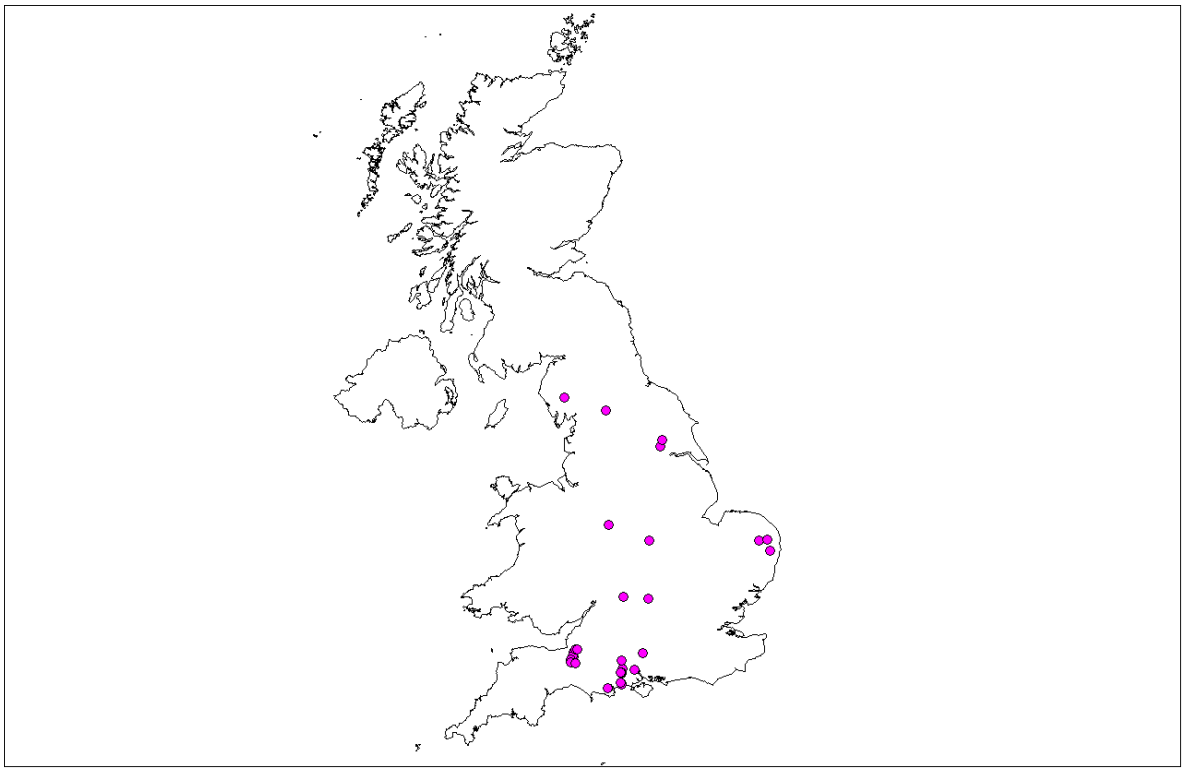


Figure 12 b. MG14b *Carex nigra-Agrostis stolonifera-Senecio aquaticus* grassland. *Anthoxanthum odoratum-Trifolium repens* subcommunity.

Plate 6. *MG14b Carex nigra-Agrostis stolonifera-Senecio aquaticus* grassland. *Anthoxanthum odoratum-Trifolium repens* subcommunity. West Sedgemoor, Somerset.

MG8 Cynosurus cristatus-Carex panicea-Caltha palustris grassland (Noda 5, 8, 9 and 11)

Synonymy

Water meadows Fream 1888, Duffey and others 1974, Ratcliffe 1977

Senecio-Brometum racemosi R.Tx and Preising 1951

Constant species

Anthoxanthum odoratum, Carex panicea, Cynosurus cristatus, Festuca rubra, Filipendula ulmaria, Holcus lanatus, Plantago lanceolata, Ranunculus acris.

Rare/scarce species

None

Vulnerable species

Oenanthe fistulosa, Parnassia palustris, Pinguicula vulgaris, Ranunculus flammula, Sagina nodosa, Stellaria palustris.

Near Threatened species

Carex echinata, Carex pulicaris, Briza media, Hydrocotyle vulgaris, Lychnis flos-cuculi (Silene flos-cuculi), Potentilla erecta, Potentilla palustris (Comarum palustre), Senecio aquaticus, Succisa pratensis, Triglochin palustris, Valeriana dioica, Valeriana officinalis.

Foreword

As early as 1998 Rodwell noted MG8 as being "one of the most poorly defined communities in the whole of the NVC" (Rodwell and others 1998).

This statement followed the extensive surveys of the Somerset Levels (Cox 1995, Prosser and Wallace 1992, 1995 and 1996) and the Derwent Ings (Benyon 1998) where damp, species rich, vegetation was widespread but fitted poorly to any of the published communities of the NVC. The work of Cox resulted in the definition of a new community, the *Carex nigra-Agrostis stolonifera-Senecio aquatica* grassland (Cox and Leach 1996); a relatively species-poor community in which small sedges, particularly *Carex nigra* and *Carex disticha,* occurred in a low sward dominated by *Agrostis stolonifera.* The work of Prosser and Wallace identified a series of relatively species-rich swards, in which small sedges were also often prevalent, and proposed four subtypes of the community relating to soil water tables and management, which were widespread on the Somerset Levels (Wallace and Prosser 2002).

Work by Gowing and others (2002), on the hydrological requirements of floodplain-meadow grasslands, including MG4, MG7 and MG8, identified much variation in the floristic composition of the communities of this habitat linked to hydrological regimes. This work led Rodwell and others (2007) to indicate that a thorough review of the communities of wetter meadows and pastures was essential.

Most of the work of Gowing and others was on lowland floodplains, but there is also evidence for considerable variation within vegetation loosely referable to MG8 in northern, and often more upland, meadows and pastures where the vegetation is not restricted to the floodplain (O'Reilly 2011).

Physiognomy

This is a species-rich community in which the role of the community constants varies considerably. The description in Rodwell (1992, p 79), though based on only a small sample of quadrats, still provides a good overview of the physiognomy of the community. The larger data set presented here does however allow for some refinement of his description.

The high frequency of sedge species helps separate this vegetation from the drier *Sanguisorba officinalis-Alopecurus pratensis* floodplain meadow (MG4), with *Carex flacca, Carex panicea, Carex nigra* and *Carex disticha* all characteristic.

Some swards are tall and grass dominated with *Holcus lanatus, Anthoxanthum odoratum, Cynosurus cristatus* and *Festuca rubr*a all prominent with occasional *Festuca pratensis* and an understorey of *Agrostis stolonifera* and small sedges which are most evident in the spring. In these stands tall, bulky, dicotyledons are very evident during the summer, notably *Filipendula ulmaria* and *Centaurea nigra*, and in some situations these are joined by *Sanguisorba officinalis, Succisa pratensis, Lotus corniculatus* and *Silaum silaus* forming a floristic and hydrological link to the MG4 community and usually managed for hay. In other situations the vegetation may have more the appearance of a fen meadow where the bulky dichotyledons are represented by *Lotus uliginosus, Cirsium palustre* and *Geum rivale* with an understory in which *Carex disticha* and mosses, most notably *Calliergonella cuspidatum,* are more prevalent. On damper soils the community may assume the appearance of a sedge lawn, especially in early summer, where the short sward of *Agrostis spp* is joined by abundant *Carex panicea* and frequent *Carex disticha* and *Carex demissa* together with a suite of low-growing forbs including *Ranunculus flammula, Hydrocotyle vulgaris, Leontodon hispidus,* and occasionally *Triglochin palustris* and *Danthonia decumbens.* Later in the season taller, fen meadow, species may add to the diversity with *Cirsium dissectum, Thalictrum flavum* and *Senecio aquaticus* locally prominent. In the north and west, the vegetation may take on a distinctive appearance in summer with the occasional prominence of *Trollius europaeus, Crepis paludosa, Alchemilla spp.* In these areas, often not on the floodplain itself but on infrequently cut adjacent banks there may be, early in the season, prominent *Myosotis discolor, Bellis perennis, Rhinanthus minor* and *Euphrasia species.*

Habitat

The community occurs on both alluvial and humic soils where hydrological conditions ensure a relatively constant water table throughout the year.

Extensive areas of the community are found on the alluvial floodplains of the Derwent Ings and the Avon and Itchen floodplains in Hampshire whilst on the Somerset Levels the ditch drained peat lands seem to provide ideal habitat for the community. Elsewhere in lowland England small patches are commonly found in areas of impeded drainage, often associated with humic accumulations, within other vegetation communities. To the north, where high precipitation and low evapotranspiration maintain constantly damp soil conditions the community expands upslope, off the floodplain. Usually as small stands on banks and around flushes it may also occupy extensive hill sides where soil conditions are favourable as seen at High Greenside (Cumbria), Great Blencow (Cumbria) and Swineley Pasture (Yorkshire).

The hydrological requirement (Gowing and others 2002) for the community is a constantly high water table throughout the year, without being subject to prolonged periods of flooding but conversely not experiencing extended periods of drought in the growing season. Where water table levels fluctuate considerably then grasses, notably *Deschampsia cespitosa,* may be at an advantage and conversion to MG9 *Holcus lanatus-Deschampsia cespitosa* coarse grassland may occur. If water lies too long into the growing season then the community may change to either the *Carex-Agrostis-Senecio* community (MG14) or to the *Agrostis stolonifera-Alopecurus geniculatus* inundation grassland (MG13). Where waterlogging occurs, often accompanied by stock poaching, infestations of rushes may lead to a transformation to the more species poor MG10, *Holcus lanatus-Juncus effusus* community, especially on more fertile soil profiles or to M23 rush mire on less fertile profiles.

In the sixteenth and seventeen centuries areas of MG8 were sometimes managed as water meadows, a system described in some detail in Rodwell (1992). It was a system of controlled flooding of meadows to provide nutrients, and to warm the soil, to encourage early spring growth of the vegetation. The more elaborate systems of leats and dams described by Rodwell were often accompanied by weeding of coarser and less palatable species. In the last 80 years or so, increased nutrient deposition due to the high nutrient loading in many river systems has resulted in some of the less species rich swards of the floodplains now being better accommodated within the MG7C and MG7D communities. These descriptions may however have led to the misconception that all MG8 sites were deliberately managed as water meadows and thus, many sites that were not so managed were discounted as potential sites for the community whilst restoration of many old water meadows to MG8 may not now be possible due to high fertility levels.

There are, however, a number of sites where the process of warping, or 'floating downwards' (Rodwell 1992) was still carried out until quite recently. At Mottey Meadows in Staffordshire, the series of internal open drains, now largely defunct, are evidence of the system employed there to ensure that the flood water was not retained on the meadows for too long into the spring, thus preventing the development of anoxic soil conditions. At Southlake, on the Somerset Levels, the practice of warping is still occasionally carried out.

Subcommunities

1). Sanguisorba officinalis (MG8a)

Sanguisorbo-Silaetum in part (Klapp ex. Hundt 1964 in part).

All the community constants are well represented in this subcommunity. Grasses are frequent and often provide high cover with *Anthoxanthum odoratum, Holcus lanatus, Cynosurus cristatus and Festuca rubra* all abundant. *Carex panicea* is more frequent than in the Typical and *Caltha-Bellis* subcommunities. Characteristic species that clearly differentiate this subcommunity from the other three include frequent, and often abundant, tall dichotyledons including *Sanguisorba officinalis, Centaurea nigra, Succisa pratensis, Lotus corniculatus* and *Leucanthemum vulgare.* It is the only subcommunity in which *Juncus acutiflorus* and *Carex acutiflorus* make significant contributions, whilst *Silaum silaus, Stachys officinalis* and *Leucanthemum vulgare* have their only representation here.

2). Typical (MG8b)

Lolio-Cynosuretum; Loletosum uliginosi Braun-Blanquet et. De Leeuw ex. Tűxen 1937.

As the name implies this subcommunity has few diagnostic species. In contrast to the *Sanguisorba officinalis* subcommunity *Carex panicea* is only occasional whilst *Anthoxanthum odoratum* and *Cynosurus cristatus* are less frequent and the tall herbs so

characteristic of that unit are sparse at best. Mosses are more frequent in the underlayer with both *Calliergonella cuspidata* and *Brachythecium rutabulum* achieving their highest constancies here. The strongest preferential species are *Geum rivale* and *Juncus articulatus* whilst other weakly preferential species include *Carex disticha, Lotus uliginosus, Cirsium palustre, Galium uliginosus* and *Carex hirta.*

3). Carex nigra-Ranunculus flammula (MG8c)

Oenanthe silaifolia-Alopecurus pratensis association Stančić (2008)

Cirsio dissecti-Molinietum. Sissingh et De Vries ex. Westhoff 1949.

This is the most distinctive expression of the community with low-growing grasses, notably *Agrostis stolonifera* and *Agrostis canina* and sedges, in particular *Carex panicea*, *Carex nigra* and occasionally *Carex demissa* being joined by rosette forming and creeping forbs including *Ranunculus flammula* and *Hydrocotyle vulgaris*. Later in the season a distinctive tall element is provided by *Cirsium dissectum, Thalictrum flavum, Senecio aquaticus* and *Leontodon hispidus.* Where poaching has occurred then *Juncus effusus* may become prominent.

4). Caltha palustris-Bellis perennis (MG8d)

Both *Filipendula ulmaria* and *Carex panicea* are much less frequent here whilst the other community constants remain faithful. It is here that *Caltha* achieves its highest representation together with a suite of common neutral grassland species which are all more frequent than in the other three subcommunities, including *Lolium perenne* and *Poa trivialis* together with *Trifolium pratense, Trifolium repens, Rumex acetosa, Bellis perennis, Rhinanthus minor, Cerastium fontanum.* The presence of *Achemilla spp. Trolius europaeus* and *Crepis paludosa* provide a distinctive northern element to some stands of the vegetation.

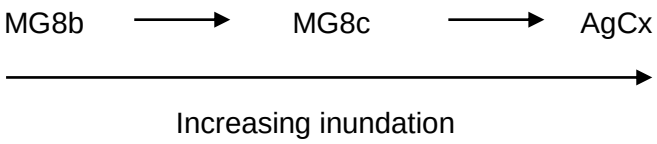
Zonation and succession

MG8 occurs on less fertile soils than those supporting the *Alopecurus pratensis-Sanguisorba officinalis* floodplain meadow community (MG4). It is characteristic of sites where the water table is constantly close to the surface such that drought and waterlogging stresses are more or less equal (Gowing and others 2002). It is found on damp alluvial or peaty substrates and occasionally, as on the Somerset Levels, on sites where clay overlies peat. Although the majority of sites supporting the community are cut for hay annually, the wetter peaty sites may be managed as permanent pasture, usually for cattle. It is not uncommon for management to alternate between an annual hay cut and cattle grazing depending on soil conditions in the spring.

The reliance of MG8 on a relatively narrow hydrological niche, where soils have a fairly constant water table level throughout the year, means that small changes in water table can result in rapid transitions between subcommunities of MG8 itself and between MG8 and other associated floodplain communities.

Patterns of change vary depending on soil type and management.

On the peat drained systems of the Somerset Levels long term monitoring of fields at West Sedgemoor subject to increased seasonal inundation over a number of years showed vegetation to change between three subcommunities over a 5 year period:



This sequence is not readily reversible, and often, even with improved water level management the vegetation does not return to its starting point, even after 5 - 7 years (Wallace and Prosser 2006; Gowing and others 2005).

Rush invasion, especially of *J.acutiflorus*, may result in temporary development of vegetation resembling M23a.

Soil fertility also plays an important role in the transitions that occur. On less fertile soils the likely progress of increasing waterlogging is that given above. On more fertile soils, the end point of increased waterlogging is more likely to be the MG13 community, or some form of inundation vegetation (OV29-OV32) or swamp, usually *Carex acutiformis* or *Glyceria maxima*-dominated. Fertiliser application on the drier soil profiles is likely to result in a shift towards the newly proposed, *Filipendula* subcommunity of MG6 (MG6d) whilst on damper soils transition to forms of the newly described MG15 (*Aloperucus pratensis-Poa trivialis-Cardamine pratensis* grassland*)* is more likely. Reversion along this gradient does seem to be occuring on the Somerset Levels where reduction in intensity of farming has shown a decrease in the area of the more species poor MG15 and increase in vegetation referrable to MG6d and, on damper profiles, progression to MG8b, the Typical subcommunity.

