

**Baseline Biological Monitoring  
of the  
Countryside Management Scheme  
in Northern Ireland  
2002 / 2003**



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## **Agri-environment Monitoring Unit**

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## SUMMARY

1. The Countryside Management Scheme (CMS) was introduced in Northern Ireland by the Department of Agriculture and Rural Development (DARD) in 2000. The scheme focuses on biodiversity, water quality of rivers and lakes, and landscape and heritage features. It is open to all farmers and landowners outside designated Environmentally Sensitive Areas (ESAs). Specific management prescriptions must be followed for all habitats. In return for following management agreements, scheme participants receive annual payments for up to 10 years.
2. Uptake of the CMS scheme has been successful. By the end of 2003, 2040 landowners had entered the scheme bringing 86,660 ha of land under agreement.
3. Baseline surveys of habitats under CMS management agreement were carried out in 2002 and 2003. Biological monitoring will form the core of a programme to evaluate the effectiveness of the CMS management prescriptions in maintaining and enhancing biodiversity, landscape and heritage features. A further important aim of the monitoring programme will be to assess the contribution of the scheme in delivering targets for Northern Ireland Biodiversity Action Plan (BAP) habitats and species.
4. The main focus of the biological monitoring is on plant and invertebrate communities. Quantitative sampling of plant communities using quadrats is used to assess the species diversity of each habitat and to describe vegetation. Ground beetles (Carabidae) and spiders (Araneae) are monitored as they are habitat specific, easily trapped in pitfall traps and are good indicators of biological change.
5. The results of baseline monitoring are presented and evaluated. Species diversity and composition of vegetation and invertebrate communities have been described and documented to provide an assessment of the biodiversity value of each habitat or option under agreement. A baseline

record for habitats has been established and will provide a benchmark by which to monitor change through resurveys. Changes in key plant and invertebrate indicator species for habitats will be determined.

6. Another component of the biological monitoring is the use of vegetation condition assessment for certain habitats. Condition assessment was carried out for grassland and peatland habitats and provides a further benchmark. This gives an indication of the baseline condition of these habitats at the time CMS management prescriptions were introduced. Vegetation change will be measured against condition targets.
7. An interpretation of the effectiveness of the scheme at this stage is limited as only baseline data is available. Monitoring will be carried out again in 2006/7 to provide a mid-term assessment of the scheme. Long-term biological monitoring should determine whether the Countryside Management Scheme is fulfilling the objective of maintaining and enhancing biodiversity.

## **1. INTRODUCTION**

### **1.1. The scheme**

In the 1980's the emphasis of European agricultural policy significantly changed to encourage farming practices compatible with protection of the environment. Agri-environment schemes in Northern Ireland have been run by Department of Agriculture and Rural Development (DARD) since 1988, when the first Environmentally Sensitive Area (ESA) was introduced. Following this further ESAs were designated, covering in all 20% of the land area of Northern Ireland.

The Countryside Management Scheme (CMS) was introduced by DARD in 2000, in compliance with Rural Development Regulation (EU) No. 1257/99. It is open to all farmers and landowners outside the designated ESAs. The scheme is designed to encourage farmers to adopt, or continue with, environmentally sensitive farming practices. The scheme is voluntary and applies to the whole farm. It focuses on biodiversity, water quality of rivers and lakes, and landscape and heritage features. All participants are required to follow Good Farming Practice and a series of general environmental requirements. Specific management prescriptions must be followed for each habitat and feature on the farm. In return for following management agreements under the CMS, participants receive annual payments for up to 10 years.

### **1.2. Policy background**

Since their first introduction, DARD has been committed to monitoring the performance of agri-environment schemes in relation to their stated environmental objectives. As part of this monitoring programme, biological and landscape data have been collected. However, since 1988, UK policies for biodiversity and rural development have evolved, mainly in response to policies introduced by the European Union. Agri-environment schemes now reside under the Northern Ireland Rural Development Plan (NIRD) 2000-2006. In addition to reporting of scheme performance *per se*, there is now a

requirement for DARD to report on the performance of schemes within a wider policy context.

The main policy driver for biodiversity is currently the UK Biodiversity Action Plan (BAP). There are 40 BAP priority habitats in Northern Ireland and action plans are being produced for these based on the existing UK plans (Northern Ireland Biodiversity Group, 2000). These rare or declining habitats are critically important for biodiversity in Northern Ireland. Agri-environment schemes are one of the main vehicles by which BAP objectives and targets for many habitats and species are expected to be met and delivered. DARD is currently conducting a review of these schemes, but the UK BAP will continue to be the driving force for habitat conservation for some time to come. Therefore, the current and future monitoring programmes will take account of BAP objectives for priority habitats.

### **1.3. Scheme uptake**

By the end of 2003, 2040 landowners had entered the CMS scheme bringing 86,660 ha of land under agreement (Table 1). This includes improved/unimproved grassland (Tier 1), priority habitats and features (Tier 2), and optional habitats and features (Tier 3). There are also currently 152,000m of field boundaries, i.e. hedges, dry stone walls and earth banks, to be restored under five-year management plans.

**Table 1:** Area under agreement for each CMS habitat and feature in 2003.

HABITAT CODE	HABITAT	AREA UNDER AGREEMENT (ha)
I	Improved grassland	45916.81
U	Unimproved grassland	10435.27
SRD	Species-rich dry grassland	312.09
SRW	Species-rich wet grassland	1858.46
SRC	Species-rich calcareous grassland	0
SRF	Species-rich fen meadow	0.57
SRH	Species-rich hay meadow	65.28
SRA1	Species-rich acid grassland (0-10ha)	137.5
SRA2	Species-rich acid grassland (10-50ha)	127.93
SRA3	Species-rich acid grassland (>50ha)	33.82
UBR	Upland breeding wader site - restricted grazing	646.99
UBN	Upland breeding wader site - closed grazing	280.29
LWG	Wetlands - lowland wet grassland	1501.74
FEN	Wetlands - fen	46.71
SWA	Wetlands - swamp	69.04
CAR	Wetlands - carr	59.84
REE	Wetlands- reed bed	12.15
EBW	Wetland - enhanced breeding wader	144.94
HMD1	Heather moorland - dry heath (0-100ha)	930.96
HMD2	Heather moorland - dry heath (100-200ha)	46.43
HMD3	Heather moorland - dry heath (>200ha)	0
HMW1	Heather moorland - wet heath (0-100ha)	8524.59
HMW2	Heather moorland - wet heath (100-200ha)	890.49
HMW3	Heather moorland - wet heath (>200ha)	129.85
HMB1	Heather moorland - blanket bog (0-100ha)	734.98
HMB2	Heather moorland - blanket bog (100-200ha)	610.44
HMB3	Heather moorland - blanket bog (>200ha)	220.15
DHM1	Degraded heath (0-100ha)	1654.2
DHM2	Degraded heath (100-200ha)	99.33
DHM3	Degraded heath (>200ha)	0
RMG1	Rough moorland grazing (0-100ha)	2182.17
RMG2	Rough moorland grazing (100-200ha)	1220.94
RMG3	Rough moorland grazing (>200ha)	782.35
LRB1	Lowland raised bog (0-100ha)	1650.81
LRB2	Lowland raised bog (100-200ha)	0
LRB3	Lowland raised bog (>200ha)	0
FWS	Farm woodland - less than 1ha	358.21
FSC	Farm scrub	617.61

AFI	Land adjacent to lakes - fields - improved grassland	167.43
AFU	Land adjacent to lakes - fields - unimproved grassland	31.78
BLI	Land adjacent lakes - buffers - improved grassland	1.7
BLU	Land adjacent lakes - buffers - unimproved grassland	6.22
GCT	Coastal farmland - cliff tops	4.19
GCF	Coastal farmland - cliff faces	0
SAS	Coastal farmland - sand dunes	18
GSM	Coastal farmland -grazed salt marsh	44.69
PRK	Parkland	974.92
ARC1	Archaeological feature (< 1.5ha)	99.5
ARC2	Archaeological feature (>1.5ha)	0
RWS	Arable - Retention of winter stubble	1364.22
CGC	Arable - Improved grassland to spring cereal/rape	16.6
CGW	Arable - Wild bird cover on improved grassland	182.75
AFW	Arable - Wild bird cover as arable margin	31.93
RGF	Arable - Rough grass field margin	86.13
CCM	Arable - Conservation crop margin	148.17
WFI1	Winter feeding sites for swans and geese - improved grassland	172.83
WFI2	Winter feeding sites for swans and geese - improved grassland	191.09
WFI3	Winter feeding sites for swans and geese - improved grassland	7.37
WFA1	Winter feeding sites for swans and geese – arable (<5ha)	49.99
WFA2	Winter feeding sites for swans and geese – arable (5-20ha)	81.05
WFA3	Winter feeding sites for swans and geese – arable (>20ha)	15
LBI	Lapwing breeding site - improved grassland	183.02
LBU	Lapwing breeding site - unimproved grassland	308.27
BUI	Buffers - improved grassland	20.33
BUU	Buffers - unimproved grassland	21.99
ORE	Restoration of traditional orchards	10.53
ORT	Recreation of traditional orchards	11.75
PNT	Provision of native trees	105.965
<b>TOTAL</b>	<b>Total area under scheme</b>	<b>86660.36</b>

#### **1.4. Monitoring programme**

Biological monitoring will form the core of a programme to evaluate the effectiveness of the CMS management prescriptions in maintaining and enhancing the wildlife, heritage and landscape value of the countryside. An important aim of the monitoring programme will be to assess the contribution of CMS in delivering targets for BAP priority habitats.