On alluvial floodplains the sequences may be different. Here, MG8c and the subcommunities of MG14 are relatively scarce and MG8a and MG8b predominate. With increasing soil moisture transitions are initially towards MG15, and then MG13 and MG16 with further increasing soil moisture. On drier soils the zonation is towards the damper subcommunities of the MG4 floodplain grassland. Good examples of these transitions can be seen on many of the Derwent Ings, especially Wheldrake. At East Cottingwith, also on the Derwent Ings, long term monitoring again shows the rapid transitions from MG4 through MG8 to MG15 and ultimately to MG16 with increased duration of flooding in the growing season - reversal of this sequence is not rapid, with delays of at least 7 years.

The *Sanguisorba officinalis* subcommunity (MG8a) appears to be largely restricted to alluvial soils that are cut for hay. Its most common transition on drier soils is therefore to forms of MG4, a sequence that is well represented at Mottey Meadows in Staffordshire. Similar transitions are also evident on the Oxford meads, Long Herdon in Buckinghamshire, Poolhay meadows in Worcestershire and Woodside meadows in Oxfordshire.

The Typical subcommunity (MG8b), which occurs equally on alluvial and peaty substrates, has a close overlap with the newly proposed, damp, MG6d, and osciallations between the two units are common and well documented on the Somerset Levels (Prosser and Wallace 1996, Wallace and Prosser 2007). As likely to be pastured as cut for hay, this is the subcommunity most prone to rush invasion. Cattle poaching, or failure to take a hay crop for a number of years, can encourage the spread of rushes, especially *Juncus effusus*, with a considerable loss of species richness due to the shading and accummulated litter that is associated with the spread of the rush. The shift is towards MG10, though occassionally to M23 if tall fen species manage to persist. On the Somerset Levels this appears to be a reversible transition if the rushes are cut hard in late summer/early autumn, immediately before the winter floods; this results in the 'drowning' of the cut stems.

The Typical subcommunity shows much overlap floristically with the fen meadow M22, and on the Hampshire Avon and Itchen gradations between the two are quite common.

Similarly on the Somerset Levels *Juncus subnodulosus* occurs in a vegetation that has more the floristic characteristics of an MG8 and particularly of the Typical subcommunity MG8b.

Where drainage has occurred and water levels start to fluctuate markedely through the growing season *Deschampsia cespitosa* is often favoured. If active cutting management followed by aftermath grazing is not maintained then a tussock grassland dominated by *D.cespitosa* may become established. At some sites *Festuca arundinacea* may also expand if management lapses. Both of these species are hard to reduce once established.

Away from the larger floodplains, MG8 often occurs as small stands associated with surface flushes, pools and other areas of impeded drainage. Here sequences may be to MG5 on drier ground and MG6 or MG15 on damper profiles. Around the flushes swamp and fen vegetation may also be a feature.

At higher altitudes in the north of Britain the *Sanguisorba officinalis* and Typical subcommunities are well represented, sometimes occupying sites above the influence of any river flooding. Here these subcommunities tend to grade into MG3 on the drier soil profiles. A distinct form of MG8 develops on damp, often flushed, hill sides. Here the transitions are different. The MG8d subcommunity may occur as small flushes within larger stands of the MG3 community but quite frequently it occupies extensive tracts of hill side where transition may occur to M24, *Molinia caerulea-Cirsium dissectum* fen meadow and to *Molinia caerulea-Crepis paludosa* mire (M26), as at Ashes Meadows and Swineley pastures in North Yorkshire. Gradations to small sedge mire of the *Carex echinata-Sphagnum auriculatum/recurvum* M6 community have been noted in some upland flushes, however insufficient data are available from these upland sites to fully characterise these zonations.

Distribution

Although MG8 is widespread throughout England many sites are small and fragmented. The most important areas for the community are on the floodplains of the Rivers Avon and Itchen in Hampshire and the peat drained systems of the Somerset Levels. It is here that the short, sedge dominated, MG8c has its stronghold, whilst it is absent from the north of England. The *Caltha-Bellis* subcommunity (MG8d) is restricted to the higher altitudes of Cumbria, Yorkshire, Northumberland and Durham, many of these are isolated fields within a wider agricultural landscape of semi-improved grassland (Prosser 1990; O'Reilly 2011). Examples of more extensive stands showing good gradients between the subcommunities are provided at Semer Water, Swineley pasture and Pry meadows. There has been considerably loss of sites in the north of England and also a deterioration in the quality of those that do remain (O'Reilly 2010).

Cynosurus cristatus-Carex panicea-Caltha palustris grassland is a rare community in Wales. It was recorded from only three sites in disparate localities, covering just 3ha (Stevens and others 2010).The topography and climate of Wales generally favours rush mire, especially M23, on the damper soil profiles of moderately poor fertility grading to the drier *Cynosurus cristatus-Centaurea nigra* meadow (MG5) on the more freely drained slopes.

The extent in Scotland is uncertain. Work by Cooper and MacKintosh (1996) lists a number of sites in the southern lowlands which support vegetation referable to both MG8 and the *Agrostis-Carex-Senecio* unit. More oceanic sites are also recorded by the same authors on the machair of the western Isles.

In Ireland there are extensive areas of both MG8 and *Agrostis-Carex-Senecio* grassland, especially on the Shannon Callows (Heery 1991; Gowing and Mountford pers com.)

Affinities

The British vegetation classified as MG8 has previously been described mainly as the modified form of the community which survives in water meadows. Page (1980) introduced an *Alopecurus pratensis-Festuca pratensis* community, later to form the basis of MG7C in the NVC. He regarded this as the typical vegetation of the water meadows and as such lying outside of the *Calthion* alliance. The 'real' *Calthion* communities, meadows and pastures of more fertile, moist, mineral and peaty soils, have their heartland in the more continental parts of Europe. Those communities of the alliance developing towards the Atlantic fringe are atypical particularly in their relative lack of *Cirsium* species and the increasing role of *Juncus* species. It has been suggested that, in the British Isles, the *Calthion* is replaced by the *Juncion acutiflori (*Braun-Blanquet and Tűxen 1952*).* Communities which have affinities with the British MG8 are found in the Netherlands, Belgium, northern France and western Germany and include the *Ranunculo-Senecionetum aquatici* of Schaminée and others 1996, the *Crepido-Juncetum acutiflora* Oberdorfer 1957 and the *Bromo-Seneconetum aquaticae* of Dierschke 1994. As with MG8 *Caltha* is often only patchy and infrequent in these vegetation types and *Cynosurus cristatus* is also relatively infrequent. Westwards, stands with strong affinities to MG8 occur on the Shannon Callows (Heery 1991) but these are even more dominated by small sedges.

Floristic table for MG8: *Cynosurus cristatus-Carex panicea-Caltha palustris* grassland

Values are % frequency of occurence and, in parathesis, the maximum % cover achieved in the sampled quadrats, using visual estimates of percentage cover.

(a) *Sanguisorba officinalis* subcommunity, (b) Typical subcommunity, (c) *Carex nigra-Ranunculus flammula* subcommunity, (d) *Caltha palustris-Bellis perennis* subcommunity. MG8 is the combined data from all four subcommunities.

	MG8a		**MG8b**		**MG8c**		**MG8d**		**MG8**	
Community constants										
Holcus lanatus	**86**	*(45)*	**86**	*(32)*	**74**	*(25)*	**83**	*(18)*	**83**	*(45)*
Anthoxanthum odoratum	**91**	*(20)*	**53**	*(65)*	**89**	*(50)*	**94**	*(40)*	**76**	*(65)*
Ranunculus acris	**83**	*(18)*	**71**	*(20)*	**60**	*(8)*	**91**	*(25)*	**73**	*(25)*
Festuca rubra	**83**	*(40)*	**81**	*(40)*	**21**	*(12)*	**68**	*(40)*	**66**	*(40)*
Filipendula ulmaria	**69**	*(60)*	**72**	*(75)*	**68**	*(30)*	**30**	*(45)*	**66**	*(75)*
Cynosurus cristatus	**77**	*(22)*	**49**	*(40)*	**61**	*(25)*	**89**	*(30)*	**63**	*(40)*
Agrostis stolonifera	**60**	*(60)*	**64**	*(85)*	**65**	*(60)*	**46**	*(20)*	**61**	*(85)*
Plantago lanceolata	**72**	*(30)*	**54**	*(25)*	**62**	*(18)*	**60**	*(15)*	**61**	*(30)*
Carex panicea	**77**	*(60)*	**38**	*(45)*	**91**	*(65)*	**16**	*(15)*	**61**	*(65)*
Species preferential to subcommunity a										
Sanguisorba officinalis	**88**	*(80)*	**4**	*(20)*	**1**	*(25)*	**10**	*(15)*	**26**	*(80)*
Centaurea nigra	**90**	*(38)*	**11**	*(18)*	**33**	*(20)*	**11**	*(15)*	**37**	*(38)*
Juncus acutiflorus	**76**	*(60)*	**17**	*(65)*	**10**	*(55)*	**20**	*(30)*	**31**	*(65)*
Succisa pratensis	**56**	*(28)*	**7**	*(20)*	**1**	*(2)*	**17**	*(10)*	**19**	*(28)*
Prunella vulgaris	**49**	*(14)*	**20**	*(10)*	**23**	*(10)*	**24**	*(10)*	**29**	*(14)*
Carex acutiformis	**29**	*(80)*	**18**	*(70)*	**1**	*(22)*	**1**	*(4)*	**15**	*(80)*
Vicia cracca	**34**	*(15)*	**12**	*(7)*	**12**	*(12)*	**2**	*(5)*	**17**	*(15)*

Carex flacca	**35**	*(32)*	**5**	*(22)*	**4**	*(35)*	**9**	*(15)*	**13**	*(35)*
Trifolium dubium	**22**	*(15)*	**6**	*(12)*	**0**	*(2)*	**11**	*(15)*	**9**	*(15)*
Briza media	**24**	*(5)*	**6**	*(6)*	**1**	*(1)*	**11**	*(7)*	**10**	*(7)*
Lotus corniculatus	**38**	*(38)*	**3**	*(12)*	**1**	*(3)*	**3**	*(5)*	**12**	*(38)*
Bromus commutatus	**26**	*(2)*	**1**	*(2)*	**9**	*(10)*			**9**	*(10)*
Silaum silaus	**26**	*(20)*	**1**	*(2)*					**7**	*(20)*
Leucanthemum vulgare	**10**	*(4)*	**0**	*(1)*					**3**	*(4)*
Ophioglossum vulgatum	**11**	*(4)*	**1**	*(3)*	**1**	*(1)*			**4**	*(4)*
Stachys officinalis	**8**	*(63)*	**0**	*(5)*			**2**	*(2)*	**2**	*(63)*
Phleum pratense	**26**	*(20)*	**9**	*(8)*	**20**	*(8)*	**11**	*(8)*	**16**	*(20)*
Deschampsia cespitosa	**32**	*(20)*	**14**	*(15)*	**10**	*(10)*	**13**	*(10)*	**18**	*(20)*
Species preferential to subcommunity b										
Calliergon cuspidatum	**24**	*(75)*	**50**	*(65)*	**46**	*(55)*	**11**	*(15)*	**38**	*(75)*
Juncus articulatus	**3**	*(40)*	**38**	*(60)*	**22**	*(50)*	**16**	*(25)*	**23**	*(60)*
Carex disticha	**10**	*(30)*	**40**	*(35)*	**24**	*(30)*			**24**	*(35)*
Lychnis flos-cuculi	**12**	*(5)*	**35**	*(15)*	**23**	*(5)*	**15**	*(2)*	**24**	*(15)*
Lotus uliginosus	**6**	*(6)*	**31**	*(12)*	**17**	*(20)*	**1**	*(2)*	**18**	*(20)*
Cirsium palustre	**4**	*(6)*	**34**	*(12)*	**3**	*(5)*	**2**	*(15)*	**16**	*(15)*
Carex hirta	**6**	*(4)*	**30**	*(65)*	**1**	*(3)*	**1**	*(3)*	**14**	*(65)*
Equisetum palustre	**20**	*(10)*	**30**	*(18)*	**1**	*(3)*	**9**	*(10)*	**19**	*(18)*
Juncus inflexus	**1**	*(4)*	**27**	*(50)*	**1**	*(8)*	**1**	*(2)*	**11**	*(50)*
Eleocharis palustris	**1**	*(2)*	**21**	*(65)*	**8**	*(12)*	**1**	*(2)*	**10**	*(65)*
Geum rivale	**1**	*(15)*	**24**	*(65)*			**6**	*(5)*	**10**	*(65)*
Brachythecium rutabulum	**3**	*(10)*	**18**	*(30)*	**1**	*(10)*	**9**	*(10)*	**9**	*(30)*
Festuca arundinacea	**3**	*(4)*	**22**	*(25)*	**16**	*(18)*			**13**	*(25)*
Galium uliginosum	**2**	*(2)*	**21**	*(20)*	**1**	*(1)*			**9**	*(20)*
Species preferential to subcommunity c										
Ranunculus flammula	**3**	*(5)*	**2**	*(4)*	**78**	*(15)*	**2**	*(3)*	**20**	*(15)*
Carex nigra	**25**	*(65)*	**55**	*(60)*	**72**	*(85)*	**35**	*(20)*	**49**	*(85)*
Senecio aquaticus	**6**	*(10)*	**37**	*(15)*	**47**	*(15)*	**3**	*(3)*	**27**	*(15)*
Agrostis canina	**18**	*(15)*	**3**	*(25)*	**58**	*(65)*	**8**	*(25)*	**21**	*(65)*
Cirsium dissectum	**22**	*(55)*	**1**	*(8)*	**56**	*(55)*			**19**	*(55)*
Galium palustre	**9**	*(8)*	**18**	*(15)*	**41**	*(25)*	**1**	*(3)*	**19**	*(25)*
Juncus effusus	**6**	*(20)*	**14**	*(38)*	**38**	*(60)*	**9**	*(10)*	**17**	*(60)*
Leontodon hispidus	**14**	*(30)*	**4**	*(10)*	**28**	*(18)*	**14**	*(5)*	**13**	*(30)*
Thalictrum flavum	**6**	*(75)*	**1**	*(40)*	**35**	*(18)*			**10**	*(75)*
Hydrocotyle vulgaris	**1**	*(10)*	**1**	*(15)*	**38**	*(60)*			**9**	*(60)*
Triglochin palustre	**0**	*(1)*	**3**	*(2)*	**14**	*(4)*			**4**	*(4)*
Carex demissa	**1**	*(12)*	**1**	*(6)*	**29**	*(25)*	**1**	*(10)*	**8**	*(25)*
Danthonia decumbens	**3**	*(15)*	**0**		**15**	*(48)*	**1**	*(5)*	**4**	*(48)*
Leontodon taraxacoides	**1**	*(3)*	**1**	*(5)*	**9**	*(20)*			**2**	*(20)*
Species preferential to subcommunity d										
Trifolium repens	**29**	*(18)*	**54**	*(60)*	**40**	*(15)*	**90**	*(25)*	**47**	*(60)*
Bellis perennis	**7**	*(3)*	**15**	*(10)*			**85**	*(7)*	**16**	*(10)*
Rumex acetosa	**43**	*(4)*	**52**	*(15)*	**18**	*(3)*	**89**	*(15)*	**45**	*(15)*
Rhinanthus minor	**37**	*(15)*	**14**	*(10)*	**2**	*(3)*	**81**	*(15)*	**24**	*(15)*
Caltha palustris	**22**	*(55)*	**46**	*(35)*	**32**	*(30)*	**72**	*(40)*	**39**	*(55)*

Lolium perenne	**24**	*(8)*	**24**	*(18)*	**4**	*(5)*	**60**	*(40)*	**23**	*(40)*
Trifolium pratense	**58**	*(35)*	**51**	*(91)*	**20**	*(10)*	**79**	*(25)*	**48**	*(91)*
Cerastium fontanum	**27**	*(3)*	**53**	*(4)*	**7**	*(2)*	**78**	*(10)*	**37**	*(10)*
Poa trivialis	**22**	*(8)*	**46**	*(35)*	**21**	*(10)*	**61**	*(30)*	**35**	*(35)*
Myosotis discolor	**3**	*(1)*	**1**	*(3)*			**43**	*(3)*	**5**	*(3)*
Euphrasia officinalis agg	**2**	*(5)*	**4**	*(12)*	**0**	*(2)*	**37**	*(33)*	**6**	*(33)*
Alopecurus pratensis	**11**	*(10)*	**5**	*(8)*	**2**	*(8)*	**36**	*(70)*	**9**	*(70)*
Luzula campestris	**11**	*(5)*	**6**	*(8)*	**0**	*(2)*	**23**	*(5)*	**8**	*(8)*
Poa pratensis			**5**	*(4)*	**1**	*(2)*	**24**	*(15)*	**5**	*(15)*
Alopecurus geniculatus			**1**	*(4)*			**16**	*(15)*	**2**	*(15)*
Bromus hordeaceus hordeaceus			**1**	*(2)*	**0**	*(2)*	**28**	*(15)*	**3**	*(15)*
Alchemilla glabra	**2**	*(3)*	**0**	*(5)*			**23**	*(5)*	**3**	*(5)*
Trollius europaeus	**1**	*(10)*	**0**	*(5)*			**23**	*(25)*	**3**	*(25)*
Crepis paludosa	**1**	*(5)*	**1**	*(15)*			**18**	*(5)*	**3**	*(15)*
Montia fontana			**0**	*(1)*			**14**	*(15)*	**2**	*(15)*
Conopodium majus	**1**	*(5)*	**0**				**12**	*(15)*	**1**	*(15)*
Associate species										
Cardamine pratensis	**44**	*(4)*	**64**	*(12)*	**63**	*(10)*	**50**	*(15)*	**57**	*(15)*
Ranunculus repens	**22**	*(35)*	**68**	*(65)*	**49**	*(20)*	**70**	*(45)*	**52**	*(65)*
Festuca pratensis	**44**	*(8)*	**26**	*(15)*	**40**	*(12)*	**28**	*(25)*	**34**	*(25)*
Leontodon autumnalis	**37**	*(10)*	**16**	*(10)*	**35**	*(15)*	**54**	*(8)*	**30**	*(15)*
Taraxacum officinale agg.	**40**	*(6)*	**27**	*(6)*	**13**	*(3)*	**46**	*(5)*	**29**	*(6)*
Lathyrus pratensis	**30**	*(25)*	**29**	*(15)*	**1**	*(1)*	**8**	*(5)*	**20**	*(25)*
Agrostis capillaris	**29**	*(20)*	**3**	*(85)*	**0**	*(2)*	**34**	*(40)*	**12**	*(85)*
Polygonum amphibium	**0**	*(1)*	**15**	*(10)*	**16**	*(10)*	**3**	*(3)*	**10**	*(10)*
Lysimachia nummularia	**13**	*(50)*	**11**	*(30)*	**6**	*(6)*	**1**	*(2)*	**9**	*(50)*
Carex acuta	**18**	*(50)*	**8**	*(40)*	**4**	*(30)*			**9**	*(50)*
Glyceria fluitans	**1**	*(2)*	**13**	*(60)*	**14**	*(35)*	**1**	*(10)*	**8**	*(60)*
Ajuga reptans	**9**	*(8)*	**11**	*(10)*			**13**	*(15)*	**8**	*(15)*
Potentilla anserina	**1**	*(3)*	**12**	*(20)*	**12**	*(18)*			**8**	*(20)*
Juncus subnodulosus	**0**	*(3)*	**12**	*(60)*	**10**	*(50)*			**7**	*(60)*
Carex riparia	**6**	*(35)*	**8**	*(50)*	**9**	*(18)*			**7**	*(50)*
Juncus conglomeratus	**14**	*(50)*	**2**	*(15)*	**8**	*(40)*	**2**	*(2)*	**7**	*(50)*
Mentha aquatica	**1**	*(15)*	**8**	*(20)*	**11**	*(15)*	**1**	*(1)*	**6**	*(20)*
Bromus racemosus	**12**	*(2)*	**6**	*(8)*	**2**	*(3)*			**6**	*(8)*
Dactylis glomerata	**16**	*(6)*	**1**	*(12)*			**11**	*(15)*	**6**	*(15)*
Potentilla erecta	**11**	*(10)*	**2**	*(6)*	**1**	*(5)*	**13**	*(5)*	**6**	*(10)*
Myosotis laxa caespitosa	**2**	*(10)*	**3**	*(2)*	**12**	*(4)*	**4**	*(1)*	**5**	*(10)*
Achillea ptarmica	**7**	*(35)*	**2**	*(3)*	**1**	*(2)*	**18**	*(5)*	**5**	*(35)*
Dactylorhiza praetermissa	**2**	*(1)*	**7**	*(4)*	**5**	*(2)*			**4**	*(4)*
Valeriana dioica	**1**	*(8)*	**9**	*(22)*	**1**	*(5)*	**3**	*(3)*	**4**	*(22)*
Iris pseudacorus	**1**	*(1)*	**9**	*(20)*	**2**	*(2)*			**4**	*(20)*
Eleocharis uniglumis	**0**	*(1)*	**8**	*(20)*	**3**	*(5)*			**4**	*(20)*
Carex distans			**9**	*(25)*					**4**	*(25)*
Pulicaria dysenterica	**0**	*(1)*	**8**	*(8)*					**3**	*(8)*
Stellaria graminea	**3**	*(3)*	**4**	*(2)*	**2**	*(3)*	**4**	*(2)*	**3**	*(3)*
Rumex crispus			**8**	*(8)*			**1**	*(5)*	**3**	*(8)*
Equisetum fluviatile			**5**	*(5)*	**2**	*(1)*			**3**	*(5)*
Phragmites australis	**6**	*(15)*	**2**	*(7)*	**0**	*(10)*			**2**	*(15)*
Angelica sylvestris	**1**	*(3)*	**5**	*(7)*			**1**	*(3)*	**2**	*(7)*

Molinia caerulea	**5**	*(40)*	**1**	*(25)*	**1**	*(10)*	**3**	*(7)*	**2**	*(40)*
Equisetum arvense	**4**	*(5)*	**1**	*(8)*			**7**	*(35)*	**2**	*(35)*
Hypericum tetrapterum			**5**	*(4)*	**1**	*(1)*			**2**	*(4)*
Hypochoeris radicata	**3**	*(3)*	**1**	*(4)*	**0**	*(1)*	**9**	*(3)*	**2**	*(4)*
Rumex conglomeratus	**0**	*(1)*	**5**	*(4)*					**2**	*(4)*
Potentilla reptans	**4**	*(3)*	**3**	*(4)*	**1**	*(3)*			**3**	*(4)*
Glyceria maxima			**5**	*(12)*	**1**	*(2)*			**2**	*(12)*
Polygonum persicaria			**2**	*(5)*	**6**	*(5)*			**2**	*(5)*
Rhytidiadelphus squarrosus	**2**	*(5)*	**3**	*(30)*			**5**	*(25)*	**2**	*(30)*
Epilobium parviflorum	**0**	*(1)*	**5**	*(4)*					**2**	*(4)*
Avenula pubescens	**4**	*(5)*	**1**	*(3)*			**7**	*(15)*	**2**	*(15)*
Ranunculus bulbosus	**4**	*(6)*	**0**	*(4)*			**9**	*(5)*	**2**	*(6)*
Phleum bertolonii	**2**	*(8)*	**1**	*(6)*	**0**	*(1)*	**9**	*(4)*	**2**	*(8)*
Anemone nemorosa	**2**	*(30)*	**1**	*(35)*			**9**	*(10)*	**2**	*(35)*
Veronica serpyllifolia serpyllifolia	**0**	*(1)*	**3**	*(1)*			**7**	*(1)*	**2**	*(1)*
Trisetum flavescens	**2**	*(1)*	**1**	*(2)*			**9**	*(15)*	**2**	*(15)*
Hordeum secalinum	**6**	*(1)*	**0**						**1**	*(1)*
Veronica chamaedrys	**1**	*(3)*	**1**	*(2)*			**7**	*(2)*	**1**	*(3)*
Crepis capillaris	**0**	*(2)*	**0**	*(3)*			**9**	*(5)*	**1**	*(5)*
Nardus stricta	**1**	*(5)*	**0**				**7**	*(15)*	**1**	*(15)*
Cerastium glomeratum			**0**				**9**	*(2)*	**1**	*(2)*
Geranium sylvaticum	**0**	*(2)*	**0**				**7**	*(15)*	**1**	*(15)*
Number of samples	**401**		**597**		**359**		**163**		**1520**	
Mean species/sample	**23.6**		**21.7**		**19.3**		**24.6**			

Species present in <5% of samples, but omitting those with a single occurrence.

Achillea millefolium	*Agrimonia eupatoria*	*Alchemilla filicaulis*	*Alchemilla xanthochlora*	*Anthriscus sylvestris*
Arrhenatherum elatius	*Aster tripolium*	*Avenula pratensis*	*Brachythecium rivulare*	*Calystegia sepium*
Campanula rotundifolia	*Cardamine flexuosa*	*Carex binervis*	*Carex caryophyllea*	*Carex dioica*
Carex echinata	*Carex hostiana*	*Carex lepidocarpa*	*Carex otrubae*	*Carex ovalis*
Carex pallescens	*Carex pilulifera*	*Carex pulicaris*	*Carex rostrata*	*Cerastium arvense*
Cirsium arvense	*Cirsium helenioides*	*Climacium dendroides*	*Cochlearia officinalis*	*Ctenidium molluscum*
Dactylorhiza fuchsii	*Dactylorhiza incarnata*	*Dactylorhiza maculata eric*	*Dactylorhiza purpurella*	*Drepanocladus aduncus*
Elymus repens	*Epilobium hirsutum*	*Epilobium palustre*	*Equisetum sylvaticum*	*Eriophorum angustifolium*
Eurhynchium praelongum	*Festuca ovina*	*Festulolium loliaceum*	*Filipendula vulgaris*	*Galium aparine*
Galium saxatile	*Galium verum*	*Geranium dissectum*	*Geranium pratense*	*Glechoma hederacea*
Glyceria declinata	*Gymnadenia conopsea*	*Heracleum sphondylium*	*Hypnum jutlandicum*	*Juncus bufonius*
Juncus bulbosus	*Juncus squarrosus*	*Lathyrus montanus*	*Linum catharticum*	*Listera ovata*
Luzula multiflora	*Lycopus europaeus*	*Lysimachia vulgaris*	*Lythrum salicaria*	*Medicago lupulina*
Menyanthes trifoliata	*Myosotis scorpioides*	*Myosotis seedling/sp*	*Narthecium ossifragum*	*Odontites vernus*
Oenanthe crocata	*Oenanthe fistulosa*	*Ononis spinosa*	*Orchis mascula*	*Parnassia palustris*
Pedicularis palustris	*Phalaris arundinacea*	*Pinguicula vulgaris*	*Plagiomnium affine*	*Plagiomnium cuspidatum*
Plagiomnium undulatum	*Plantago major*	*Poa annua*	*Polygala vulgaris*	*Polygonum viviparum*
Potentilla palustris	*Primula farinosa*	*Primula veris*	*Primula vulgaris*	*Pseudoscleropodium purum*
Quercus seedling/sp	*Ranunculus auricomus*	*Ranunculus ficaria*	*Rhizomnium punctatum*	*Rumex obtusifolius*
Rumex sanguineus	*Sagina nodosa*	*Sagina procumbens*	*Salix repens agg.*	*Saxifraga granulata*
Scirpus setaceus	*Scrophularia auriculata*	*Scutellaria galericulata*	*Senecio erucifolius*	*Senecio jacobaea*
Serratula tinctoria	*Stachys palustris*	*Stellaria alsine*	*Stellaria palustris*	*Thuidium tamariscinum*

Trifolium fragiferum	*Trifolium medium*	*Urtica dioica*	*Valeriana officinalis*	*Veronica arvensis*
Veronica beccabunga	*Veronica officinalis*	*Vicia sativa*	*Viola palustris*	

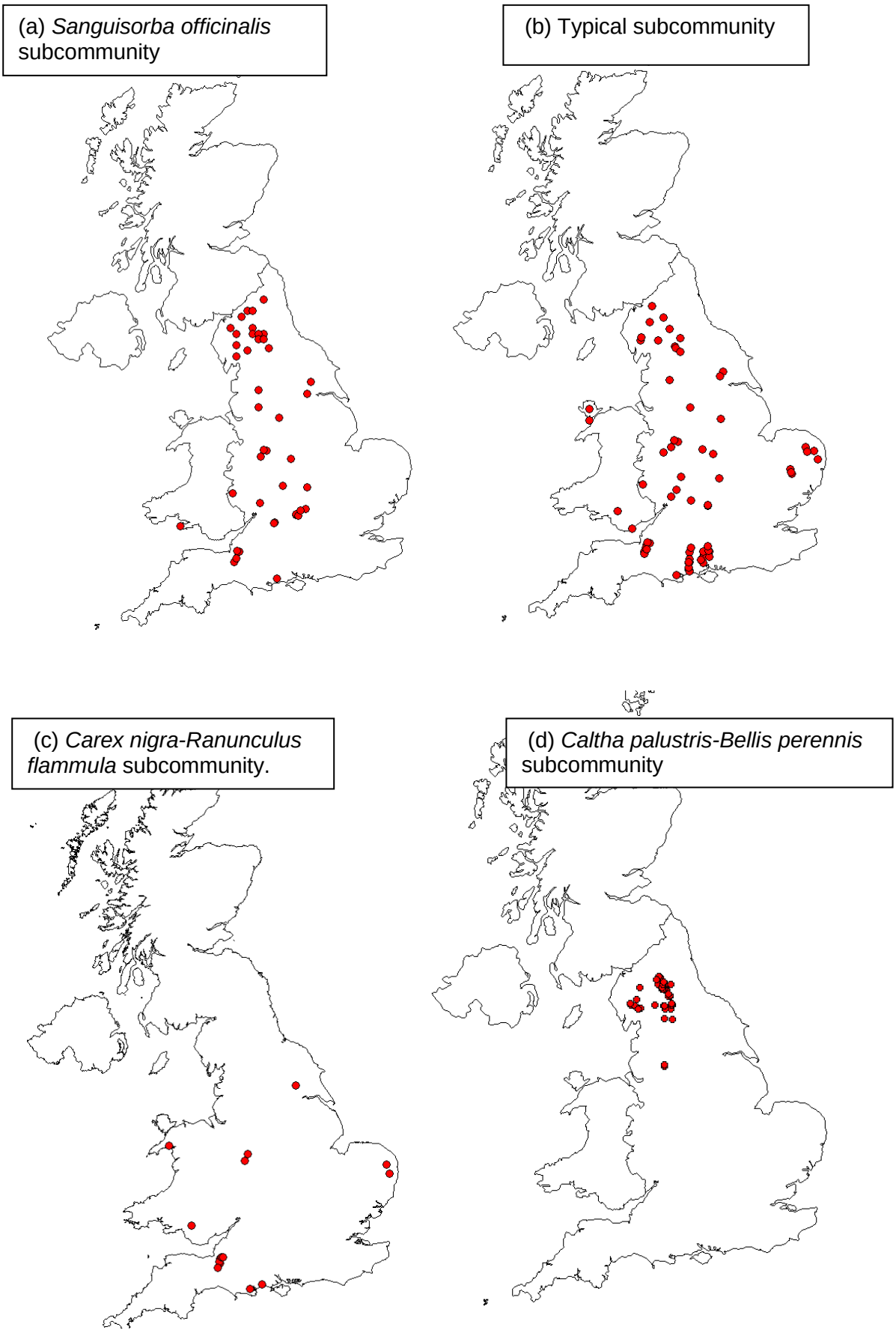


Figure 13. MG8 *Cynosurus cristatus-Carex panicea-Caltha palustris* grassland showing the four subcommunities' distribution.

Plate 7. MG8a *Sanguisorba officinalis* subcommunity (Mottey Meadows, Staffordshire).

Plate 8. MG8b Typical subcommunity (Baswich Meadow, Staffordshire).

Plate 9. MG8c *Carex nigra-Ranunculus flammula* subcommunity (West Sedgemoor, Somerset).

Plate 10. MG8d *Caltha palustris-Bellis perennis* subcommunity (Ashes Meadow, Yorkshire).

M22b. Briza media-Trifolium spp. subcommunity of Juncus subnodulosus-Cirsium palustre fen-meadow (nodum 6).

Synonyms

Rich-fen meadows. Various authors

Juncus-Carex disticha nodum Wheeler 1980

Table of the Principal preferential species for M22b (Rodwell 1991).

The first figure in brackets (NVC) is the constancy in the published NVC table (Rodwell 1991); the second (FMP) is that from the current analysis of the Floodplain Meadows Partnership samples**.**

	NVC	FMP		NVC	FMP
Anthoxanthum odoratum	(IV)	(IV)	*Juncus inflexus*	(III)	(I)
Trifolium pratense	(IV)	(III)	*Epilobium parviflorum*	(III)	(I)
Rumex acetosa	(III)	(III)	*Juncus articulatus*	(IV)	(I)
Plantago lanceolata	(III)	(IV)	*Briza media*	(IV)	(I)
Cardamine pratensis	(IV)	(II)	*Prunella vulgaris*	(III)	(I)
Ranunculus repens	(III)	(II)	*Centaurea nigra*	(III)	(I)
Cerastium fontanum	(IV)	(II)	*Dactylorhiza fuchsii*	(III)	(I)
Trifolium repens	(IV)	(I)	*Triglochin palustris*	(III)	(I)
Molinia caerulea	(III)	(I)			
Vicia cracca	(IV)	(IV)			
Galium uliginosum	(IV)	(IV)			
Carex nigra	(II)	(IV)			
Festuca rubra	(V)	(IV)			
Agrostis stolonifera	(V)	(IV)			
Carex panicea	(V)	(III)			
Carex disticha	(III)	(II)			

Foreword

Stands of the more meadow-like subcommunity of M22 which are characterised by constant *Juncus subnodulosus, Filipendula ulmaria, Lotus uliginosus, Vicia cracca* and *Galium uliginosum* have been sampled from Strumpshaw fen and Marston Meadows in Norfork; West Sedgemoor, Kings Sedgemoor, Moorlinch and Shapwich heath in Somerset and from the floodplain of the River Itchen in Hampshire. A handfull of other records were obtained from eight other sites including a northern outlier at Semer water, N. Yorkshire, close to the northern limit of distribution of the blunt-flowered rush.