Baseline surveys of habitats under CMS agreement were carried out in 2002 and 2003. This report presents and evaluates the results of the baseline monitoring.

The main focus of biological monitoring is on plant and invertebrate communities. Quantitative sampling of plant communities using quadrats is used to assess the species diversity of each habitat and to describe vegetation composition. Changes in plant species composition have been widely used to examine long-term ecological changes such as the relationship between species diversity and agricultural management.

Ground beetle and spider communities have been used successfully in monitoring other agri-environment schemes (e.g. Hegarty, 1994). Ground beetles (Carabidae) and spiders (Araneae) are monitored as they are habitat specific, easily trapped in pitfall traps and are good indicators of biological change (Kirby, 1992). The wealth of data on the ecological requirements of individual ground beetle species (Lindroth 1974) has proven useful in environmental quality assessment (Eyre & Rushton 1989; Rushton *et al.* 1989; Gardner 1991). Information on the ground beetle assemblages and habitats specific to Northern Ireland has been published (Anderson *et al.* 2000) and this will prove useful in the current monitoring programme. Spiders are sensitive to habitat architecture and as such provide useful indicator species (Coulson & Butterfield, 1985). A quality scoring system using spider species assemblages has been devised (Cameron *et al.* 2004). This adds a further dimension to the understanding of site biodiversity and can be used to provide a comparable score for any monitored site. The integration of plant and invertebrate monitoring provides a more comprehensive measure of habitat diversity. Perner (2003) suggests that vegetation monitoring be used

as a long-term approach and should be coupled with short-term sensitive invertebrate monitoring (e.g. ground-dwelling spiders and beetles) when monitoring change in agricultural land use. Monitoring will determine changes in key indicator species of habitats as a result of CMS management prescriptions.

Another component of the biological monitoring is the use of vegetation condition assessment for particular habitats. A variety of methods have been developed by the UK agencies for Rapid Condition Assessment (RCA) of designated sites. RCA is a method for assessing habitat condition against predetermined targets and so clear site objectives are critical. A review of botanical monitoring methods in the England recommended that RCA be carried out alongside quadrat or plot monitoring of agri-environment scheme sites (Critchley *et al*, 2002) These methods are complementary, with RCA designed to gain coverage of individual sites, while quantitative methods are used to sample vegetation types across the scheme. Standards for assessing the condition of Northern Ireland vegetation, including BAP priority habitats, have still to be agreed. At present methods have been developed for CMS monitoring based on UK condition assessment for lowland grassland and upland habitats (Robertson & Jefferson, 2000; Jerram & Drewitt, 1998). This assessment gives an indication of the baseline condition of these habitats at the time CMS management prescriptions were introduced. At resurvey vegetation change will be measured against condition targets. This will determine whether the scheme is meeting its objectives of maintaining or enhancing habitats, particularly those corresponding to BAP priority habitats. However some further work is recommended to validate the methods and the targets.

## **2. METHODS**

### **2.1. Sampling strategy and selection of sites**

Due to the extensive nature of the scheme, i.e. 80% of the land area of Northern Ireland, baseline monitoring was carried out over two years (2002 and 2003) on CMS participant farms. These were farms that had joined in tranches 1 and 2 respectively. It was thought impractical to use non-participant sites as comparable areas of many habitat types were not available in intensively managed farmland. It was also found in previous monitoring exercises that a high number of original non-participants had joined the scheme before re-monitoring could take place. Monitoring participant farms will determine the effect of management prescriptions over time.

There are over 40 habitat types recognised within the scheme. Sites were chosen on a stratified random basis from a database provided by DARD to reflect the geographical and ecological range of habitats encompassed by the scheme. Sampling was stratified by county to ensure sites were representative of Northern Ireland. Sites for botanical monitoring were selected so that there were greater numbers of the more common habitats sampled in keeping with their level of representation within the scheme (Table 2). There was at least a 5% sample of each habitat. Ideally, for statistical purposes, there should be good replication of each habitat sampled. Therefore less common habitats were sampled at a proportionally higher intensity, which may also reflect their conservation value. Where numbers of these sites are too low to permit statistical analyses they will be compared on an individual site basis to determine any changes in biodiversity over time.

Invertebrate sites formed a sub-sample of plant monitoring sites (Table 2). This means that comprehensive vegetation and management data is available for the analysis of invertebrate results.

**Table 2.** The number of sites surveyed for each CMS habitat.

HABITAT CODE	HABITAT	Total no. of sites under agreement	No. of plant sites surveyed	%	No. of invertebrate sites surveyed	%
		SRD	Species-rich dry grassland	94	18	19
SRW	Species-rich wet grassland	414	32	8	10	2
SRH	Species-rich hay meadow	30	9	30	6	20
SRA	Species-rich acid grassland	20	7	35		
LWG	Lowland wet grassland	509	29	6	12	2
FEN	Fen	28	2	7		
SWA	Swamp	56	5	9		
CAR	Carr	42	5	12		
REE	Reedbed	7	2	29		
EBW	Enhanced breeding wader	46	5	11		
HMD	Dry heath	31	8	26		
HMW	Wet heath	309	33	11	12	4
HMB	Blanket bog	25	5	20	2	8
DHM	Degraded heath	125	22	18	9	7
RMG	Rough moorland grazing	234	18	8	9	4
LRB	Lowland raised bog	214	20	9	8	4
FWS	Farm woodland	458	63	14	11	2
FSC	Farm scrub	423	28	7	8	2
RWS	Retention of winter stubble	158	9	6	13	8
CGW	Conversion of grassland to wild bird cover	117	12	10	11	9
AFW	Wild bird cover as arable margin	17	4	24	1	6
RGF	Rough grass field margin	22	8	36		
BUI	Buffers - improved grassland	39	6	15		
BUU	Buffers – unimproved grassland	33	5	15		
FBR	Field boundary restoration	1558	25	2	13	1
<b>TOTAL</b>		<b>5009</b>	<b>380</b>	<b>8</b>	<b>133</b>	<b>3</b>

Certain habitats were not monitored where there were only one or two sites under agreement, e.g. coastal dunes. Other habitats such as upland breeding wader sites, lapwing breeding sites and winter-feeding sites for swans and geese were not surveyed. Objectives for these habitats are primarily for bird species, monitoring of which is not included under this current project. Small isolated pockets of habitats are not likely to have much impact on bird populations.

A total of 11% of agreement farms available at the time of survey in 2002/3, i.e. from tranches 1 and 2, were visited. Subsequent joiners in tranches 3 and 4 bring this percentage down to 7% of farms currently participating in the scheme. Not all habitats present on each farm were surveyed as the priority was to have an adequate proportion of each of the sampled habitats.

## **2.2. Field methods**

### **2.2.1. Botanical sampling**

#### ***Grasslands / wetlands***

Plant communities were sampled during June and July using standard nested quadrats. Quadrats were equally spaced along a transect across the diagonal of the field or area to give a representative sample of the vegetation. The estimated percentage cover of plant species in five 1m x 1m quadrats (and presence of additional species in a surrounding 2m x 2m) was recorded. All vascular plant species (higher plants) in each quadrat were recorded. Mosses and liverworts were collectively recorded as total bryophyte cover. Other information recorded for each quadrat was vegetation height, bare ground, litter and dung, together with any management observations. Any rare or uncommon plant species observed on the site were noted.