The lack of comprehensive coverage of the unit renders a meaningful comparison with the published nodum unhelpful. Nevertheless, M22b is an intregal component of the floodplain meadow sequence and so the data available are included in this overview. The data presented include the 114 releves from nodum 6 in the TWINSPAN plus a further 59 gleaned from other surveys not included in the original analysis.

A second reason for an examination of floodplain M22b lies in the difficulty experienced by some workers, especially those from the more southerly sites, in separating such stands from those of the Typical subcommunity of MG8. This is a real problem. As shown on the plot of bivariate ellipses (Figure 4) there is a very high degree of overlap between the

floodplain M22b and the Typical MG8 (MG8b). The two units appear to physically intergrade at some sites, for instance Winnals Moor on the River Itchen and Marston Meadows in Norfolk. A parallel difficulty has been encountered on West Sedgemoor where stands of M22b with prevalent *Cirsium dissectum* and *Carex nigra* are, apart from the presence of *Juncus subnodulosus*, almost identical to examples of MG8c, the *Carex nigra-Ranunculus flammula* subcommunity.

One solution to the situation might be to remove M22b from the more fen-like trio of subcommunities comprising the rest of the *Juncus subnodulosus-Cirsium palustre* community and to establish it either as a new subcommunity of MG8 or as a variant of the Typical subcommunity; the latter would seem a less favourable option. In the meanwhile it is probably sensible to consider apparently intermediate stands between M22/MG8 having 15% or more of *Juncus subnodulosus* and with a good representation of some or all of *Lotus uliginosus, Galium uliginosum, Lythrum salicaria* and *Mentha aquatica* but with very little *Cynosurus cristatus* or *Caltha palustris* as being referrable to M22b - otherwise they should be accommodated in the most appropriate MG8 unit.

Physiognomy and habitat

For a detailed review see Rodwell (1991).

The M22b stands sampled are almost all on peat soils. Most are mown for hay. The published version of the subcommunity extends its range onto base-rich wet mineral stagnogley and ground water gley profiles. In the subcommunity *Molinetalia* species account for the bulk of the vegetation cover. This holds both for the published version and for the floodplain meadow stands with *Ranunculus acris, Rumex acetosa, Vicia cracca, Galium uliginosum* and *Trifolium pratense* prevalent in both sets of samples. The current samples diverge from those of Rodwell (1991) in the relatively lower frequencies of some tall forbs such as *Angelica sylvestris, Cirsium palustre, Thalictrum flavum* and *Centaurea nigra* and the scarcity of the taller rushes and sedges though *Carex disticha* is occasionally prominent. The subcommunity differs from the other more truly fen-like expressions of the community in that *Juncus subnodulosus*, though remaining constant, is less dominant and contributions from *Mentha aquatica, Equisetum palustre* and *Valeriana officinalis* are less evident.

Zonation and succession

The nodum is part of the *Calthion* alliance and as such is closely related to subcommunities of the MG8 community. Transitions between M22b and the Typical subcommunity of MG8 have been noted as have intergrades between M22b and the *Carex nigra-Ranunculus flammula* unit of MG8. Some stands of M22b have arisen from peaty stands of M23b, the J*uncus effusus* subcommunity of *Juncus effusus/acutiflorus-Galium palustre* rush pasture where the soft rush has been rigorously controlled by cutting immediately before the onset of winter flooding. Other areas of M22b have been restored after a period of transformation to MG9a *Deschampsia cespitosa* grassland following a diminution of grazing and the application of organic fertiliser.

Distribution

The distribution map in Rodwell (1991) shows the stands sampled to be concentrated in the Midlands, East Anglia and North Wales. The current additions extend the sampled range onto the peat substrates of the Somerset Moors and Levels and to the Hampshire floodplains.

Affinities

Rodwell (1991) deals at length with the problems associated with constructing a realistic framework for the inclusion of the *Juncus-Cirsium* fen meadow in a natural series of communities moving from east to west across the lowland south of Britain and the further difficulties in incorporating the community into a continental system. Noda accompanying M22b in the DCA (Figure 9) include the submontane waterlogged grasslands on alkaline soils from Bulgaria and the Czech republic [nodum 32] Hájeck and others (2008), the *Cirsium oleraceum-Angelica sylvestris* community of Tüxen (1937) from Germany [nodum 37] and the *Filipendulo-Scorzoneretum* from France Géhu 1961 [nodum 53], which the author places in the *Molinion*; this series places emphasis on the high base status of stands of the M22b nodum.

Floristic table for samples assigned to M22b; *Briza media-Trifolium* spp. subcommunity of *Juncus subnodulosus-Cirsium palustre* fen-meadow in the current analysis.

Values are % frequency of occurence and, in parathesis, the maximum % cover achieved in the sampled quadrats, using visual estimates of percentage cover.

Subcommunity constants	**M22b**	
Filipendula ulmaria	**86**	(50)
Holcus lanatus	**86**	(25)
Juncus subnodulosus	**84**	(75)
Anthoxanthum odoratum	**73**	(25)
Agrostis stolonifera	**67**	(65)
Carex panicea	**64**	(50)
Plantago lanceolata	**61**	(18)
Species at constancy II and III		
Carex nigra	**58**	(60)
Festuca rubra	**58**	(28)
Vicia cracca	**53**	(20)
Lotus uliginosus	**49**	(10)
Galium uliginosum	**47**	(6)
Rumex acetosa	**46**	(4)
Poa trivialis	**42**	(20)
Ranunculus acris	**42**	(5)
Trifolium pratense	**41**	(12)
Festuca arundinacea	**39**	(25)
Ranunculus repens	**36**	(18)
Cardamine pratensis	**35**	(4)
Lychnis flos-cuculi	**34**	(6)
Calliergon cuspidatum	**34**	(35)
Mentha aquatica	**32**	(12)
Cerastium fontanum	**31**	(2)
Lythrum salicaria	**28**	(8)
Carex disticha	**28**	(60)
Carex riparia	**27**	(30)
Lathyrus pratensis	**27**	(6)
Festuca pratensis	**25**	(12)
Dactylorhiza praetermissa	**22**	(2)

Polygonum amphibium	**22**	(15)
Cynosurus cristatus	**21**	(15)
Hydrocotyle vulgaris	**21**	(60)
Parnassia palustris	**21**	(4)
Rhinanthus minor	**21**	(8)

Associate species

Cirsium palustre	**20**	(6)
Galium palustre	**19**	(12)
Thalictrum flavum	**19**	(40)
Prunella vulgaris	**18**	(6)
Senecio aquaticus	**18**	(6)
Taraxacum officinale agg.	**17**	(4)
Juncus effusus	**17**	(30)
Cirsium dissectum	**17**	(55)
Ranunculus flammula	**16**	(6)
Equisetum palustre	**16**	(10)
Succisa pratensis	**15**	(20)
Trifolium repens	**15**	(10)
Potentilla anserina	**14**	(10)
Brachythecium rutabulum	**13**	(6)
Briza media	**12**	(8)
Deschampsia cespitosa cespitosa	**12**	(35)
Centaurea nigra	**11**	(14)
Juncus acutiflorus	**11**	(20)
Potentilla erecta	**11**	(2)
Agrostis canina	**10**	(20)
Juncus inflexus	**10**	(10)
Carex acutiformis	**10**	(40)
Phalaris arundinacea	**10**	(12)
Caltha palustris	**9**	(12)
Lolium perenne	**9**	(8)
Juncus articulatus	**8**	(25)
Luzula campestris	**8**	(3)
Molinia caerulea	**8**	(22)
Phragmites australis	**8**	(4)
Lysimachia vulgaris	**8**	(25)
Carex demissa	**7**	(4)
Ajuga reptans	**6**	(4)
Angelica sylvestris	**6**	(5)
Iris pseudacorus	**6**	(4)
Lotus corniculatus	**6**	(8)
Lysimachia nummularia	**6**	(10)
Phleum pratense	**6**	(3)
Valeriana officinalis	**6**	(5)
Myosotis laxa caespitosa	**6**	(3)
Potentilla reptans	**6**	(3)
Danthonia decumbens	**6**	(12)
Triglochin palustre	**6**	(2)
Hypericum tetrapterum	**5**	(4)
Leontodon hispidus	**5**	(5)

Rumex conglomeratus	**5**	(5)
Valeriana dioica	**5**	(12)
Rhytidiadelphus squarrosus	**5**	(40)
Eleocharis palustris	**5**	(35)

Number of samples	**173**
Mean species/sample	**20.5**

Species recorded in <5% of samples omitting those with only a single occurrence.

Alopecurus geniculatus	*Arrhenatherum elatius*	*Bromus commutatus*	*Bromus racemosus*	*Calystegia sepium*
Carex acuta	*Carex distans*	*Carex flacca*	*Carex hirta*	*Carex lepidocarpa*
Carex ovalis	*Carex pulicaris*	*Cirriphyllum piliferum*	*Dactylis glomerata*	*Dactylorhiza fuchsii*
Elymus repens	*Epilobium hirsutum*	*Epilobium parviflorum*	*Equisetum fluviatile*	*Geum rivale*
Glyceria fluitans	*Glyceria maxima*	*Juncus conglomeratus*	*Leontodon autumnalis*	*Menyanthes trifoliata*
Myosotis scorpioides	*Poa pratensis*	*Polygonum persicaria*	*Pulicaria dysenterica*	*Rumex crispus*
Stellaria graminea	*Stellaria holostea*	*Trifolium dubium*	*Urtica dioica*	*Veronica beccabunga*

No comprehensive map is available but it is unlikely that the present study has expanded the distribution of M22b beyond that presented in Rodwell and others (2007).

MG6d Filipendula ulmaria subcommunity of Lolium perenne-Cynosurus cristatus grassland (Nodum 12).

Synonomy

None known

Principal preferential species for MG6d

Filipendula ulmaria, Ranunculus repens, Trifolium pratense, Cardamine pratensis, Phleumpratense.

Principal differential species for MG6d

Carex disticha, Carex hirta, Agrostis canina, Stellaria graminea.

Rare/Scarce species.

None

Vulnerable species

None

Near Threatened species.

Briza media, Lychnis flos-cuculi, Potentilla erecta, Senecio aquaticus, Succisa pratensis, Valeriana dioica

Foreword

During early discussions on the progress of the floodplain-meadow scoping exercise, disquiet was expressed concerning the size of the original nodum 11, its lack of characteristic species and its possible lack of homogeneity. The nodum, of 819 quadrats, originally viewed as a semi-improved form of the MG8 community, was subsequently reanalysed through a new twinspan using the same parameters as for the original analysis. This analysis produced an endgroup where *Caltha palustris* and *Bellis perennis* were both constant and this formed the basis of the northern MG8d unit. Small endgroups were identified which could be refered to MG3, which were omitted from further analysis, and to MG13 and MG8b; these were added to their respective tables. This left a residuum of 553 releves, which represented damp, semi-improved, grassland with strong affinities to MG6. These form the new *Filipendula ulmaria* subcommunity of MG6, a decision which gained almost universal acceptance at the scoping workshop.

Physiognomy

Although the MG6 community constants are well represented in the new subcommunity *Lolium perenne* is less prevalent whilst *Festuca rubra* usually occurs at higher than normal levels of cover. The principal distinguishing feature lies in the constancy of *Filipendula ulmaria,* a species absent from the rest of the community. Such may be the extent of the meadowsweet that some stands resemble a *Filipendulion* sward. Other tall forbs are

occasional to frequent: these include *Centaurea nigra, Lychnis flos-cuculi* and *Cirsium palustre,* sometimes supplemented by patches of *Carex disticha*. These stands thus contrast with the usually short, tight, grass-dominated swards common elsewhere in the community. The understorey is also subtly different; although sharing with the other subcommunities the high frequency and cover of *Trifolium repens*, in MG6d the clover is supplemented by a much higher incidence of *Ranunculus repens,* occasional *Carex panicea* and more evident patches of the moss *Brachythecium rutabulum*.

The drier subcommunities of MG6 often support a weed component featuring *Senecio jacobea* often with *Cirsium arvense.* These are absent from the published constancy table. The former is not found in MG6d whilst the creeping thistle occurs only rarely.

Habitat

The *Lolio-Cynosuretum* is a grassland type common on moist, but free draining, circum-neutral brown earth soil profiles across lowland Britain. Though stands of the *Filipendula ulmaria* subcommunity frequently occur on such substrates, the present study demonstrates its expansion onto the peat soils of the Somerset Moors and Levels. Indeed, the most extensive stands have been recorded from Tadham Moor where this vegetation grades into the Typical subcommunity of MG8 (MG8b).

In contrast to the other units of the community, which are normally managed as pasture but which may be shut up in spring at irregular intervals for summer mowing, the *Filipendula ulmaria* unit is normally cut for hay and aftermath grazed. This management is consistent with its position as a component of the floodplain habitat, many areas of which are controlled by management agreements in which traditional practices are encouraged. It may well be that the management for hay rather than pasture has allowed for the expansion of *Filipendula,* a species not resistant to regular grazing.

With appropriate water-level management, cutting and the cessation of inorganic fertiliser application, these stands can shift in their composition towards a species-poor expression of the Typical subcommunity of MG8.

Zonation and Succession

On unprotected sites MG6d often develops when stands of the Typical subcommuity of MG8 are subject to fertiliser application and/or summer grazing. Conversely, appropriate management may encourage the reverse switch from the *Lolio-Cynosurion* to the *Calthion* of MG8.

Although *Deschampsia cespitosa* is of only sporadic occurance in MG6d, some mismanaged stands towards the drier end of the hydrological envelope may be degraded to areas of *Holcus lanatus-Deschampsia cespitosa* coarse grassland (MG9). At the wetter end periods of neglect may result in a shift towards *Filipendula-Angelica sylvestris* mire (M27). Where management of the unit is unchanged it is likely to remain as a stable component of the floodplain meadow sequence for long periods of time.

Distribution

The map shows this unit to be ubiquitous across both damp mineral and peaty soil profiles throughout the range of floodplain meadows studied.

Affinities

The *Filipendula ulmaria* subcommunity is closely related to the *Junceo-Cynosuretum*, a pan-European community described by Zuidhoff and others (1995) even though *Filipendula* occurs here only at constancy I. On the DCA plot the two vegetation types are inseparable. Fig. 9 also demonstrates the position of MG6d as a 'bridge' between the drier subcommunities of the *Lolio-Cynosuretum* and the even damper *Alopecurion* associations of floodplains in the Netherlands. Other damper forms of the communtiy are described in the literature, thus Tüxen (1937) presents a *Lotus uliginosus* subcommunity whilst a subcommunity of the same name is listed within an *Arrhenatherion* alliance by Le Brun and others (1949) from Belgium. This unit is further characterised by the frequency of *Deschampsia cespitosa, Cirsium palustre* and *Senecio aquaticus.* The *Lolium -Cynosurus* community described by Westhoff and den Held (1969) also includes a *Lotus uliginosus* subassociation which features *Lychnis flos-cuculi, Cirsium palustre, Juncus effusus* and *Juncus inflexus* all weakly preferential to the proposed *Filipendula* subcommunity.

Floristic table for MG6d. *Lolium perenne-Cynosurus cristatus* grassland, *Filipendula ulmaria* subcommunity.

Values are % frequency of occurence and, in parathesis, the maximum % cover achieved in the sampled quadrats, using visual estimates of percentage cover.

	6d	
Subcommunity constants		
Holcus lanatus	**95**	(30)
Festuca rubra	**90**	(55)
Ranunculus acris	**90**	(30)
Rumex acetosa	**87**	(25)
Anthoxanthum odoratum	**87**	(60)
Ranunculus repens	**82**	(80)
Cerastium fontanum	**80**	(20)
Filipendula ulmaria	**79**	(65)
Cardamine pratensis	**71**	(17)
Trifolium pratense	**69**	(38)
Cynosurus cristatus	**68**	(40)
Plantago lanceolata	**68**	(75)
Trifolium repens	**64**	(35)
Lolium perenne	**61**	(30)
Species at constancy II and III		
Brachythecium rutabulum	**56**	(80)
Agrostis capillaris	**46**	(28)
Taraxacum sect. vulgaria	**45**	(18)
Phleum pratense	**44**	(16)
Poa trivialis	**44**	(40)
Leontodon autumnalis	**39**	(25)
Festuca pratensis	**35**	(22)
Agrostis stolonifera	**31**	(55)
Centaurea nigra	**31**	(40)
Taraxacum officinale agg.	**27**	(12)
Carex hirta	**26**	(20)
Alopecurus pratensis	**25**	(52)
Lathyrus pratensis	**24**	(12)
Stellaria graminea	**24**	(10)
Agrostis canina	**23**	(20)

Carex disticha	**23**	(30)
Prunella vulgaris	**22**	(18)
Poa pratensis	**22**	(11)

Associate species

Carex nigra	**20**	(60)
Juncus effusus	**20**	(37)
Calliergon cuspidatum	**17**	(50)
Veronica serpyllifolia serpyllifolia	**16**	(3)
Deschampsia cespitosa cespitosa	**15**	(15)
Rhinanthus minor	**15**	(25)
Lotus uliginosus	**15**	(15)
Dactylis glomerata	**14**	(15)
Sanguisorba officinalis	**14**	(60)
Polygonum amphibium	**14**	(20)
Caltha palustris	**13**	(60)
Carex panicea	**13**	(25)
Juncus articulatus	**13**	(60)
Lysimachia nummularia	**13**	(15)
Trifolium dubium	**13**	(30)
Vicia cracca	**13**	(20)
Potentilla anserina	**12**	(6)
Rhynchostegium confertum	**12**	(20)
Juncus acutiflorus	**12**	(65)
Carex flacca	**10**	(20)
Juncus inflexus	**10**	(22)
Cirsium arvense	**9**	(17)
Potentilla reptans	**9**	(5)
Bromus racemosus	**9**	(12)
Cirsium palustre	**9**	(13)
Lychnis flos-cuculi	**9**	(10)
Poa subcaerulea	**9**	(21)
Leontodon hispidus	**8**	(7)
Luzula campestris	**8**	(20)
Galium palustre	**8**	(8)
Ajuga reptans	**8**	(12)
Bellis perennis	**8**	(10)
Equisetum palustre	**6**	(8)
Senecio aquaticus	**6**	(12)
Arrhenatherum elatius	**6**	(40)
Alopecurus geniculatus	**6**	(20)
Eleocharis palustris	**6**	(25)
Carex acutiformis	**5**	(30)
Myosotis laxa caespitosa	**5**	(2)
Bromus commutatus	**5**	(12)
Rumex crispus	**5**	(24)

Number of samples	**551**
Mean species/sample	**22.4**

Achillea millefolium	*Achillea ptarmica*	*Alchemilla glabra*	*Angelica sylvestris*	*Anthriscus sylvestris*
Avenula pubescens	*Briza media*	*Bromus hordeaceus*	*Bryum caespiticium*	*Calystegia sepium*
Cardamine hirsuta	*Carex acuta*	*Carex distans*	*Carex otrubae*	*Carex ovalis*
Carex riparia	*Ceratodon purpureus*	*Cirsium dissectum*	*Cirsium vulgare*	*Climacium dendroides*
Conopodium majus	*Dactylorhiza fuchsii*	*Dactylorhiza praetermissa*	*Drepanocladus aduncus*	*Elymus repens*
Equisetum arvense	*Equisetum fluviatile*	*Euphrasia officinalis agg*	*Eurhynchium praelongum*	*Festuca arundinacea*
Festuca ovina	*Festulolium loliaceum*	*Filipendula vulgaris*	*Fraxinus excelsior (g)*	*Galium aparine*
Galium uliginosum	*Geranium dissectum*	*Geum rivale*	*Glechoma hederacea*	*Glyceria declinata*
Glyceria fluitans	*Glyceria maxima*	*Heracleum sphondylium*	*Hordeum secalinum*	*Hypochoeris radicata*
Iris pseudacorus	*Juncus conglomeratus*	*Juncus subnodulosus*	*Leucanthemum vulgare*	*Lotus corniculatus*
Lythrum salicaria	*Mentha aquatica*	*Mentha arvensis*	*Myosotis discolor*	*Myosotis scorpioides*
Ophioglossum vulgatum	*Orchis morio*	*Phalaris arundinacea*	*Phleum bertolonii*	*Phragmites australis*
Plantago major	*Poa annua*	*Polygonum persicaria*	*Potentilla erecta*	*Pseudoscleropodium purum*
Pulicaria dysenterica	*Ranunculus bulbosus*	*Ranunculus ficaria*	*Ranunculus flammula*	*Rhytidiadelphus squarrosus*
Rumex conglomeratus	*Sagina procumbens*	*Silaum silaus*	*Stachys officinalis*	*Stellaria alsine*
Succisa pratensis	*Tragopogon pratensis*	*Trisetum flavescens*	*Valeriana dioica*	*Veronica chamaedrys*

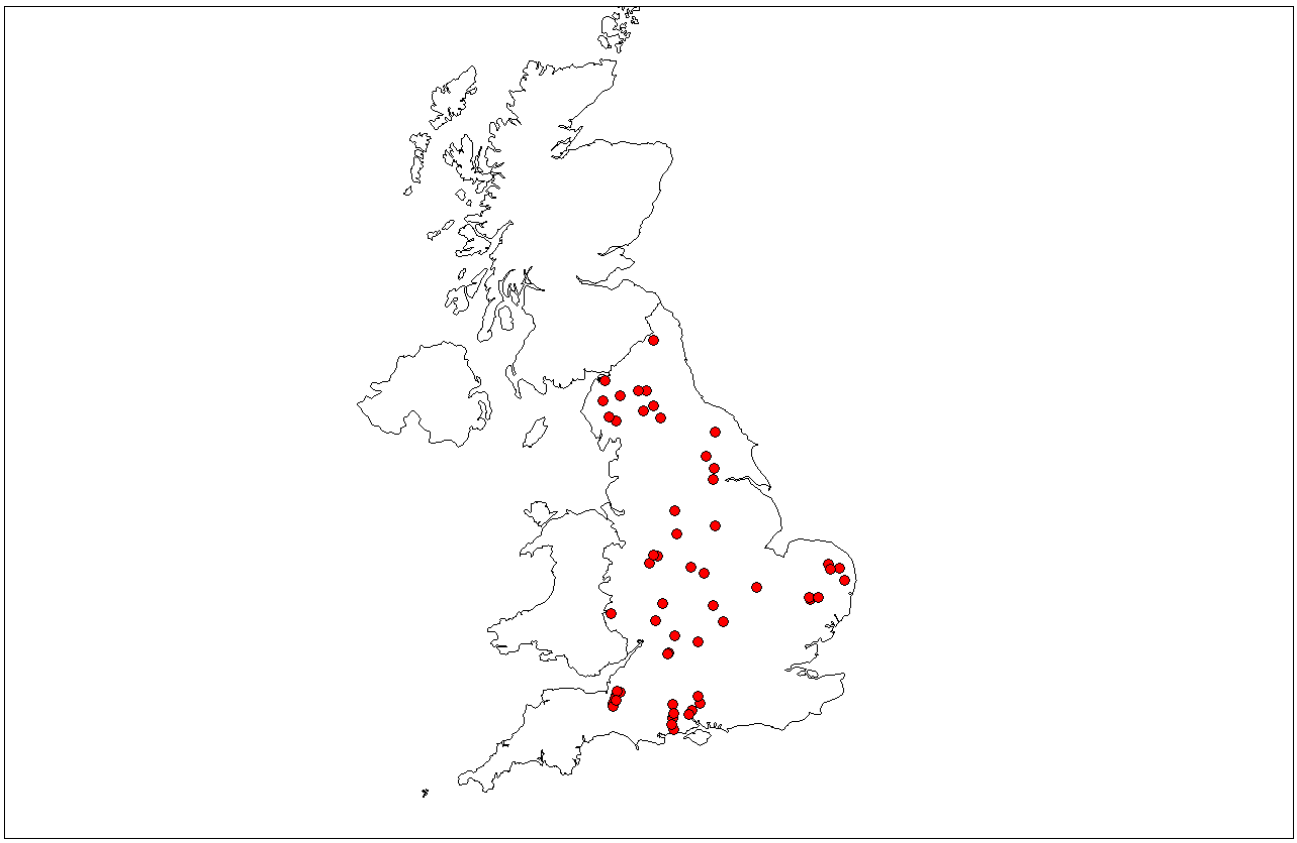


Figure 14. Distribution map for MG6d *Filipendula ulmaria* subcommunity of *Lolium perenne-Cynosurus cristatus* grassland

Plate 11. MG6d *Filipendula ulmaria* subcommunity of *Lolium perenne-Cynosurus cristatus* grassland.

5. Wider European perspective

An attempt has been made to place the 12 noda segregated in the present work into a broader phytosociological context by comparing them with a selection of noda drawn largely from Continental Europe.

In addition to the 12 new UK noda, 46 continental vegetation noda plus three from the Republic of Ireland, have been included, together with 12 communities/subcommunities from the published British Plant Communities (Rodwell 1991 - 2000). Of the nine alliances recognised from the British data, seven are also represented from the search of the continental literature (Table 5).

Table 5. Breakdown of the 49 continental noda included in the DCA analysis according to the alliance given by the authors.

The DCA column indicates the code number used to distinguish alliances on the DCA plot whilst N is the number of noda in each alliance from the continental noda.

DCA	Alliance	N
1	*Phragmition*	none
2	*Calthion* (including the Bromion racemosi)	26
3	*Caricion gracilis*	2
4	*Potentillion*	7
5	*Alopecurion*	4
6	*Lolio-Cynosurion*	5
7	*Deschampsion*	2
8	*Molinion*	3
9	*Lolio-Plantaginion*	none

The full list of 73 noda used in the DCA, including authorship and alliance, is provided in Appendix 1 whilst the floristic data of the noda are given in the supplementary excel file (Calthion_Synoptic73.xls).

This is considered to give a fair representation of the damper grasslands within which a range of British floodplain-meadow species are commonly found.

The DCA was run using the same parameters as for the full analysis of 4705 releves; rare species downweighted and axes rescaled. The percentage variation explained by the analysis was high; relative euclidian coefficients were Axis 1=54.6, Axis 2=16.8 and Axis 3=7.9.

A second matrix of mean Ellenberg scores for fertility (N), soil moisture (F) and soil reaction (R) was used to produce the biplots presented in Figure 15.

In common with the DCA of the full quadrat data set, the first axis of the 73 noda DCA is strongly correlated with soil fertility, as measured using Ellenberg N scores (Kendal Rank coefficient r^2 =0.638) whilst correlation with soil moisture, Ellenberg F, on axis 2 is equally strong (r^2 =0.685). This is clearly illustrated in the joint plot of Axis 1 versus Axis 2 (Figure 15) where the length and direction of the lines illustrate the direction and strength of the relationship between axis score and environmental variables. Axis 3, which is not shown here, appears to be weakly related to pH (r^2=0.32).

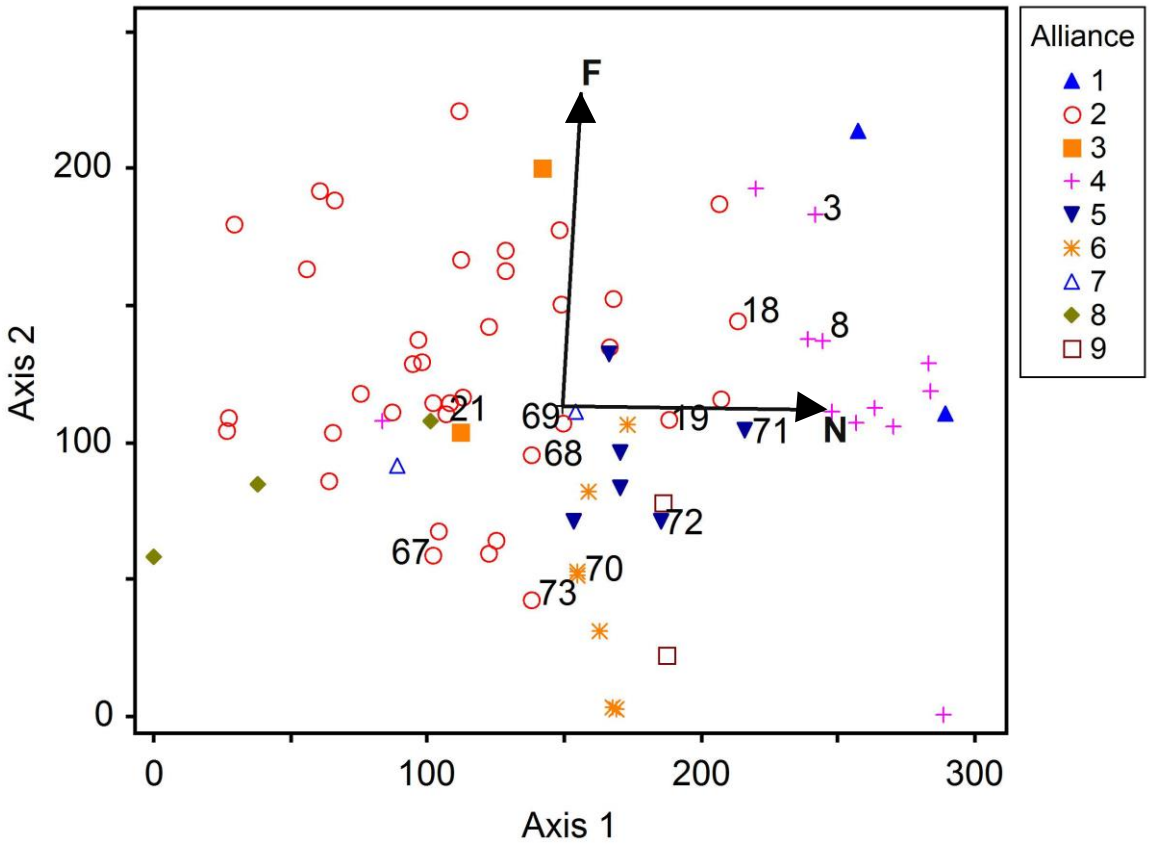


Figure 15. DCA plot of 73 noda.

Alliances are indicated by different symbols (see key). 1 = *Phragmition*, 2 = *Calthion* (including *Bromus racemosi*), 3 = *Caricium gracilis*, 4 = *Potentillion*, 5 = *Alopecurion*, 6 = *Lolio-Cynosuretum,* 7 = *Deschampsion*, 8 = *Molinion*, 9 = *Lolio-Plantaginion.*

The 12 British noda described in this report are labelled. 3=*Agopstis stolonifera-Eleocharis palustris (MG16), 8=revised MG13, 18=Agrostis-Carex-Senecio Typical subunit (MG14a), 19=Agrostis-Carex-Senecio Anthoxanthum-Trifolium subunit (MG14b), 21=M22b, 67=Cynosurus cristatus-Carex panciea-Caltha palustris, Sanguisorba subunit (MG8a), 68= Cynosurus cristatus-Carex panciea-Caltha palustris, Typical unit (MG8b) 69= Cynosurus cristatus-Carex panciea-Caltha palustris , Carex nigra-Ranunculus flammula unit (MG8c) 70=Lolium perenne-Cynosurus cristatus, Filipendula ulmaria subunit (MG6d) 71=Alopecurus-Poa-Cardamine, Agrostis stolonifera subunit (MG15a), 72=Alopecurus-Poa-Cardamine, Lolium-Ranunculus subunit (MG15b). 73 =Cynosurus cristatus-Carex*

panciea-Caltha palustris, Caltha palustris-Bellis perennis subunit (MG8d). The lines F and N indicate the strength of the relationship between axis score and mean noda Ellenberg indicator values for moisture (F) and fertility (N). Appendix 2 presents the same diagram with all 73 noda labelled according to their descriptions in Appendix 1.

The first two axes of the ordination (Figure 15) represent the two principal environmental factors affecting these vegetation types: Axis 1 reflects the spread of the associations and sub-associations along a gradient of soil fertility with units of the *Potentillion* clustered at the fertile end of the spectrum and a pair of *Molinion* communities from the Czech Republic at its infertile extremity. The second axis is an equally strong partitioning of the vegetation types in relation to their Ellenberg F scores with the communities of the *Cynosurion* at the 'dry' end (low axis 2 scores) and associations featuring *Carex acuta* (=*C.gracilis)* and *Eleocharis palustris* at the wetter extreme (high axis 2 scores).