Two metal poles were put in at opposite sides of the field marking the line of the transect. The position of markers was recorded using a Garmin 12 XL Global Positioning System (GPS). A magnetic compass bearing was taken of the direction of the transect and a sketch map drawn showing the field with the position of marker poles and direction of transects. The quadrat locations

were accurately measured from the marker poles using a 100m tape to aid relocation of quadrats on subsequent visits.

Monitoring of wetlands, i.e. fen, swamp and reedbeds, posed some problems as habitats were potentially waterlogged or flooded, thus dangerous to walk on. Transects were therefore located on the driest part of habitat and any other plant species from wetter areas noted. Wetland sites were visited from July onwards to avoid disturbance to nesting birds. Carr was surveyed using same method as farm woodland.

### ***Heather moorland / lowland raised bog***

These habitats were surveyed during August and September. Transects were 100m in length with five quadrats recorded as above at 20m intervals. The origin and end of each transect were marked with metal poles and the position of these marked with the GPS. The use of a GPS allowed transects to be randomly located on moorland sites without the need to be near to a boundary or observable feature. As upland sites were often large, heterogeneous areas more than one transect was occasionally recorded.

Heather cover and mean height in each quadrat, along with growth phase and morphology was recorded during monitoring of CMS moorland sites as changes in these are indicative of changes in management practices. Bryophyte and lichen species were individually recorded on moorland as they form an integral and characteristic component of the vegetation.

### ***Farm woodlands***

Woods were surveyed during May 2002 and May 2003. At each site a 200m<sup>2</sup> permanent quadrat was marked out using metal poles at the centre and corners. The position of the central pole was recorded using a GPS. Plant species and percentage cover estimates were recorded from a central 2m x 2m quadrat. Mosses and liverworts were recorded collectively as 'bryophytes'. Tree and shrub species percentage cover was recorded in the 200m<sup>2</sup> quadrat, together with any additional ground flora species. The number of seedlings and saplings (i.e. 25cm+) of tree and shrub species were counted within each

quadrat. Recent management was noted, i.e. presence of fencing, livestock, degree of any grazing/browsing and poaching.

### ***Farm scrub***

The method used for surveying farm scrub was similar to that used for woodland except that cover of shrubs and ground flora were both recorded in a 4m x 4m quadrat. Dense patches of scrub were often inaccessible so quadrats were located in areas with more scattered shrubs or on edges.

### ***Arable fields managed for wildlife***

Options chosen to survey for higher plants were retention of winter stubble (RWS), creation of rough grass field margin (RGF) and planting wild-bird cover as arable crop margin (AFW) or on improved grassland (CGW). The majority of sites surveyed were in Co. Down and Co. Londonderry where most cereal crops are grown. Sites were visited during July and August 2003. RWS sites chosen were fields that were to have stubble retained over the following winter. These sites were also surveyed again in February 2004 (together with some additional sites) to see if they were providing a winter food source for birds.

On RWS fields a boundary was randomly selected and along this a 30m long sampling zone located. At two distances along this three quadrats were positioned at certain distances from the boundary. These were generally 2m, 8m and 16m but depended on where the tramlines were as efforts were made not to trample the crop in summer. In winter sampling distances used were 4m, 16m and 32m. Ten random samples of a 1cm depth of soil from 25cm x 25cm quadrats were also taken within this zone in winter. This was to determine the density of grain and seeds available to birds on or near the soil surface.

On wild-bird cover plots six quadrats were recorded at equidistant positions across the site, generally every 10m. In the rough grass field margins a 100m long sampling zone was located and six quadrats were recorded at 20m intervals along the centre of the margin. Any additional species observed in the plots were noted.

For all options percentage cover estimates were made for all plant species within a 0.5m x 0.5m quadrat and the presence of additional species recorded from a surrounding 1m x 1m quadrat. Mosses and liverworts were grouped as bryophytes. Vegetation height was measured in the centre of each quadrat. The position of each field or plot was entered onto GPS but marker poles were not used as these habitats are not permanent and may be moved each year.

### ***Buffers for ASSI's / NNR's, woodlands, streams and rivers***

A 100m transect was located through the centre of the buffer strip and five 1m x 1m quadrats recorded at intervals. Sample size was small due to the comparatively small number of farms with this option.

### ***Field boundary restoration***

Boundaries surveyed were all hedges that were highlighted on farm maps as those to be restored through coppicing, interplanting or laying during a five-year plan. The method was based on that in the Hedgerow Survey Handbook (Bickmore 2002), which details a standardised procedure for surveying hedges in the UK.

At each hedge a 30m length was randomly chosen. If any management had already taken place on a section this was included. The start of the sampled length was permanently marked with a metal pole and a GPS position recorded. Within the 30m all woody species were recorded, i.e. shrubs and trees. The percentage area of the 30m length contributed by each shrub species was assessed, together with the percentage of gaps. The number and age of any trees present was recorded. In addition two 2m x 1m quadrats were positioned at the base of the hedge to record ground flora. These were located at points measured 10m and 20m along the sampled 30m length. Bryophyte and bare ground cover were also recorded. Information was also gathered on the hedge structure, management, associated features (e.g. banks, ditches) and adjacent land-use.

## 2.2.2. Vegetation condition assessment

### **Grasslands**

Site condition was monitored from walking across the whole site assessing a number of attributes according to predefined targets. Key criteria for each grassland habitat were derived from the English Nature rapid assessment methods for grasslands (Robertson & Jefferson, 2000). This uses attributes selected for the assessment of designated sites i.e. SSSIs, based on specific National Vegetation Classification (NVC) communities. Therefore some modification was needed for their application to the CMS habitats, e.g. defining appropriate targets and positive indicator species. After baseline monitoring further evaluation and refinement of methodological issues may be required.

Condition assessment was carried out on species-rich grassland and lowland wet grassland habitats. Site condition was monitored from an assessment of the whole site, carried out in approximately 30 minutes. A W-walk was done over the site to estimate the frequency of positive and negative indicator species (Appendix 1). Definitions of frequency were as follows: frequent or more (F) = found regularly throughout stand, occasional (O) = scattered plants, rare (R) = few individuals of a species. Any rare plant species and any invertebrates, animals or birds observed were recorded where possible.

Grassland attributes recorded were based on sward composition (Table 3) and sward structure (Table 4) and had certain targets. An estimate of percentage cover was recorded for sward composition attributes. Herbs were defined as vascular plants except grasses, sedges and rushes. Rush cover included all species of *Juncus*. Mean sward height was also recorded.

Condition categories recorded at baseline were 'favourable', 'potential' and 'unfavourable'. One failure among mandatory attributes meant that the site was classified as being in unfavourable condition. Sward structure attributes (i.e. sward height, bare ground and litter cover) were not mandatory for the habitat to be classified as in favourable condition, but were commented on. This is because these attributes are easily altered by management changes.

**Table 3.** Grassland attributes and targets for sward composition.

Habitat	Positive indicator species	Negative indicator species	Herb cover	Tree/shrub cover	<i>Juncus</i> species cover	<i>Molinia caerulea</i> cover	<i>Pteridium aquilinum</i> cover
SRW	2 or more frequent and 3 occasional	Not frequent and <5% cover		<5%	<75%	<75%	
SRD	2 or more frequent and 3 occasional	Not frequent and <5% cover	>25%	<5%			<5%
SRH	2 or more frequent and 3 occasional	Not frequent and <5% cover		< 5%	<75%		
SRA	2 or more frequent and 2 occasional	Not frequent and <5% cover	>25%	< 5%			<5%
LWG	2 or more frequent and 2 occasional	Not frequent and <5% cover		< 5%	<75%	<75%	

**Table 4.** Grassland attributes and targets for sward structure.

Habitat	Sward height	Bare ground cover	Litter cover
SRW	<50cm	<10%	<25%
SRD	5-10cm	<5%	<25%
SRH	na	<10%	<25%
SRA	5-10cm	<10%	<25%
LWG	<50cm	<10%	<25%

***Heather moorland***

Methods were adapted from English Nature's assessment of upland vegetation condition (Jerram & Drewitt, 1998) and Environment and Heritage Service (EHS) methods for upland monitoring in Northern Ireland. The condition of the CMS habitat types wet heath, dry heath, blanket bog and also lowland raised bog were assessed using certain attributes (see Tables 5, 6 & 7). Degraded heath and rough moorland grazing were also assessed using appropriate criteria. The area assessed was the whole of the habitat if

practicable or if very large a representative area of approximately 5 –10ha. Time taken was 30-45 minutes for a W- walk over each site.