In broad terms, the British units of the *Calthion* are seen to lie higher on Axis 1, i.e. they occur on more fertile soils than the typical European communities of the alliance but lower on Axis 2, suggesting that they are somewhat drier than is the norm for more continental noda. The wide spread of the 12 noda across the ordination emphasises the variety and complexity of the sites covered by the study.

The proposed *Agrostis stolonifera-Eleocharis palustris* inundation grassland (MG16) occupies almost precisely the same position on the fertility axis as do both the original (Rodwell 1992) and revised types of the *Agrostis stolonifera-Alopecurus geniculatus* grassland (MG13) and a pair of other *Potentillion* communities described by Sýkora from the Netherlands and Ireland [Noda 10 and 13]. The *Agrostis stolonifera-Eleocharis* unit has however a much higher Ellenberg F score, similar to the French equivalent of MG13 [6] (Géhu 1961) indicative of more prolonged periods of inundation than the typical British MG13 [8].

The pair of subcommunities into which the original *Agrostis stolonifera-Carex spp* grassland of Cox and Leach (1996) has been partitioned [18 and 19] lie between the noda of the *Potentillion* and those of the *Alopecurion* in terms of their fertility and occupy a similar zone of dampness to the 'wetter' members of the *Alopecurion* and typical MG13.

Within the *Alopecurion* the proposed new *Alopecurus pratensis-Poa trivialis-Cardamine pratensis* association appears to occupy sites which are more fertile than those of the rest of the alliance but utilises substrates from the same part of the hydrological gradient. Of the two suggested subcommunities, the *Agrostis stolonifera* unit [71] occupies the damper and more fertile sites whilst the *Lolium* unit [72] is characteristic of somewhat drier areas than those supporting the more typical members of the alliance. The original species-rich form of MG7C recognised by Gowing and others (2002) lies adjacent to the *Lolium* unit in the DCA.

The proposed additional subcommunity of *Lolium perenne-Cynosurus cristatus* grassland (MG6d) [70] lies towards the wetter end of the hydrological gradient in which the units of the alliance are commonly found and is inseparable in the DCA from the *Junceo-Cynosuretum* of Zuidhoff and others (1995), a pan-European community.

The nodum representing M22b [21], the *Briza media* subcommunity of *Juncus subnodulosus* fen meadow nestles alongside the published NVC M22 in a tight group featuring noda rich in tall fen species developing on base-rich substrates from Bulgaria, the Czech Republic and Germany [noda 32 and 55]. The cluster forms a bridge between the British and Irish forms of the MG8 on the one hand and their damper counterparts from the Netherlands, Belgium and western Germany. The combined group of *Calthion* associations from the Atlantic fringe from Ireland to western Germany are separated on the DCA from the more continental communities of the alliance, which occur on less fertile soils with examples drawn from Austria and Slovakia.

6. Conclusions

The extensive data collection and analysis undertaken here have resulted in some proposed changes to the NVC to reflect this enhanced knowledge of the plant communities found in England and Wales. These changes are justified due to the small number of releves collected in wet grasslands originally, compared to the large number of relevees analysed during this work. The proposals for change are:

- the MG8 code from the NVC should be retained, but the name changed from *Cynosurus cristatus-Caltha palustris* community to *Cynosurus cristatus-Carex panicea-Caltha palustris* grassland, to reflect the wider diversity of the community. Within the new MG8 description, four subcommunities are recognised.
- the *Carex-Agrostis-Senecio* grassland be coded as MG14 and that two subcommunities be recognised within it.
- a new community, the *Alopecurus pratensis-Poa trivialis-Cardamine pratensis* grassland, with two subcommunities, be introduced into the NVC, coded as MG15.
- a second new community, *Agrostis stolonifera-Eleocharis palustris* inundation grassland, coded as MG16, be erected as a vegetation type distinct from either MG13 grassland or S19 swamp.
- the new releves for MG13 be incorporated into a revised constancy table for that community.
- a new, *Filipendula ulmaria* subcommunity, be accepted as an addition to the existing *Lolium perenne-Cynosurus cristatus* community and be coded as MG6d.
- consideration be given to the removal of subcommunity M22b from the rest of the *Juncus subnodulosus-Cirsium palustre* community and relocated as a fifth, *Juncus subnodulosus*, subcommunity of MG8. More data need to be collated to explore whether this change is appropriate.

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Appendix 1. Listing of the 73 noda used in the DCA analysis presented in Section 5: Wider European perspective.

The columns in the table indicate:

N: identification number on the DCA plot
Author (and date) of the source floristic tables,
Unit: name given by the authors to the community/subcommunity
Alliance: the alliance assigned by the authors
Location: Country or region of data collection
Comment: abbreviation used in the published account for the nodum used in the DCA analysis

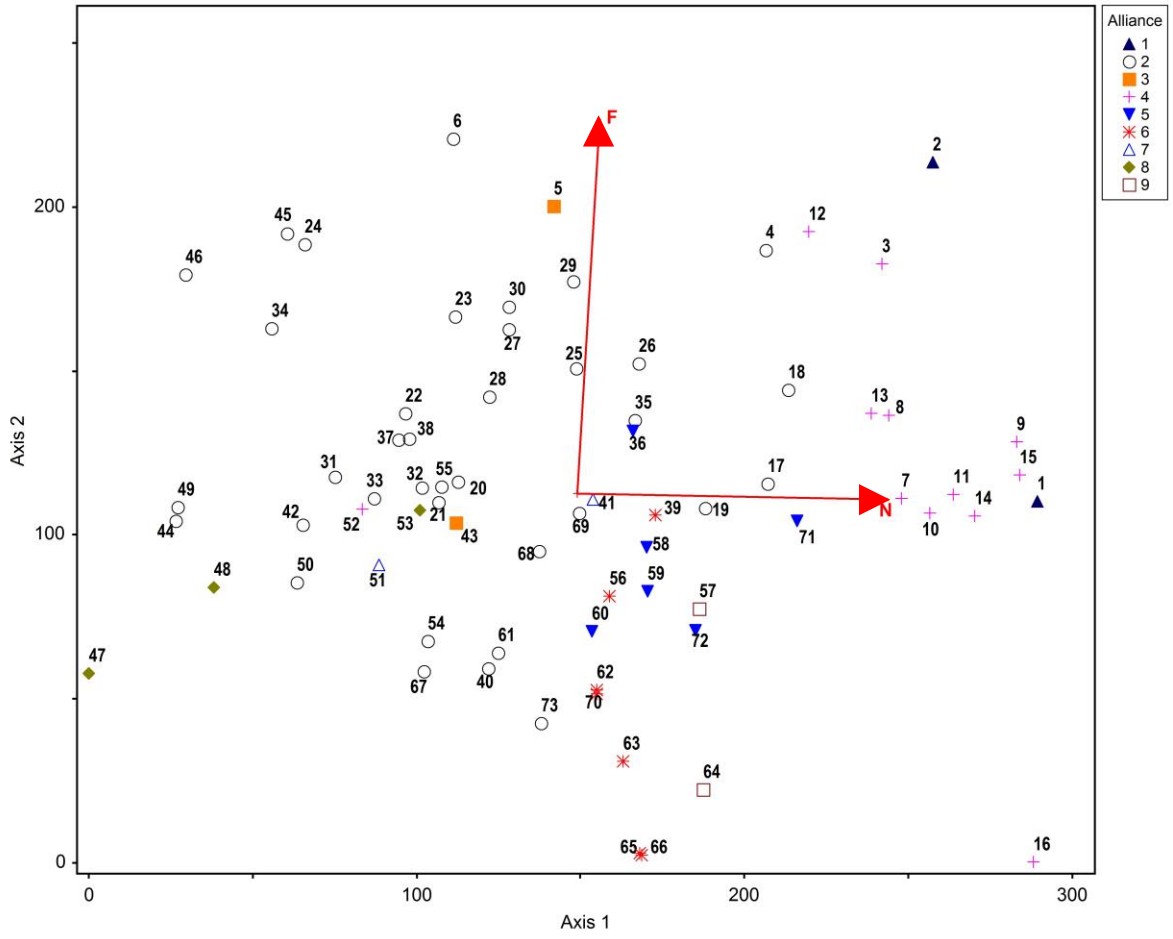
N	Author	Unit	Alliance	Location	Comment
1	Rodwell (1992)	*Eleocharis palustris* swamp, *Agrostis stolonifera* subcommunity	*Phragmition*	Great Britain	S19c
2	Rodwell (1992)	*Eleocharis palustris* swamp, *Eleocharis palustris* subcommunity	*Phragmition*	Great Britain	S19a
3	Prosser and Wallace (unpub)	*Agrostis stolonifera-Eleocharis palustris* inundation grassland	*Potentillion*	Great Britain	Ass.nov.
4	Heery (1991)	*Carex nigra-Ranunculus repens* community: *Eleocharis* sub-variant.	*Calthion*	Ireland	Table 1 Column 4
5	Kovář (1981)	*Caricetum gracilis typicum*	*Caricion gracilis*	Czech Republic	
6	Géhu (1961)	*Filipenduleto-Cirsetum oleracea*	*Bromion racemosi*	Northern France	Table 11
7	Rodwell (1992)	*Agrostis stolonifera-Alopecurus geniculatus* grassland	*Potentillion*	Great Britain	MG13
8	Prosser and Wallace (unpub)	*Agrostis stolonifera-Alopecurus geniculatus* grassland	*Potentillion*	Great Britain	MG13 Revised
9	Sýkora (1982a)	*Ranunculo -Alopecuretum Typicum*	*Potentillion*	Netherlands	Cluster 6
10	Sýkora (1982a)	*Ranunculo -Alopecuretum Equisetetosum palustris*	*Potentillion*	Netherlands	Cluster 8
11	Schaminée *et al*. (1996)	*Ranunculo -Alopecuretum geniculati Typicum*	*Potentillion*	Netherlands	Table 12.4, Col. 3.
12	Géhu (1961)	*Alopecuretum geniculati*	*Potentillion*	France	Table 14
13	Sýkora (1982b)	Basal community of *Agrostis stolonifera. Juncus effusus-Holcus lanatus* type	*Potentillion*	Ireland	Cluster 3
14	Sýkora (1982b)	Basal community of *Agrostis stolonifera. Juncus inflexus-Rumex obtusifolius* type	*Potentillion*	Ireland	Cluster 1
15	Sýkora (1982c)	Basal community of *Agrostis stolonifera. Trifolium fragiferum-Carex hirta* type	*Potentillion*	Belgium	Cluster 4
16	Schaminée *et al*. (1996)	*Trifolio-fragiferi Agrostetum lolietosum*	*Potentillion*	Netherlands	Table 12.3, Col. 6
17	Cox and Leach (1996)	*Agrostis stolonifera-Carex* spp grassland	*Calthion*	England	
18	Prosser and Wallace (unpub)	*Agrostis stolonifera-Carex* spp - *Senecio aquaticus* grassland. Typical subunit	*Calthion*	England and Wales	
19	Prosser and Wallace (unpub)	*Agrostis stolonifera-Carex* spp - *Senecio aquaticus* grassland. *Anthoxanthum-Trifolium repens* unit	*Calthion*	England and Wales	
20	Rodwell (1991)	*Juncus subnodulosus-Cirsium*	*Calthion*	England	M22b

		palustre fen meadow. *Briza media-Trifolium* spp subcommunity		and Wales	
21	Prosser and Wallace (unpub)	*Juncus subnodulosus-Cirsium palustre fen* meadow. *Briza media-Trifolium* spp subcommunity	*Calthion*	England and Wales	
22	Schaminée *et al*. (1996)	*Crepido-Juncetum acutiflori*.	*Calthion*	Netherlands	Table 16.3 column 1
23	van Schaik and Hogeweg (1977)	*Scirpetum sylvaticae*	*Calthion*	Netherlands & Belgium	Cluster 5
24	van Schaik and Hogeweg (1977)	*Crepido-Juncetum acutiflori.*	*Calthion*	Netherlands & Belgium	Cluster 6
25	Schaminée *et al*. (1996)	*Ranunculo-Senecionetum aquatici*	*Calthion*	Netherlands	Table 16.3 column 6
26	Schaminée *et al*. (1996)	*Ranunculo-Senecionetum Juncetosum articulati*	*Calthion*	Netherlands	Table 16.3 column 7
27	Passarge (1964)	*Holcetum lanati*	*Calthion*	Germany	Table 57 Column G
28	Schaminée *et al*. (1996)	*Ranunculo-Senecionetum Caricetosum paniceae*	*Calthion*	Netherlands	Table 16.3 column 8
29	Van Schaik and Hogeweg (1977)	*Ranunculo-Seneconetum aquaticae*	*Calthion*	Netherlands	Cluster 1
30	Van Schaik and Hogeweg (1977)	*Glycerio-Calthetetum*	*Calthion*	Netherlands	Cluster 2
31	Hájeck *et al*. (2008)	Central European waterlogged *Cirsium palustre* grasslands.	*Calthion*	Czech republic	Cluster 5
32	Hájeck *et al*. (2008)	Submontane waterlogged grasslands on alkaline soils.	*Calthion*	Bulgaria and Czech republic	Cluster 6
33	Botta-Dukát *et al*. (2005)	Suboceanic *Calthion* meadows	*Calthion*	Slovakia	Cluster 2.1
34	Botta-Dukát *et al*. (2005)	Suboceanic unmown *Calthion* grassland dominated by *Filipendula ulmaria*	*Calthion*	Czech republic	Cluster 2.2
35	Géhu (1961)	*Brometo-Senecietum*	*Bromion racemosi*	Northern France	Table 13
36	Schamineé *et al*. (1996)	*Fritillario-Alopecuretum Calthetosum*	*Alopecurion*	Netherlands	Table 16.4 column 4
37	Tüxen (1937)	*Cirsium oleraceum-Angelica sylvestris community, subass. Carex fusca*	*Calthion*	Germany	
38	Passarge (1964)	*Circetum oleracei*	*Calthion*	N.E. Germany	Table 59 Column D
39	Géhu (1961)	*Lolio-Cynosuretum uliginosa*	*Cynosurion*	Northern France	Table 15
40	Heery (1991)	*Carex panicea-Festuca rubra community: Carex flava* variant.	*Calthion*	Ireland	Table 1 Columns 12+13 amalgamated
41	Stančić (2008)	*Oenanthe silaifolia-Alopecurus pratensis* association	*Deschampsion*	Croatia	Group 7
42	Kuyper *et al*. (1978)	*Trifolio patentis-Calthetum palustris*	*Calthion*	Austria	Column 7
43	Kuyper *et al*. (1978)	*Caricetum gracilis-vulpinae*	*Caricion gracilis*	Austria	Column 8
44	Kuyper *et al*. (1978)	*Valeriano dioicae-Caricetum davallianae Calthetosum palustris*	*Calthion*	Austria	Column 20

45	Dierschke (1994)	*Bromo-Senecionetum aquaticae*	*Calthion*	Germany	Column 37
46	Dierschke (1994)	*Geranio-Chaerophylletum hirsutii*	*Calthion*	Germany	Column 41
47	Havlová (2006)	*Molinetum caeruleae var. Carex hostiana*	*Molinion*	Czech republic	Column 1
48	Havlová (2006)	*Junco effusi- Molinetum caerulea var. Carex dioica*	*Molinion*	Czech republic	Column 4
49	Kuyper *et al*. (1978)	*Valeriana dioicae-Caricetum davallinae: Calthetosum palustris*	*Calthion*	Austria	Nodum 20
50	Dierschke (1994)	*Junco Molinetum*	*Calthion*	Czech Republic	Nodum 49
51	Kuyper *et al*. (1978)	*Deschampietum cespitosae*	*Deschampsion*	Austria	Nodum 9
52	Dierschke (1994)	*Sanguisorba officinalis-Polygonum bistorta* community	*Calthion*	Germany	Nodum 35
53	Géhu (1961)	*Filipenduleto-Schorzoneretum*	*Molinion*	Northern France	Table 12
54	Prosser (1990)	Northern *Caltha* meadow community	*Calthion*	England	
55	Tüxen (1937)	*Cirsium oleraceum-Angelica sylvestris* community	*Calthion*	Germany	
56	Schaminée *et al*. (1996)	*Lolio-Cynosuretum Lotetosum uliginosi*	*Lolio Cynosurion*	Netherlands	Table 16 column 8
57	Gowing *et al*. (2002b), revised	*Lolium perenne-Alopecurus pratensis-Festuca pratensis*	*Lolio-Plantaginion*	England	
58	Schaminée *et al*. (1996)	*Fritillario-Alopecuretum pratensis*	*Alopecurion*	Netherlands	Table 16.4 column 1
59	Schaminée *et al*. (1996)	*Fritillario-Alopecuretum Cynosuretosum*	*Alopecurion*	Netherlands	Table 16.4 column 2
60	Schaminée *et al*. (1996)	*Sanguisorbo-Silaetum*	*Alopecurion*	Netherlands	Table 16.4 column 5
61	Rodwell et al. (1992)	*Cynosurus cristatus-Caltha palustris*	*Calthion*	England	MG8
62	Zuidhoff *et al*. (1995)	*Junceo-Cynosuretum*	*Cynosurion*	Pan European	
63	Géhu (1961)	*Lolio-Cynosuretum*	*Cynosurion*	Northern France	Table 16
64	Rodwell *et al*. 1992	*Lolium perenne-Alopecurus pratensis-Festuca pratensis*	*Lolio-Plantaginion*	England	MG7C
65	Rodwell *et al*. 1992	*Lolio-Cynosuretum cristati*	*Cynosurion*	England	MG6b
66	Zuidhoff *et al*. (1995)	*Lolio-Cynosuretum*	*Cynosurion*	Pan European	
67	Prosser and Wallace (unpub)	*Cynosurus cristatus-Carex panicea-Caltha palustris* grassland, *Sanguisorba officinalis* subunit	*Calthion*	England and Wales	Sub.Ass.nov.
68	Prosser and Wallace (unpub)	*Cynosurus cristatus-Carex panicea-Caltha palustris* grassland, Typical subunit	*Calthion*	England and Wales	Sub.Ass.nov.
69	Prosser and Wallace (unpub)	*Cynosurus cristatus-Carex panicea-Caltha palustris* grassland, *Carex nigra-Ranunculus flammula* subunit	*Calthion*	England and Wales	Sub.Ass.nov.
70	Prosser and Wallace (unpub)	*Lolium perenne-Cynosurus cristatus* grassland, *Filipendula ulmaria* subunit	*Calthion*	England and Wales	Sub.Ass.nov.
71	Prosser and Wallace (unpub)	*Alopecurus pratensis-Poa trivialis-Cardamine pratensis* grassland. *Agrostis stolonifera* subunit	*Alopecurion*	England and Wales	Sub.Ass.nov.
72	Prosser and Wallace (unpub)	*Alopecurus pratensis-Poa trivialis-Cardamine pratensis* grassland.	*Alopecurion*	England and Wales	Sub.Ass.nov.

		Lolium perenne-Ranunculus acris subunit			
73	Prosser and Wallace (unpubl)	*Cynosurus cristatus-Carex panicea-Caltha palustris* grassland, *Caltha palustris-Bellis perennis* subunit	*Calthion*	England and Wales	Sub.Ass.nov.

Appendix 2. Full DCA analysis showing 73 noda all labelled as listed in Appendix 1 and presented in Section 5: Wider European perspective.



DCA plot of 73 noda.
All noda numbered according to their listing in Appendix 1. Alliances indicated by different symbols (see key). 1 = *Phragmition*, 2 = *Calthion* (including *Bromus racemosi*), 3 = *Caricium gracilis*, 4 = *Potentillion*, 5 = *Alopecurion*, 6 = *Lolio-Cynosuretum*, 7 = *Deschampsion*, 8 = *Molinion*, 9 = *Lolio-Plantaginion*.

Appendix 3

Names that have to be altered for entry into MAVIS software, together with MATCH and MAVIS code numbers.

MATCH name	MATCH code	MAVIS code	Mavis name
Agrostis canina	120	92035	*Agrostis canina sens.lat.*
Aphanes arvensis	177	920131	*Aphanes arvensis agg.*
Aphanes microcarpa	178	920133	*Aphanes inexspectata*
Scirpus maritimus	1213	9201860	*Bolboschoenus maritimus*
Bromus erectus	256	920263	*Bromopsis erecta*
Bromus hordeaceus hordeaceus	258	920269	*Bromus hordeaceus*
Callitriche stagnalis	277	920307	*Callitriche stagnalis sens.lat.*
Carex lepidocarpa	329	920387	*Carex viridula subsp.brachyrrhyncha*
Carex demissa	312	920361	*Carex viridula subsp.oedocarpa*
Cirsium helenioides	417	920518	*Cirsium heterophyllum*
Cochlearia officinalis	427	9202547	*Cochlearia officinalis sens.lat.*
Dactylorhiza maculata ericetorum	468	920610	*Dactylorhiza maculata*
Dactylorhiza praetermissa	469	920612	*Dactylorhiza majalis praetermissa*
Deschampsia cespitosa cespitosa	477	920627	*Deschampsia cespitosa*
Drepanocladus sp	3117	8201138	*Drepanocladus [spp]*
Elymus repens	118	92033	*Elytrigia repens*
Epilobium sp	2836	9204530	*Epilobium [spp]*
Festuca ovina	574	920821	*Festuca ovina agg.*
Festulolium loliaceum	580	920815	*Festuca pratensis x Lolium perenne (xFestulolium loliaceum)*
Festuca rubra	576	920824	*Festuca rubra agg.*
Galeopsis tetrahit	602	920868	*Galeopsis tetrahit agg.*
Galium album	3565	920879	*Galium mollugo*
Glyceria plicata	641	920936	*Glyceria notata*
Filaginella uliginosa	646	920941	*Gnaphalium uliginosum*
Avenula pratensis	655	920961	*Helictotrichon pratense*
Avenula pubescens	656	920962	*Helictotrichon pubescens*
Hieracium sp	675	9202560	*Hieracium indeterminate*
Hypochoeris radicata	706	9201020	*Hypochaeris radicata*
Scirpus setaceus	1214	9201047	*Isolepis setacea*
Juncus bufonius	725	9201057	*Juncus bufonius s.l.*
Lathyrus montanus	757	9201112	*Lathyrus linifolius*
Leontodon taraxacoides	770	9201131	*Leontodon saxatilis*
Lophocolea bidentata	2167	8101056	*Lophocolea bidentata sens.lat.*
Lotus uliginosus	802	9201194	*Lotus pedunculatus*
Chamomilla suaveolens	839	9201242	*Matricaria discoidea*
Chamomilla recutita	840	9201239	*Matricaria recutita*
Myosotis laxa caespitosa	886	9201319	*Myosotis laxa*
Polygonum amphibium	998	9201521	*Persicaria amphibia*
Polygonum bistorta	1000	9201525	*Persicaria bistorta*
Polygonum hydropiper	1004	9201530	*Persicaria hydropiper*

Polygonum persicaria	1008	9201537	*Persicaria maculosa*
Polygonum viviparum	1012	9201543	*Persicaria vivipara*
Phleum pratense	960	9202247	*Phleum pratense s.l.*
Poa subcaerulea	989	9201506.5	*Poa humilis*
Poa pratensis	988	9201506	*Poa pratensis s.l.*
Polygonum aviculare	999	9201522	*Polygonum aviculare agg.*
Rorippa islandica	1116	9202546	*Rorippa islandica sens.str.*
Salix cinerea ssp oleifolia (g)	2632	9201789	*Salix cinerea*
Salix cinerea (s)	1169	9201789	*Salix cinerea*
Scirpus lacustris tabernaemontani	1216	9201852	*Schoenoplectus tabernaemontani*
Solanum dulcamara (g)	1268	9201947	*Solanum dulcamara*
Stellaria alsine	1295	9202007	*Stellaria uliginosa*
Taraxacum sect. vulgaria	1318	9202034	*Taraxacum agg.*
Taraxacum officinale agg.	2982	9202034	*Taraxacum agg.*
Matricaria perforata	3180	9201241.1	*Tripleurospermum inodorum*
Veronica serpyllifolia serpyllifolia	1406	9202180	*Veronica serpyllifolia*

Abbreviations used in Figure 5.

Abbreviation in Figure 5.	**Full Name**	**Abbreviation in Figure 5.**	**Full Name**
Agrocani	Agrostis canina	Galiveru	Galium verum
Agrocapi	Agrostis capillaris	Geumriva	Geum rivale
Agrostol	Agrostis stolonifera	Glycflui	Glyceria fluitans
Alchfili	Alchemilla filicaulis	Glycmaxi	Glyceria maxima
Alchglab	Alchemilla glabra	Heraspho	Heracleum sphondylium
Alchxant	Alchemilla xanthochlora	Holclana	Holcus lanatus
Alisplan	Alisma plantago-aquatica	Hydrvulg	Hydrocotyle vulgaris
Allivine	Allium vineale	Hyporadi	Hypochoeris radicata
Alopgeni	Alopecurus geniculatus	Juncacut	Juncus acutiflorus
Alopprat	Alopecurus pratensis	Juncarti	Juncus articulatus
Anagtene	Anagallis tenella	Junceffu	Juncus effusus
Anthodor	Anthoxanthum odoratum	Juncsunb	Juncus subnodulosus
Arrhelat	Arrhenatherum elatius	Lemnmino	Lemna minor
Atripatu	Atriplex patula	Leonautu	Leontodon autumnalis
Avenpube	Avenula pubescens	Leucvulg	Leucanthemum vulgare
Bellpere	Bellis perennis	Linucath	Linum catharticum
Bidetrip	Bidens tripartita	Lolipere	Lolium perenne
Brizmedi	Briza media	Lotucorn	Lotus corniculatus
Bromrace	Bromus racemosus	Lotuulig	Lotus uliginosus
Callcusp	Calliergon cuspidatum	Luzucamp	Luzula campestris
Callstag	Callitriche stagnalis	Lychflos	Lychnis flos-cuculi
Caltpalu	Caltha palustris	Lysinumm	Lysimachia nummularia
Capsburs	Capsella bursa-pastoris	Mentaqua	Mentha aquatica
Cardprat	Cardamine pratensis	Myosdisc	Myosotis discolor
Careacut	Carex acuta	Myoslaxa	Myosotis laxa caespitosa
Carebine	Carex binervis	Oenaaqua	Oenanthe aquatica

Caredist	Carex disticha	Oenapimp	Oenanthe pimpinelloides
Careflac	Carex flacca	Ophivulg	Ophioglossum vulgatum
Carenigr	Carex nigra	Phalarun	Phalaris arundinacea
Carepani	Carex panicea	Phleprat	Phleum pratense
Careripa	Carex riparia	Planlanc	Plantago lanceolata
Centnigr	Centaurea nigra	Planmajo	Plantago major
Cirsdiss	Cirsium dissectum	Poa triv	Poa trivialis
Cirshele	Cirsium helenioides	Polyamph	Polygonum amphibium
Cirspalu	Cirsium palustre	Poteanse	Potentilla anserina
Conomaju	Conopodium majus	Prunvulg	Prunella vulgaris
Creppalu	Crepis paludosa	Ranuacri	Ranunculus acris
Cynocris	Cynosurus cristatus	Ranuflam	Ranunculus flammula
Dactglom	Dactylis glomerata	Ranurepe	Ranunculus repens
Dantdecu	Danthonia decumbens	Rhinmino	Rhinanthus minor
Desccesp	Deschampsia cespitosa cespitosa	Roriamph	Rorippa amphibia
Eleopalu	Eleocharis palustris	Roriisla	Rorippa islandica
Eleoquin	Eleocharis quinqueflora	Rumeacet	Rumex acetosa
Elymrepe	Elymus repens	Sangoffi	Sanguisorba officinalis
Epippalu	Epipactis palustris	Seneaqua	Senecio aquaticus
Equifluv	Equisetum fluviatile	Silasila	Silaum silaus
Equipalu	Equisetum palustre	Stelalsi	Stellaria alsine
Festarun	Festuca arundinacea	Succprat	Succisa pratensis
Festprat	Festuca pratensis	Tarasect	Taraxacum sect. vulgaria
Festrubr	Festuca rubra	Thalflav	Thalictrum flavum
Filaulig	Filaginella uliginosa	Trifprat	Trifolium pratense
Filiulma	Filipendula ulmaria	Trifrepe	Trifolium repens
Galipalu	Galium palustre	Trigpalu	Triglochin palustre
Galiulig	Galium uliginosum	Trisflav	Trisetum flavescens
		Troleuro	Trollius europaeus
		Urtidioi	Urtica dioica
		Valedioi	Valeriana dioica

Appendix 4. Dichotomous key to mesotrophic grasslands. Revised.

1 Coarse/tussocky grasslands with constant, and often abundant, *Arrhenatherum elatius* and *Dactylis glomerata. Heracleum sphondylium* and *Holcus lanatus* usually frequent and sometimes abundant. 2

These species usually occasional at most and rarely abundant in the sward 7

2 *Deschampsia cespitosa* present and usually co-dominant with *Arrhenatherum* and other coarse grasses but without large umbellifers

MG9b. *Holcus lanatus-Deschampsia cespitosa* grassland

Arrhenatherum elatius subcommunity.

D.cespitosa usually absent but *Heracleum sphondylium* frequent and often abundant with one or more of *Anthriscus sylvestris, Pastinaca sativa, Urtica dioica, Filipendula ulmaria* and *Centaurea nigra* 3

3 Species rich and luxuriant vegetation with frequent *Mercurialis perennis, Valeriana officinalis, Geum rivale, Dryopteris felix-mas* and *Silene dioica*. 4

MG2. *Arrhenatherum elatius-Filipendula ulmaria* tall-herb grassland

Filipendulo -Arrhenatheretum elatioris Shimwell 1968a

Sward can be quite species-rich and luxuriant but never with the above-listed species common 5

4 *Polemonium caeruleum* constant, often with *Oxalis acetosella* and *Stellaria holostea*.

MG2b. *Filipendulo-Arrhenatheretum*

Polemonium caeruleum subcommunity

P.caeruleum absent but two or more of *Sanguisorba officinalis, Avenula pubescens, Senecio jacobaea, Poa pratensis* and *Origanum vulgare* present

MG2a. *Filipendulo-Arrhenatheretum*

Filipendula ulmaria subcommunity

5 *Geranium sylvaticum* and *G.pratense* present and sometimes abundant

MG3c. *Anthoxanthum odoratum-Geranium sylvaticum* grassland

Arrhenatherum elatius subcommunity

COMMENT: Around less heavily grazed margins of northern meadows where *Arrhenatherum* is sparse this vegetation may grade to the other subcommunities of *Anthoxanthum odoratum-Geranium sylvaticum* grassland.

G.sylvaticum absent, though *G.pratense* can be locally prominent 6

MG1. *Arrhenatherum elatius* grassland

Arrhenatheretum elatioris Br.-Br. 1919

COMMENT. *Arrhenatherum* and *Dactylis* may assume dominance in neglected, or under-managed, stands of *Alopecurus pratensis-Sanguisorba officinalis* grassland on more freely drained soil profiles. Where the annual cut is missed for only one or two years transition to the *Arrhenatheretum elatioris* grassland appears to be reversible with a return to early, annual, hay cutting.

6 *Pastinaca sativa* constant and sometimes abundant with frequent *Festuca ovina, Agrostis capillaris, Galium verum* and *Senecio jacobaea*

MG1d. *Arrhenatheretum elatioris,*

Pastinaca sativa subcommunity.

Filipendula ulmaria constant and sometimes co-dominant with *Arrhenatherum elatius*.

MG1c. *Arrhenatheretum elatioris*

Filipendula ulmaria subcommunity

Urtica dioica constant and sometimes co-dominant with *Arrhenatherum* without either *Pastanaca* or *Filipendula ulmaria.*

MG1b. *Arrhenatheretum elatioris*

Urtica dioica subcommunity

Centaurea nigra and Lotus corniculatus constant with one or more of *Leucanthemum vulgare, Veronica chamaedrys, Anthoxanthum odoratum* and *Trisetum flavescens.*

MG1e. *Arrhenatheretum elatioris*

Centaurea nigra subcommunity

Generally grass-dominated vegetation, often rank and species-poor, with frequent and abundant *Festuca rubra* in the general absence of the above species.

MG1a. *Arrhenatheretum elatioris*

Festuca rubra subcommunity

7 *Deschampsia cespitosa* constant and abundant with *Holcus lanatus* and *Poa trivialis.*

MG9a. ***Holcus lanatus-Deschampsia cespitosa* grassland**

Poa trivialis subcommunity

D.cespitosa generally infrequent and not usually abundant 8

COMMENT: *Deschampsia cespitosa* can be locally prominent in poorly drained areas of *Alopecurus pratensis-Sanguisorba officinalis* grassland and the *Lolio-Cynosuretum,* and ill-defined transitions to the latter are particularly common.

8 *Juncus effusus* and/or *Juncus inflexus* constant and usually dominant in a grassy ground with frequent *Holcus lanatus, Agrostis stolonifera* and *Ranunculus repens.* 9

MG10. *Holcus lanatus-Juncus effusus* rush pasture.

Juncus effusus and *Juncus inflexus* generally infrequent and not usually abundant 10

COMMENT: It is not uncommon in badly drained areas of other grasslands for *J.effusus* and *J.inflexus* to become locally prominent. This is particularly common in stands of *Lolio-Cynosuretum* (MG6) and *Centaureo-Cynosuretum* (MG5) grasslands.