Dwarf-shrub cover included heathers (*Calluna vulgaris*, *Erica* spp.), bilberry (*Vaccinium myrtillus*), crowberry (*Empetrum nigrum*) and western gorse (*Ulex gallii*). Graminoid species were all grasses, sedges and rushes, including cotton-grasses (*Eriophorum* spp.) and deer-grass (*Scirpus cespitosus*). Bryophyte cover included *Sphagnum* species (except for blanket bog and raised bog where these were recorded separately). Bare ground included ground covered by *Campylopus* spp., *Polytrichum* spp., algal mats or crust-forming lichens. Frequent dead *Calluna* was recorded in the general assessment as it may indicate heather beetle damage.

Vegetation was classed as being in unfavourable condition if the survey area failed to meet all the attribute targets. A scoring system closely based on the English Nature method was devised to determine the degree of unfavourability. Scores were totalled for each attribute and sites graded as follows:

- 0 points: favourable.
- 1-5 points: unfavourable.
- >6 points: severely unfavourable.

**Table 5.** Attributes and targets for wet heath.

Attribute	Favourable	Unfavourable		
	(0 points)	(1 point)	(2 points)	(4 points)
Dwarf-shrub cover	51-75	>75% or 26-50%	5-25%	<5%
Range of dwarf-shrubs	2 or more spp. widespread and frequent	1 spp. widespread and frequent		
Bryophyte abundance	frequent		occasional	rare
Graminoid cover	<50%	50-75%	>75%	
Trees and shrubs	none/rare	frequent		
Grazing impact	light	moderate	heavy	

**Table 6.** Attributes and targets for dry heath.

Attribute	Favourable	Unfavourable		
	(0 points)	(1 point)	(2 points)	(4 points)
Dwarf-shrub cover	>75%	26-75%	5-25%	<5%
Range of dwarf-shrubs	2 or more spp widespread and frequent	1 spp. widespread and frequent		
Bryophyte abundance	frequent	occasional	rare	
Trees and shrubs	none/rare	frequent		
Grazing impact	light	moderate	heavy	

**Table 7.** Attributes and targets for blanket and raised bogs.

Attribute	Favourable	Unfavourable		
	(0 points)	(1 point)	(2 points)	(4 points)
Dwarf-shrub cover	>33%	<33% except in wetter areas	<5%	
Range of dwarf-shrubs	2 or more spp. widespread and frequent	1 spp. widespread and frequent		
Bryophyte abundance	abundant, Sphagnum spp. frequent	frequent, Sphagnum spp. occasional	occasional, Sphagnum spp. absent	rare
Graminoid cover	<50%	50-75%	>75%	
Extent of bare ground	none	present	frequent	
Trees and shrubs	none	present		
Active peat extraction	none	present	extensive	
Grazing impact	light	moderate	heavy	

### 2.2.3. Invertebrate sampling

Ground beetles and spiders were sampled during three, four-week periods between April and October. This was achieved at each site using five pitfall traps (polythene containers 9cm wide and 20cm deep) part filled with ethylene glycol to prevent the escape and deterioration of specimens before collection. Pitfall traps are the most efficient method of collecting invertebrate samples and produce more species than any other method (Coulson & Butterfield 1985). They also collect animals throughout the time they are in place and so

are less labour intensive for the number of species trapped. Traps were placed 20m apart in a line through the centre of each site. At the end of each sampling period traps were emptied and removed. At the beginning of the next sampling period traps were replaced and refilled with a fresh ethylene glycol solution. The contents from all 5 traps were pooled for each sampling site and frozen at -5°C until sorting. All adult ground beetles taken in the traps were identified to species using Lindroth (1974) and identifications were confirmed by Dr. Roy Anderson, (Agriculture and Environmental Science, Department of Agriculture and Rural Development). All adult spiders were identified to species using Roberts (1985). Spider species identifications were confirmed by Dr Peter Merrett, (British Arachnological Society). Invertebrate sampling was carried out on all suitable terrestrial habitats.

### **2.3. Soil sampling**

One of the performance indicators for the certain CMS habitats, particularly species-rich grasslands, is the maintenance of low soil fertility. There is a EU requirement to determine whether reduction of fertiliser inputs under agri-environment schemes is positively linked to species diversity. The procedure for sampling followed a standardised method. Soil samples were taken from grassland habitats, woodlands and buffer strips. The top 10cm of soil from 10 random points along each vegetation transect was taken using a 3cm diameter soil auger. These were mixed to give a composite sample for the site. After air drying chemical analysis was carried out for pH, P, K and Mg (Allen, 1974).

### **2.4. Data handling**

Plant data was recorded on standard record sheets and transferred to a database in MS Access 2000. Invertebrate data was collated and put onto an MS Access database. These records were also stored on the relational database Recorder 2002 and will be transferred to CEDaR (Centre for Environmental Data and Recording) at the Ulster Museum. Plant and invertebrate data will therefore contribute to information widely available through the National Biodiversity Network (NBN).

Grid references for sites recorded using a GPS have been downloaded and stored electronically.

## **2.5. Data analysis**

Species richness, the number of species found on a habitat is the most widely adopted measure of diversity (Magurran, 1988). To monitor the success of the CMS scheme in maintaining or enhancing diversity of habitats, changes in plant and invertebrate species richness, and also frequency and abundance, will be analysed.

The DARD classification of agri-environment habitats is not standardised with BAP habitats although many are directly related. BAP priority habitats are characterised in terms of NVC community types. Therefore NVC types have been used where possible in the following report to describe CMS habitats (Appendix 2). Quadrat data for each site was assigned to the closest NVC type using the TABLEFIT program (Hill, 1996) and by reference to Rodwell (1991 *et seq.*). For woodland sites the program TWINSPAN (Hill, 1979) was used to classify the large sample into groups for analysis.

An indication of invertebrate species diversity at each site was given by alpha of the log series distribution of species abundance data. Alpha species diversity was calculated for carabid beetles and spiders for each site. Alpha ( $\alpha$ ) was estimated by maximum likelihood in:-

$$S = \alpha \ln (1 + N/\alpha)$$

Where:- S is the species total and N is the total individuals of all species at each site (Southwood 1978).

Quality scores for each spider species based on rarity have been derived from all previous agri-environment monitoring data (Cameron *et al*, 2004). This allowed an overall spider biodiversity score to be calculated for each site.

### 3. BOTANICAL RESULTS

#### 3.1. Species-rich grassland

The species diversity of each species-rich grassland habitat (together with lowland wet grassland) on CMS participant farms was calculated (Table 8).

**Table 8.** Numbers of plant species recorded on grassland habitats.

<i>Grassland type</i>	<i>n</i>	<i>Mean no. higher plant species per transect (se)</i>	<i>Total no. of higher plant species</i>
Species-rich dry	18	31.7 (3.0)	120
Species-rich wet	32	34.7 (1.7)	142
Hay meadow	9	32.3 (3.1)	92
Species-rich acid	8	35.6 (2.1)	89
Lowland wet	34	28.0 (1.6)	151

##### 3.1.1. Species-rich dry grassland

###### **Habitat description**

The number of sample sites was 18. Dry grassland was grazed (by sheep, cattle or horses) or often ungrazed and rank. Some sites had scrub invasion by brambles and/or gorse. Species-richness was variable, with some sites relatively poor in terms of herb species. Sites were often small parcels or sloping edges of fields that were too steep to plough.

Seven of the sites (39%) could be best described as NVC community type MG5 (*Cynosurus cristatus-Centaurea nigra* grassland), typical lowland herb-rich grassland. An ungrazed site dominated by tussocky grass was classified as MG1 (*Arrhenatherum elatius* grassland). Four sites (22%) were classified as acidic grassland U4 (*Festuca ovina-Agrostis capillaris-Galium saxatile* grassland), a community generally found on upland margins. One site classified as M23 (*Juncus effusus/acutiflorus-Galium palustre* rush pasture) had vegetation more like species-rich wet grassland. The remaining 28% of sites did not show a good affinity to any NVC type and were generally mosaics with damper soils, either close to fen-meadow vegetation, or ungrazed and relatively species-poor.

### **Species composition**

The most abundant species were grasses; common bent (*Agrostis capillaris*), sweet vernal-grass (*Anthoxanthum odoratum*) and yorkshire fog (*Holcus lanatus*). Other frequently recorded species were rough meadow-grass (*Poa trivialis*), red fescue (*Festuca rubra*), smooth meadow-grass (*Poa pratensis*), ribwort plantain (*Plantago lanceolata*), common sorrel (*Rumex acetosa*), white clover (*Trifolium repens*), meadow buttercup (*Ranunculus acris*), mouse ear (*Cerastium fontanum*) and creeping buttercup (*Ranunculus repens*). Characteristic herb species included meadow vetchling (*Lathyrus pratensis*), selfheal (*Prunella vulgaris*), red clover (*Trifolium pratense*), cat's ear (*Hypochaeris radicata*), lesser bird's foot trefoil (*Lotus corniculatus*), yarrow (*Achillea millefolium*) and knapweed (*Centaurea nigra*).