9 *Juncus inflexus* constant and abundant usually with some *Juncus effusus.*

MG10b. *Holcus lanatus-Juncus effusus* rush pasture.

Juncus inflexus subcommunity

Iris pseudacorus constant and sometimes dominant with an often reduced cover of *Juncus effusus.*

MG10c. *Holcus lanatus-Juncus effusus* rush pasture.

Iris pseudacorus subcommunity

Juncus effusus abundant without *Juncus inflexus* or *Iris pseudacorus*

MG10a. *Holcus lanatus-Juncus effusus* rush pasture.

Typical subcommunity

COMMENT: In western Britain separation of the *Holcus-Juncus* community from the damper *Juncus-Galium palustre* rush mire (M23) often becomes difficult; but the increase frequency of *Galium palustre, Lotus uliginosus, Cirsium palustre* and *Agrostis canina* usually helps distinguish stands of the mire community. Prolonged inundation of *Cynosurus-Carex panicea-Caltha palustris* grassland can also result in extensive rush invasion and transition of this community to both *Holcus-Juncus effusus* grassland and *Juncus-Galium* mire are common place.

10 *Festuca arundinacea* constant and usually dominant in a coarse sward with *Festuca rubra, Agrostis stolonifera* and *Potentilla anserina.* 11

MG12. ***Festuca arundinacea* grassland**

Festuca rubra, Agrostis stolonifera and *Potentilla anserina* can be frequent but *Festuca arundinacea* generally infrequent and not abundant. 12

11 One or more of *Oenanthe lachenalii, Juncus gerardii, Glaux maritima, Carex otrubae* and *Sonchus arvensis* present in usually small quantities.

MG12b. *Festuca arundinacea* grassland
Oenanthe lachenalii subcommunity
On upper saltmarshes, constant and abundant *J.maritimus* marks out mosaics and gradations to the *Juncus maritimus* saltmarsh community.
Above listed species at most occasional but *Lolium perenne* and/or *Holcus lanatus* frequent and abundant.
MG12a. *Festuca arundinacea* grassland
Lolium perenne-Holcus lanatus subcommunity

12 Species poor, sometimes quite open, swards dominated by mixtures of *Festuca rubra, Agrostis stolonifera* and *Potentilla anserina.* 13
MG11. ***Festuca rubra-Agrostis stolonifera-Potentilla anserina* grassland**
Festuca rubra and *Agrostis stolonifera* can be frequent and abundant but not with *Potentilla anserina.* 14

13 One or more of *Honkenya peploides, Carex arenaria, Sagina procumbens* and *Silene dioica* occasional to frequent.
MG11c. *Festuca rubra-Agrostis stolonifera-Potentilla anserina* grassland
Honkenya peploides subcommunity
One or more of *Atriplex prostrata, Matricaria maritima, Polygonum aviculare* and *Oenanthe lachenalii* occasional.
MG11b. *Festuca rubra-Agrostis stolonifera-Potentilla anserina* grassland
Atriplex prostrata subcommunity
COMMENT: This vegetation may grade to *Juncus maritimus* or *Juncus gerardi* communities on upper saltmarshes.
Lolium perenne and or *Holcus lanatus* frequent and abundant in the general absence of the above sets of species.
MG11a. *Festuca rubra-Agrostis stolonifera-Potentilla anserina* grassland
Lolium perenne subcommunity.

14 Swards with a limited diversity of grasses, sometimes rather open, dominated by 15
Agrostis stolonifera with one or more of the following frequent and abundant: *Eleocharis palustris, Phalaris arundinacea, Glyceria maxima, Alopecurus geniculatus,* and *Glyceria fluitans.*

Agrostis stolonifera, Alopecurus geniculatus and *Glyceria fluitans* may occur together 16
but generally in swards with a more diverse grass flora in which some of *Holcus lanatus, Anthoxanthum odoratum, Cynosurus cristatus, Festuca rubra, Alopecurus pratensis* or *Lolium perenne* are prominent. *Phalaris arundinacea* and *Glyceria maxima* occasional at most.

15 *Agrostis stolonifera* and *Eleocharis palustris* constant and often abundant, with frequent *Phalaris arundinacea, Glyceria maxima* and *Galium palustre* and occasional *Mentha aquatica, Polygonum amphibium, Carex acuta* and *Myosotis spp* often over an understorey of *Lysimachia nummularia*.
MG16. *Agrostis stolonifera-Eleocharis palustris* inundation grassland
Agrostis stolonifera constant but the other above listed species occasional at most. *Alopecurus geniculatus, Glyceria fluitans* and *Poa trivialis* constant with often abundant *Ranunculus repens* forming a low carpet.
MG13. ***Agrostis stolonifera-Alopecurus geniculatus* grassland**
NOTE: On upper saltmarshes where there is only occasional saline inundation stands of MG13 may support halophytic species, including *Juncus gerardii* and *Triglochin maritima*.

16 *Agrostis stolonifera* constant and often abundant in a bulky grass-dominated sward with 17

constant *Alopecurus pratensis, Poa trivialis, Lolium perenne* and with *Ranunculus acris, Rumex acetosa* and *Cardamine pratensis* frequent.

MG15. *Alopecurus pratensis-Poa trivialis-Cardamine pratensis* grassland

Agrostis stolonifera may be frequent but not with the above combination of grass species. 18

17 Species poor, grass-dominated vegetation with frequent *Alopecurus geniculatus* and occasionally abundant *Elymus repens.* Often with abundant *Ranunculus repens* and frequent *Polygonum amphibium* and *Rumex crispus*.

MG15a. *Alopecurus pratensis-Poa trivialis-Cardamine pratensis* grassland.

Agrostis stolonifera subcommunity

More species-rich vegetation with constant *Ranunculus acris, Rumex acetosa* and *Anthoxanthum odoratum* and frequent *Holcus lanatus, Cynosurus cristatus, Trifolium repens. Ranunculus repens* may be frequent but rarely abundant.

MG15b. *Alopecurus pratensis-Poa trivialis-Cardamine pratensis* grassland

Lolium perenne-Ranunculus acris subcommunity

18 Generally low-growing swards dominated by *Agrostis stolonifera* and *Carex nigra* with constant *Senecio aquaticus* and frequent *Glyceria fluitans.* Other frequent associates include *Ranunculus flammula, Polygonum amphibium, Cardamine pratensis, Calliergon cuspidatum, Carex disticha,* and occasionally *Eleocharis palustris*. 19

MG14. *Carex nigra-Agrostis stolonifera-Senecio aquaticus* grassland

Above combination of species not frequent or abundant 20

19 Moderately species rich swards with constant *Anthoxanthum odoratum, Trifolium repens, Cardamine pratensis, Calliergon cuspidatum* and frequent *Ranunculus acris, Rumex acetosa, Cynosurus cristatus* and *Leontodon autumnalis.*

MG14b. *Carex nigra-Agrostis stolonifera-Senecio aquaticus* grassland

Anthoxanthum odoratum-Trifolium repens subcommunity

Above listed species occasional at most. *Glyceria fluitans* constant with *Eleocharis palustris* frequent.

MG14a. *Carex nigra-Agrostis stolonifera-Senecio aquaticus* grassland

Typical subcommunity

20 *Cynosurus cristatus* constant with one or more of *Carex panicea, Carex nigra*, *Ranunculus flammula, Caltha palustris, Juncus acutiflorus* and *Calliergon cuspidatum* constant and often abundant. *Lolium perenne* and *Alopecurus pratensis* generally scarce. 21

MG8. *Cynosurus cristatus-Carex panicea-Caltha palustris* grassland.

NOTE: this is a variable vegetation in which it is not uncommon for any one of the named community species to be scarce or absent.

Carex panicea, *Carex nigra*, *Ranunculus flammula, Caltha palustris, Juncus acutiflorus* and *Calliergon cuspidatum* generally very scarce. 24

21 *Sanguisorba officinalis, Centaurea nigra* and *Juncus acutiflorus* constant with frequent

Succisa pratensis and *Prunella vulgaris* in a species rich, often bulky sward, including occasional *Vicia cracca, Carex flacca, Lotus corniculatus* and *Silaum silaus. Ranunculus repens* generally scarce

MG8a. *Cynosurus cristatus-Carex panicea-Caltha palustris* grassland

Sanguisorba officinalis subcommunity

Sanguisorba officinalis, Centaurea nigra and *Juncus acutiflorus* occasional at most or altogether absent. 22

22 Low-growing sward with constant, often abundant *Carex nigra;* constant *Agrostis canina* with frequent *Ranunculus flammula, Carex disticha, Senecio aquaticus* and *Cirsium dissectum* together with occasional *Carex demissa, Hydrocotyle vulgaris*, *Galium palustre, Juncus effusus, Thalictrum flavum.*

MG8c. *Cynosurus cristatus-Carex panicea-Caltha palustris* grassland

Carex nigra-Ranunculus flammula

Above species generally scarce or absent 23

23 *Carex panicea* scarce but *Caltha palustris* constant in a species rich sward in which *Bellis perennis, Rhinanthus minor, Trifolium repens, T.pratense, Rumex acetosa, Cerastium fontanum* and *Poa trivialis* are all constant with occasional *Myosotis discolor, Euphrasia agg., Bromus hordeaceus*. Occasional records for *Alchemilla glabra, Trollius europaeus* and *Crepis paludosa* provide a distinct northern element to the subcommunity.

MG8d. *Cynosurus cristatus-Carex panicea-Caltha palustris* grassland

Caltha palustris-Bellis perennis subcommunity

Carex panicea occasional and *Caltha palustris* frequent with the above listed species scarce or absent. *Carex disticha, Lychnis flos-cuculi, Lotus uliginosus, Cirsium palustre, Geum rivale, Carex hirta, Equisetum palustre, Juncus inflexus* and *Eleocharis palustris* all weakly preferential.

MG8b. *Cynosurus cristatus-Carex panicea-Caltha palustris* grassland

Typical subcommunity

24 Generally species-rich swards dominated by mixtures of bulky perennial dichotyledons such as *Sanguisorba officinalis, Geranium sylvaticum, Filipendula ulmaria, Alchemilla glabra* and *Lathyrus pratensis.* 25

Sward can be species rich but above listed species are occasional at most. 30

25 *Geranium sylvaticum, Alchemilla glabra, A.xanthochlora* and *Conopodium majus* frequent with constant *Anthoxanthum odoratum* and *Agrostis capillaris* but usually little *Alopecurus pratensis.* 26

MG3. ***Anthoxanthum odoratum-Geranium sylvaticum* grassland**

G.sylvaticum, A.glabra, A.xanthochlora and *Conopodium majus* usually absent. *Agrostis capillaris* generally scarce but *Alopecurus pratensis, Filipendula ulmaria* and *Lathyrus pratensis* all frequent. 27

MG4. *Alopecurus pratensis-Sanguisorba officinalis* grassland

NOTE: on alluvial soils in valleys in the northern England this can be a difficult separation to make.

26 *Bromus hordeaceus hordeaceus, Lolium perenne* and *Phleum pratense pratense* frequent

MG3a. *Anthoxanthum odoratum-Geranium sylvaticum* grassland
Bromus hordeaceus hordeaceus subcommunity
The above species usually no more than infrequent but some of the following present: *Briza media, Lotus corniculatus, Luzula campestris, Hypochaeris radicata, Centaurea nigra, Trifolium pratense.*
MG3b. *Anthoxanthum odoratum-Geranium sylvaticum* grassland
Briza media subcommunity

27 *Centaurea nigra, Plantago lanceolata* and *Trifolium pratense* constant with frequent *Cynosurus cristatus, Trifolium repens* and *Lathyrus pratensis.* 28

Above listed species occasional at most but *Agrostis stolonifera* constant and often abundant in species-poor swards with frequent *Cardamine pratensis.* 29

28 *Dactylis glomerata, Trisetum flavescens, Rhinanthus minor* and *Leucanthemum vulgare* constant with frequent *Arrhenatherum elatius, Lotus corniculatus, Ranunculus bulbosus* and *Prunella vulgaris* and occassional *Heracleum sphondylium* and *Briza media*.

MG4a. *Alopecurus pratensis-Sanguisorba officinalis* grassland
Dactylis glomerata subcommunity
Above listed species occasional or rare

MG4b. *Alopecurus pratensis-Sanguisorba officinalis* grassland
Typical subcommunity

29 *Holcus lanatus, Cynosurus cristatus* and *Anthoxanthum odoratum* frequent

MG4c. *Alopecurus pratensis-Sanguisorba officinalis* grassland
Holcus lanatus subcommunity
Above listed species very scarce in swards dominated by *Agrostis stolonifera* and *Filipendula ulmaria* with constant *Cardamine pratensis* and occasional *Carex acuta, Carex disticha* and *Achillea ptarmica.*

MG4d. *Alopecurus pratensis-Sanguisorba officinalis* grassland
Agrostis stolonifera subcommunity

30 Generally species rich swards with an abundance of herbaceous dicotyledons including *Lotus corniculatus* and some of *Leontodon hispidus, Ranunculus bulbosus, Leucanthemum vulgare, Primula veris, Centaurea nigra, Rumex acetosa, Trifolium pratense* and with frequent and sometimes abundant *Dactylis glomerata, Anthoxanthum odoratum* and *Agrostis capillaris.* 31
MG5. *Cynosurus cristatus-Centaurea nigra* grassland
Above combination of species lacking 32

31 *Galium verum* and *Trisetum flavescens* frequent and sometimes abundant with occasional records for *Sanguisorba minor, Carex flacca* and *Koeleria macrantha*
MG5b. *Cynosurus cristatus-Centaurea nigra* grassland
Galium verum subcommunity
Danthonia decumbens, Luzula campestris, Succisa pratensis and *Potentilla erecta* present without *Galium verum*
MG5c. *Cynosurus cristatus-Centaurea nigra* grassland
Danthonia decumbens subcommunity
Lolium perenne and *Lathyrus pratensis* frequent in the general absence of the above

combination of species.

MG5a. *Cynosurus cristatus-Centaurea nigra* grassland
Lathyrus pratensis subcommunity.

32 *Lolium perenne* and *Cynosurus cristatus* constant sometimes with frequent *Anthoxanthum odoratum* but with *Agrostis capillaris* and *Dactylis glomerata* at most occasional. 33

MG6. *Lolium perenne-Cynosurus cristatus* grassland

Species-poor vegetation often dominated by *Lolium perenne* in the absence of *Cynosurus cristatus*. 36

MG7. *Lolium perenne leys* and related grasslands

33 *Trisetum flavescens* and *Phleum pratense* ssp.*bertolonii* frequent without *Anthoxanthum odoratum*

MG6c. *Lolio-Cynosuretum*
Trisetum flavescens subcommunity

Trisetum and Phleum pratense bertolonii absent 34

34 Species-rich swards with constant *Filipendula ulmaria, Ranunculus repens, R.acris, Cardamine pratensis,* and *Plantago lanceolata; Poa trivialis* and *Phleum pratense* frequent.

MG6d. *Lolium perenne-Cynosurus cristatus* grassland
Filipendula ulmaria subcommunity

Species-poor swards with above listed species occasional at most 35

35 *Anthoxanthum odoratum*, *Rumex acetosa, Ranunculus acris* constant

MG6b. *Lolium perenne-Cynosurus cristatus* grassland
Anthoxanthum odoratum subcommuntiy

Above listed species scarce

MG6a. *Lolium perenne-Cynosurus cristatus* grassland
Typical subcommunity

36 *Poa trivialis* and *Phleum pratense ssp pratense* frequent and sometimes co-dominant with *Lolium perenne.*

MG7B. *Lolium perenne* leys and related grasslands.
Lolium perenne-Poa trivialis leys

Alopecurus pratensis and *Festuca pratensis* frequent and sometimes co-dominant with *L.perenne.*

MG7C. *Lolium perenne* leys and related grasslands
Lolium perenne-Alopecurus pratensis-Festuca pratensis grassland

Alopecurus pratensis frequent and sometimes co-dominant with *L.perenne* without *F.pratensis.*

MG7D. *Lolium perenne* leys and related grasslands
Lolium perenne-Alopecurus pratensis grassland

L.perenne and *Trifolium repens* co-dominant with infrequent *Poa trivialis*, *A.pratensis* and *F.pratensis*

MG7A. *Lolium perenne* leys and related grasslands
Lolium perenne-Trifolium repens leys

Plantago lanceolata and *Poa pratensis* frequent and the latter sometimes co-dominant

with *L.perenne.*

MG7F. *Lolium perenne* leys and related grasslands

Poa-Lolium perennis De Vries & Westhoff *apud* Bakker 1965

Plantago lanceolata frequent with *Poa pratensis* uncommon

MG7E. *Lolium perenne* leys and related grasslands

Lolio-Plantaginetum (Link 1921) Beger 1930 *emend. Sissingh* 1969.