There were three notable species recorded: lesser butterfly orchid (*Platanthera bifolia*), recorded on one site Co. Down; burnet saxifrage (*Pimpinella saxifraga*), recorded on one site Co. Fermanagh; and hairy oat-grass (*Helictotrichon pubescens*), recorded on two sites in Co. Londonderry.

### **Vegetation condition assessment**

A target of >25% for herb cover (i.e. non-Graminae) was used for CMS sites and was met by 78% of the sites. The other sites failed to meet this criteria and were therefore in unfavourable condition and generally species-poor.

In terms of frequency of positive indicator species, 39% of sites were in favourable condition. (One further site had indicators for species-rich wet grassland). Another 39% of sites had frequent negative indicator species, i.e. creeping thistle (*Cirsium arvense*), nettle (*Urtica dioica*) and/or ragwort (*Senecio jacobea*). Grassland 'weed' species were often related to problems such as local nutrient enrichment or disturbance. Abundant ragwort may a problem because of toxicity to livestock threatening continuation of management. Bracken cover on four sites was >5%, suggesting control may be necessary to prevent further spread.

Half the sites surveyed had frequent shrub species (gorse and/or bramble), with cover ranging from 5% to 45%. At the time of survey scrub control had been carried out on three sites.

Two of the sites had sward height >50cm and a further 44% had height 26-50cm. These sites were therefore undergrazed at time of survey and some appeared unmanaged. None of the sites had a sward height below 5cm, suggesting that heavy grazing was not occurring. Three sites had a continuous litter layer, also indicating undergrazing. The mean vegetation height recorded per quadrat was 32cm. (N.B. Grazing is not permitted from 1 May –31 July if the farmer has opted for a no grazing period).

Two sites had a bare ground cover of 5-10%. One of these had fairly wet soil and had been poached by cattle. Another site had 5% bare ground due to recent scrub removal and disturbance.

Overall, sites were not of high quality in terms of positive indicators or condition for designated sites. Only one site met all the criteria to be described as in favourable condition at baseline. Many of the other sites (61%) had the potential to improve under positive management.

### **3.1.2. Species-rich wet grassland**

#### ***Habitat description***

A total of 32 sites were surveyed. This habitat occurred on moist mineral or peaty soils and was characterised by abundant rush (*Juncus*) species. Sites varied in terms of species-richness, vegetation type and condition. Approximately half the sites were ungrazed at the time of survey. Most of the other sites were grazed by cattle and often poached.

Most of the sites (78%) could be described as NVC community M23 (*Juncus effusus/acutiflorus-Galium palustre* rush pasture). Two relatively species-poor sites were classified as MG10 (*Holcus lanatus-Juncus effusus* rush-pasture) and U4 (*Festuca ovina-Agrostis capillaris-Galium saxatile* grassland).

The remaining five sites (16%) were best classified as fen meadow (M24). These were generally on peaty soils (i.e. often derived from wet heath) and characterised by purple moor-grass (*Molinia caerulea*), sedges (*Carex* spp.) and meadow thistle (*Cirsium dissectum*). Several other sites, particularly in Co. Fermanagh, showed an affinity to M24, but *Molinia caerulea* was at very low abundance or absent.

### **Species composition**

The most abundant species were sharp-flowered rush (*Juncus acutiflorus*), soft rush (*Juncus effusus*), yorkshire fog (*Holcus lanatus*), sweet vernal-grass (*Anthoxanthum odoratum*), velvet bent (*Agrostis canina*), creeping bent (*Agrostis stolonifera*), common sedge (*Carex nigra*) and creeping buttercup (*Ranunculus repens*). Characteristic herb species were ladies smock (*Cardamine pratensis*), marsh thistle (*Cirsium palustre*), tormentil (*Potentilla erecta*), meadowsweet (*Filipendula ulmaria*), lesser spearwort (*Ranunculus flammula*), marsh bedstraw (*Galium palustre*) and common/heath spotted orchid (*Dactylorhiza fuchsii/maculata*).

Meadow thistle, a species frequent in the west but declining, was recorded on six sites. Some sedge species were recorded that have a local distribution in Northern Ireland. These include pale sedge (*Carex pallescens*) and greater pond sedge (*Carex riparia*), both recorded on a single site in Co. Fermanagh. Cyperus sedge (*Carex pseudocyperus*) was recorded on one site in Co. Tyrone, which appears to be a new record for this county.

### **Vegetation condition assessment**

The target for positive indicators of at least two species 'frequent' and three species 'occasional' was met on 69% of sites. The remaining sites did not meet the target for indicator species. This was expected, as CMS sites were not as high quality as designated sites (i.e. ASSIs). Three sites had frequent negative indicator species, perennial rye-grass (*Lolium perenne*) and/or marsh ragwort (*Senecio aquaticus*). A further three sites had patches of 'weed' species that may be of concern as this may indicate local disturbance or nutrient enrichment.

One quarter of the sites had at least one shrub or tree species frequent at >5% cover. This indicated a potential problem with scrub invasion and therefore the need for scrub control to prevent the loss of grassland habitat.

The cover of *Juncus* species was very high (>75%) on 13% of sites. Overall three-quarters of sites had 50% or higher rush cover. This may be due to lack of grazing/cutting management. The CMS requirement is that not more than 50% of the area of a field should be covered in rushes and therefore rush control may be necessary.

The sward height was >50cm (excluding *Juncus* spp.) on 38% of sites which may indicate undergrazing. One quarter of sites had a more or less continuous litter layer, indicating inadequate grazing levels. There was no apparent grazing on these sites at the time of survey (June/July) and a few sites appeared neglected.

Bare ground cover was only high at one site (11-25%), due to poaching by livestock. A further 13% of sites had 5-10% bare ground with localised heavy poaching also recorded. Excessive trampling and poaching on wet ground can increase bare ground to damaging levels.

Overall 44% of sites met all the criteria to be in favourable condition at time of baseline survey. A further 25% of sites having frequent positive indicators failed to meet other targets for mandatory attributes. Several sites had a mean sward height above the target and therefore had potential to improve if grazing levels were maintained as per management prescriptions.

### **3.1.3. Species-rich hay meadow**

#### ***Habitat description***

A total of nine hay meadow sites were surveyed. Hay meadows occurred on damp neutral soils, with abundant *Juncus acutiflorus* and were generally quite species-rich (Table 8). Some sites were relatively species-poor rushy fields with only occasional occurrences of indicator species.

The sites showed poor fit to any NVC community, although many sites could be best described as M23 (*Juncus acutiflorus*/*J. effusus*-*Galium palustre* rush-pasture). Some were a poor fit to MG4 or MG8, seasonally-flooded grassland communities found in England.

### **Species composition**

The most abundant species was *Juncus acutiflorus*, which had a mean cover of 25%. Other frequently recorded grasses, rushes and sedges were soft rush (*Juncus effusus*), common sedge (*Carex nigra*), red fescue (*Festuca rubra*), rough meadow-grass (*Poa trivialis*), creeping bent (*Agrostis stolonifera*), common bent (*Agrostis capillaris*), crested dog's tail (*Cynosurus cristatus*), yorkshire fog (*Holcus lanatus*), sweet vernal-grass (*Anthoxanthum odoratum*) and field wood-rush (*Luzula campestris*). Characteristic herb species were buttercups (*Ranunculus* spp.), white clover (*Trifolium repens*), common sorrel (*Rumex acetosa*), ladies smock (*Cardamine pratensis*), meadowsweet (*Filipendula ulmaria*), meadow vetchling (*Lathyrus pratensis*) and tufted forget-me-not (*Myosotis laxa*).

### **Vegetation condition assessment**

Hay meadows were generally closest to the species-rich wet grassland habitat type so the same attributes were used except for sward height (where no target was necessary). In terms of positive indicator species 44% of sites were favourable. Other sites had potential as they had several indicators present but not in high enough frequencies to meet the target. None of the hay meadow sites surveyed had frequent negative indicator species.

One site had frequent alder trees spreading from the boundary, covering >10% of the field. Scrub control may be necessary to prevent loss of grassland species. Another site had >76% cover of *Juncus* species and therefore rush control may be required.

Only one site had a continuous litter layer suggesting infrequent cutting. This was a wet site with several ditches and was therefore probably not cut for hay every year.

Two sites met all targets for attributes and were therefore in favourable condition, although one of these had a continuous layer of litter. Other sites were in unfavourable condition but with potential to improve through management.

#### **3.1.4. Species-rich acid grassland**

##### ***Habitat description***

A total of eight sites of this habitat were sampled. Acid grassland sites were a mixture of sheep-grazed hill pasture or degraded heath/poor fen on wetter peaty soils. They were variable in terms of species-diversity and composition, with some sites particularly herb-rich (Table 8). Grazing was usually moderate or fairly heavy. Drier sites had short turf whereas wetter sites were often cattle poached. The mean vegetation height was 21.5cm ( $\pm$  4.71).

Two sites on basalt hill slopes in Antrim were species-rich and were best classified as CG10 (*Festuca ovina*-*Agrostis capillaris*-*Thymus praecox* grassland). Two other sites were comparatively poorer hill pasture and classified as acidic grassland, U4. The remaining four sites were on peaty soil and classified as fen meadow (M24) or poor fen (M6). These were characterised by frequent purple moor-grass, rushes and sedge species, and generally derived from heathland.

##### ***Species composition***

Sites were generally dominated by sharp-flowered rush (*Juncus acutiflorus*), common bent (*Agrostis capillaris*), purple moor-grass (*Molinia caerulea*) and/or mat grass (*Nardus stricta*). Characteristic species were tormentil (*Potentilla erecta*), sedges (*Carex* spp.), heath bedstraw (*Galium saxatile*), lousewort (*Pedicularis sylvatica*) and devils' bit scabious (*Succisa pratensis*). On the two sites on basalt, species indicative of base-rich soils such as fairy flax (*Linum catharticum*), eyebright (*Euphrasia* sp.) and flea sedge (*Carex pulicharis*) were present.

There were two notable species: the rarely recorded moonwort (*Botrychium lunaria*), found on one site in Co. Antrim, and field gentian (*Gentianella*

*campestris*) noted on one site in Co. Antrim. The latter species is frequent on basaltic hills but is possibly declining.

### ***Vegetation condition assessment***

All sites had 26-75% herbs and therefore met the target for acidic grassland communities. Half of the sites were in favourable condition for frequency of positive indicator species. No sites had more than occasional negative indicator species. None of the sites had frequent shrub or tree species or any bracken present.

The target for sward height was <10cm. This was exceeded in 75% of sites with three sites having a sward height of 26-50cm. These were generally wet sites on peaty soils and therefore were not typical acid grassland. (N.B. SRA is now being classified by DARD as either SRW or SRD).

Bare ground cover should be less than 10%. Three of the wetter sites had 5-10% bare ground due to heavy poaching by cattle. All sites had patchy or very little litter cover, indicating moderate or heavy grazing levels.

Overall four sites were in favourable condition at baseline survey, although three of these had sward height >10cm. Other sites failed to meet the target for positive indicator species, although condition was favourable for other criteria.

## 3.2. Wetlands

### 3.2.1. Lowland wet grassland

#### ***Habitat description***

The total number of sites sampled was 34, which included five enhanced breeding wader (EBW) sites. EBW is a voluntary option applying to land classified as lowland wet grassland. Therefore as the habitat is the same, sites have been analysed together for purposes of this baseline study.

This was a variable habitat, generally occurring on wet or waterlogged mineral or peaty soils. Most sites had abundant rushes, *Juncus effusus* and/or *Juncus acutiflorus*. Vegetation composition varied from species-poor, rush dominated grassland to species-rich grassland and fen/swamp. Mean species diversity was lower than for species-rich grassland habitats (Table 8). Several sites occurred on cutover raised bog. Sample sites were often ungrazed at the time of survey due to the wetness of the soils.

Overall 65% of the surveyed sites showed best fit with rush-pasture, M23. Five sites (16%) were classified as MG10 (*Holcus lanatus*-*Juncus effusus* rush-pasture), generally a species-poor community.

Four sites on peaty soils showed more affinity to *Molinia* grasslands and/or poor fen communities. Of the sites on cutover bog, two were closest to M6 (*Carex echinata*- *Sphagnum* mire) and the other was M25 (*Molinia*- *Potentilla erecta* mire). Another site was more like fen meadow vegetation (M24) and was comparatively species-rich.

The remaining three sites were waterlogged, one site in Co. Down was a base-rich mire community M9 (*Carex rostrata*-*Calliergon cuspidatum* mire). Two other ungrazed sites were best classified as M27 (*Filipendula ulmaria*-*Angelica sylvestris* mire), a tall-herb fen community.

#### ***Species composition***

The most frequently occurring species were yorkshire fog (*Holcus lanatus*), sweet vernal-grass (*Anthoxanthum odoratum*), creeping bent (*Agrostis*

*stolonifera*), soft rush (*Juncus effusus*), rough meadow-grass (*Poa trivialis*), sharp-flowered rush (*Juncus acutiflorus*), common sorrel (*Rumex acetosa*) and common sedge (*Carex nigra*). Most of these species were also abundant in terms of percentage cover. The rush species *Juncus effusus* and *J. acutiflorus* had the highest mean cover per quadrat, 27% and 17% respectively. Other characteristic species were ladies smock (*Cardamine pratensis*), buttercups (*Ranunculus* spp.) and marsh bedstraw (*Galium palustre*).

There were several species recorded on this habitat that are uncommon or have a local distribution in Northern Ireland: Whorled caraway (*Carum verticillatum*), a very local species, was recorded on two sites in Co. Londonderry. Two uncommon sedges were recorded; lesser tussock sedge (*Carex diandra*) recorded on one site in Co. Down, and dioecious sedge (*Carex dioica*) recorded on one site in Co. Londonderry. Trifid bur-marigold (*Bidens tripartita*) and flowering rush (*Butomus umbellatus*) were noted on one site in Co. Tyrone, and are occasional around Lough Neagh. Another local wetland species, water dock (*Rumex hydrolapathum*), was noted on one site in Co. Down.

### **Vegetation condition assessment**

The same attributes were recorded as for species-rich wet grassland, although many of the sites were not likely to meet the targets as by definition this habitat has fewer indicator species.

Around 35% of sites could be described as favourable in terms of numbers of positive indicators present. Around one quarter of sites had frequent or locally frequent weed species present, such as nettles or broad-leaved dock. These negative indicators suggest a relatively high degree of nutrient enrichment of some fields.

Frequent shrub or tree species, generally willow, were present on 18% of sites, with cover from 5-15%. Just over half of sites had 51-75% rush cover and three sites had high rush cover of >76%. CMS management prescriptions

are that rush control should be carried out if rushes cover greater than 50% of the field area.

A total of 62% of sites had vegetation height (excluding rushes) of >50cm. Only one site (EBW) had a short sward of 5-10cm due to heavy grazing by horses. Two sites had high bare ground cover of 11-25% and a further three 5-10% cover. This was usually the result of poaching damage by livestock, with 56% of sites being cattle-grazed. However half of the sites had a more or less continuous litter layer indicating no or very little grazing. At least 30% of sites appeared ungrazed at any recent time.

Overall 24% of sites were in favourable condition at baseline survey meeting all targets, although sward height was >50cm in a few of these. A further 32% of sites were potentially in favourable condition, many of these not meeting targets for scrub cover.

### **3.2.2. Fen, swamp and reedbeds**

#### ***Habitat description***

Nine fen, swamp and reedbed sites were surveyed. Due to dry weather conditions during the 2003 survey season, access to many of the sites including swamp was possible. Results for each habitat were analysed together as sites generally had similar vegetation or were mosaics of wetland types. Fen and swamp have the same permitted grazing levels whereas grazing of reedbeds is not allowed.

The location of sites varied from river or lake edges, adjacent to woodland or bog, or interdrumlin hollows. Of the two sites classified as reedbeds, one had no common reed (*Phragmites australis*) but did have bulrush (*Typha latifolia*), and the other had approximately 25% common reed. Several of the wetland sites had been subject to past drainage and probably enrichment from adjacent land. Some were waterlogged wet grassland (i.e. species-poor) rather than typical fen/swamp vegetation.

Two-thirds of the sites were ungrazed, including the two reedbeds. It is likely that active grazing rarely occurred in the past on these sites due to the waterlogged conditions. Of the other sites two were presently cattle grazed and one site sheep grazed. Most sites were not fenced from adjacent land. No other management was being carried out on any of the sites.

The sites generally had a poor fit to NVC types and were often a mosaic of vegetation communities. Two-thirds of the sites had tall vegetation with wetland herbs, tall sedges and water horsetail (*Equisetum fluviatile*). These were best described as M27 (*Filipendula ulmaria*-*Angelica sylvestris* mire) or S10 (*Equisetum fluviatile* swamp). One swamp site on peat was a poor fen dominated by sedges and *Sphagnum* moss, M6 (*Carex echinata* – *Sphagnum recurvum* /*auriculatum* mire). The two remaining swamp sites were more like wet grassland and closer in terms of vegetation to rush-pasture, M23.

### **Species diversity and composition**

In total 76 species were recorded. The mean number of higher plant species recorded per transect was 22.1 (se 1.7).

The most frequently occurring species were creeping bent (*Agrostis stolonifera*), soft rush (*Juncus effusus*), rough meadow-grass (*Poa trivialis*) and meadowsweet (*Filipendula ulmaria*). Other characteristic species were water horsetail (*Equisetum fluviatile*), common sorrel (*Rumex acetosa*) and marsh bedstraw (*Galium palustre*).

### **3.2.2. Carr**

#### **Habitat description**

A small sample of five sites was surveyed. The canopy was dominated by grey willow (*Salix cinerea*), alder (*Alnus glutinosa*) and/or birch (*Betula pubescens*). Bramble (*Rubus fruticosus*) was frequent in the understorey. Four sites were on the edge of loughs. All sites were fenced and ungrazed at the time of survey. One site showed signs of poaching but had been recently fenced to prevent livestock access.

Alder woodland on the shore of Lough Neagh corresponded to NVC types W5 (*Alnus glutinosa-Carex paniculata* woodland) and W6 (*Alnus glutinosa-Urtica dioica* woodland). Those sites with willow and birch were on waterlogged soils near lough edges and more typical of fen carr, W2 (*Salix cinerea-Betula pubescens-Phragmites australis* woodland). The other site was on cutover raised bog dominated by birch and best classified as W4 (*Betula pubescens-Molinia caerulea* woodland).

### **Species diversity and composition**

In total 84 species were recorded. The mean number of higher plant species per 200m<sup>2</sup> was 27.8 (± 5.4) and the mean number per 4m<sup>2</sup> was 11.8 (± 1.5).

The most frequent ground flora species (occurring on 80% or more sites) were meadowsweet (*Filipendula ulmaria*), marsh bedstraw (*Galium palustre*) and creeping bent (*Agrostis stolonifera*). Other characteristic species were bittersweet (*Solanum dulcamara*), reed canary-grass (*Phalaris arundinacea*), wild angelica (*Angelica sylvestris*) and water horsetail (*Equisetum fluviatile*). The most abundant herbs in terms of mean cover per 4m<sup>2</sup> were meadowsweet (19%) and nettle (14%).

### 3.3. Heather moorland

The species diversity of heather moorland habitats (together with lowland raised bog) under CMS agreement is shown below (Table 9).

**Table 9.** Numbers of plant species recorded on heather moorland habitats.

<i>Habitat type</i>	<i>n</i>	<i>Mean no. of species per transect (se)</i>	<i>Total no. of species</i>
Dry heath	8	38.5 (5.1)	113
Wet heath	33	33.4 (1.2)	120
Blanket bog	5	25.2 (2.8)	50
Degraded heath	22	39.4 (1.6)	137
Rough moorland grazing	18	36.9 (1.3)	131
Lowland raised bog	20	25.2 (1.6)	113

#### 3.3.1. Dry heath

##### ***Habitat description***

A total of eight sites were surveyed. Sites were usually dominated by heather (*Calluna vulgaris*). There were six upland sites and two lowland sites. Peat depth was below or around 0.5m with the exception of one site where peat was greater than 1m. Sites were all sheep grazed with the exception of the site on deep peat. Four sites were also grazed by cattle.

Only one of the monitored sites could be identified as typical dry heath in terms of indicators such as bell heather (*Erica cinerea*) and was classified as H10 (*Calluna vulgaris-Erica cinerea* heath). Another site was a dry heath (H10) and acidic grassland (U4) mosaic. One site also classified as H10 was on cutover lowland raised bog with mature heather. The remaining sites had variable peat depths and were more like wet heath / dry heath mosaics, best described overall as M15 (*Scirpus cespitosus-Erica tetralix* wet heath).

##### ***Species diversity and composition***

A total of 113 species were recorded, which included 42 bryophytes and lichens (Table 9). Sites were very variable in terms of diversity, ranging from 13 to 54 species recorded per transect.

*Calluna vulgaris* was dominant on most sites, with a mean cover per quadrat of 47%. Other frequent higher plants were purple moor-grass (*Molinia caerulea*), tormentil (*Potentilla erecta*), cross-leaved heath (*Erica tetralix*), common cotton-grass (*Eriophorum angustifolium*), sweet vernal-grass (*Anthoxanthum odoratum*) and bent grasses (*Agrostis* spp.). Characteristic mosses were *Hylocomium splendens*, *Hypnum cupressiforme* and *Rhytidiadelphus loreus*. Dry heath indicator species, bell heather and bilberry (*Vaccinium myrtillus*) were both found on half of the sites surveyed.

### **Vegetation condition assessment**

Dwarf-shrub cover should ideally be >75% for dry heath to be classified as in good condition. Only a quarter of the sites met this target. A further quarter had 5-25% overall cover indicating degradation of habitat and very poor condition at baseline. All sites had dominant or frequent *Calluna*. Half of the sites had frequent cross-leaved heath and another frequent bell heather. Bryophytes were frequent on three quarters of the sites surveyed.

None of the sites showed any signs of past burning. Four sites were dominated by late mature/degenerate heather. Pioneer heather was only noticeable on one site.

Alien trees or shrubs should not be present. One site had spruce (*Picea* sp.) present which is undesirable. Three sites had frequent gorse (*Ulex europaeus*). The presence of native shrubs is not a problem unless heather cover is decreasing as a result of scrub invasion.

Four sites showed signs of moderate grazing by sheep and/or cattle. Two had heavy grazing and poaching by cattle. All these sites showed some grazing-induced *Calluna* growth forms (i.e. drumstick, topiary or carpet).

The degree of unfavourability was calculated using a grading system that gave a score for each site on a scale of 0 to 8 points. Only one site was in overall favourable condition for dry heath. The other sites failed on two or more targets and were in unfavourable condition, scoring from 2 to 5 points.

### **3.3.2. Wet heath**

#### ***Habitat description***

A total of 33 wet heath sites were surveyed. Sites included typical wet heath on shallow peat and heath vegetation on deeper peat, i.e. blanket and raised bogs (degraded or drying out). Peat depth varied from 0.2m to greater than 1m. Most of the sites were cattle or sheep grazed.

One third of sites were classified as NVC community M15 (*Scirpus cespitosus-Erica tetralix* wet heath). The majority of the rest of the sites were classified as blanket or raised mire vegetation (i.e. M17, M18 or M19). The exceptions being one site that was more like fen meadow (M24), and five drier sites dominated by mature *Calluna* (H10 or H21).

#### ***Species diversity and composition***

The total number of plant species recorded was 120, including 54 bryophytes and lichens (Table 9).

Wet heath sites were generally dominated by *Calluna vulgaris* with abundant cotton-grasses (*Eriophorum* species) and purple moor-grass (*Molinia caerulea*). Characteristic species of the habitat were cross-leaved heath (*Erica tetralix*), tormentil (*Potentilla erecta*), deer-grass (*Scirpus cespitosus*) and carnation sedge (*Carex panicea*). Bryophytes were an important component of the vegetation with the most frequent species being *Hypnum cupressiforme/jutlandicum*, *Sphagnum capillifolium*, *S. papillosum*, *Pleurozium schreberi*, *Polytrichum commune*, *Rhytidiadelphus loreus* and *Dicranum scoparium*.

Fir clubmoss (*Huperzia selago*), a local species of upland heaths, was recorded on one site. Lesser twayblade (*Listera cordata*) was found on five sites.

#### ***Vegetation condition assessment***

Peat depth was greater than 1m on 18% of the sites, suggesting that technically these were blanket bog and may be better assessed using

appropriate criteria. There were also signs of old hand peat cutting on 27% of sites. (N.B. The CMS definition of wet heath, i.e. peat depth of less than 1m, differs from the English Nature definition which specifies a peat depth of 0.5m or less (Jerram & Drewitt, 1998). Only 52% of the monitored CMS sites had peat depth of <0.5m).

The target for dwarf-shrub cover on wet heath is 50-75%, which was met on 30% of sites. Of the rest, one third of sites had 5-25% cover, i.e. severely degraded, and a further 27% of sites had 25-50% cover. (N.B. Heather cover greater than 25% is required for CMS classification as heather moorland). Three sites had >75% cover, which also suggests unfavourable condition and can often indicate drying out of peat. At least two dwarf-shrub species were at least frequent and widespread on 70% of sites, although seven of these have <25% cover so were classified as in unfavourable condition.

Bryophytes should be at least frequent below or between the dwarf-shrubs. Two sites had occasional bryophytes and one site only rare occurrence, so were in unfavourable condition. Only 21% of sites met the target of <50% graminoid cover (i.e. grasses, sedges and rushes). The other sites were unfavourable in terms of this attribute. Two sites had been recently burned and three showed evidence of past burning. Almost a quarter of sites had only late mature /degenerate heather present, suggesting no burning for decades.

Wet heaths were generally subject to grazing by cattle or sheep, with the exception of two sites. Overall heavy grazing impacts were apparent on 27% of sites and therefore these were in unfavourable condition. Two of these sites had four indicators of heavy grazing: abundant grazing-induced *Calluna* growth forms, encroachment by graminoids, abundant dung and trampling/poaching damage by livestock.

Alien trees and shrubs should be no more than rare. One site had frequent pine (*Pinus* sp.) and two sites had frequent spruce (*Picea* sp.) spreading from adjacent conifer plantations. A further five sites had frequent native tree species, willow (*Salix* sp.) or birch (*Betula* sp.), also unfavourable.

None of the wet heath sites met all the targets for vegetation to be classified as in favourable condition. However 36% of sites scored well, i.e. 1 or 2 points, therefore were in reasonable baseline condition. Five sites had 6 or more points and were therefore in very poor condition. Sites with a high proportion of late mature /degenerate heather were often otherwise in good condition in terms of the vegetation.

### **3.3.3. Blanket bog**

#### ***Habitat description***

Five blanket bog sites were surveyed. This was a small sample but still 20% of overall CMS farms with blanket bog under agreement. All sites were on deep peat greater than 1m.

Two sites were classified as M17 (*Scirpus cespitosus* -*Eriophorum vaginatum* blanket mire). One site was best fit with M19 (*Calluna vulgaris* -*Eriophorum vaginatum* blanket mire). The other two sites were classified as M18 (*Erica tetralix*- *S. papillosum* raised and blanket mire) and had characteristics of raised bog although at >200m altitude.

#### ***Species diversity and composition***

The total number of plant species recorded was 50, which included 32 bryophyte and lichen species (Table 9). The mean number of species recorded was lower than for other heather moorland habitats.

Sites were dominated by heather (*Calluna vulgaris*), hare's-tail cotton-grass (*Eriophorum vaginatum*) and deer-grass (*Scirpus cespitosus*). Other species with relatively high cover were purple moor-grass (*Molinia caerulea*), common cotton-grass (*E. angustifolium*), cross-leaved heath (*Erica tetralix*), bog asphodel (*Narthecium ossifragum*) and bilberry (*Vaccinium myrtillus*). Frequently occurring bryophytes were *Sphagnum capillifolium*, *S. papillosum*, *S. tenellum*, *Hypnum cupressiforme* and *Odontoschisma sphagni*. The declining species cranberry (*Vaccinium oxycoccus*) was recorded on one site.

### ***Vegetation condition assessment***

Four of the sites had dwarf-shrub cover of >33%, which is favourable. All sites had a range of dwarf-shrub species. However all sites had 51-75% graminoid cover, i.e. above the target for favourable condition. Four sites had abundant *Sphagnum* mosses.

Two sites had trees or shrubs present. The presence of any trees on blanket bog is indicative of low water levels and hence poor vegetation condition.

In terms of management, one site had indicators of heavy grazing and also extensive recent peat extraction. This has resulted in a high cover of bare ground. Another site had moderate grazing impacts and with some bare ground present. Two sites had indications of past burning. Burning of blanket bog is not permitted under CMS agreement.

Overall four sites were in unfavourable condition but with low scores of 1 to 3. The other site was severely unfavourable (score 9) due to mechanical peat cutting and heavy grazing by sheep.

### **3.3.4. Degraded heath**

#### ***Habitat description***

The total number of degraded heath sites surveyed was 22. Sites included degraded wet heath and blanket bog. Peat depth was variable, from 0.2 to 0.8m with the exception of two sites on deeper peat greater than 1m. All sites were sheep or cattle grazed.

Six sites were classified as wet heath, M15. Four heath sites with heath/grassland mosaic were classified as acidic grassland (U4 or U5). Seven sites were best described as degraded blanket bog (M17 or M19). The other five sites were classified as fen meadow / poor fen (M6/M24) and were on wet peaty soils dominated by *Juncus acutiflorus* and/or *Molinia caerulea*.

### ***Species diversity and composition***

The total number of plant species recorded was 137, including 62 species of bryophytes and lichen (Table 9). Species numbers were higher than on wet or dry heath due to presence of more typical grassland species.

Heather (*Calluna vulgaris*) occurred on all sites but at a low mean percentage cover of 11%. Sites were variable but often dominated by purple moor-grass (*Molinia caerulea*), cotton-grasses (*Eriophorum* spp.) and/or sharp-flowered rush (*Juncus acutiflorus*). Other species frequently occurring were tormentil (*Potentilla erecta*), velvet bent (*Agrostis canina*), sweet-vernal grass (*Anthoxanthum odoratum*), carnation sedge (*Carex panicea*), heath rush (*Juncus squarrosus*) and cross-leaved heath (*Erica tetralix*). The most frequent bryophytes were *Hypnum cupressiforme*, *Sphagnum capillifolium*, *Rhytidiadelphus squarrosus* and *Hylocomium splendens*.

*Ptilidium ciliare*, a rare liverwort in Ireland, was recorded on one site in Co. Antrim.

### ***Vegetation condition assessment***

The same condition criteria were applied as those for wet heath as the majority of sites were of this habitat type. All sites were in unfavourable condition as would be expected as all had <25% dwarf-shrub cover. One site had <5% cover, i.e. severely unfavourable. Ten sites had two dwarf shrub species frequent which is desirable. All sites except one had frequent bryophytes. In terms of graminoid abundance sites were all unfavourable all having >50% cover.

In terms of management, three sites had been subject to some burning in the past. Half of the sites had old peat cutting, with a further two of these subject to some more recent mechanical cutting. All sites with the exception of two were subject to livestock grazing. Overall 82% of sites had moderate/heavy grazing impacts, although not all of these had signs of current heavy grazing. Bare ground cover was high on seven sites due to poaching, burning and/or peat cutting.

Frequent trees or shrubs (alien or native) on heath or bog are undesirable. Occasional spruce trees were present on one site. Gorse was present on nine sites but only frequent on one of these.

Overall 60% of sites were in unfavourable condition and 40% were in severely unfavourable condition (i.e. scoring 6 points or above). Degraded heath is defined as heather moorland having 5-25% dwarf shrub cover. Therefore sites were expected to be in a poor condition at baseline survey.

### **3.3.5. Rough moorland grazing**

#### ***Habitat description***

A total of 18 rough moorland grazing sites were surveyed. These sites were diverse in terms of vegetation and often patchy with a mosaic of different moorland habitat types. Sites were generally on peat or peaty soils, with depth varying from 0.05m to greater than 1m. Most sites were sheep and/or cattle grazed.

A third of the sites were purple moor-grass (*Molinia caerulea*) dominated grasslands (M24/M25). A further third of sites dominated by rushes were classified as either rush-pasture (M23) or poor fen (M6). The remaining third of sites were degraded peatland, either blanket mire (i.e. M17/M18/M19) or heath/acidic grassland (U4) mosaic.

#### ***Species diversity and composition***

In total 131 species were recorded, including 49 bryophyte and lichen species (Table 9). Species diversity was relatively high.

Sites were dominated by purple moor-grass and /or sharp-flowered rush (*Juncus acutiflorus*). Other frequently occurring species were tormentil (*Potentilla erecta*), sweet vernal-grass (*Anthoxanthum odoratum*), velvet bent (*Agrostis canina*), carnation sedge (*Carex panicea*) and common sedge (*Carex nigra*). Common bryophytes recorded were *Rhytidiadelphus squarrosus* and *Polytrichum commune*.

Whorled caraway (*Carum verticillatum*), a species with a very local distribution in Northern Ireland, was recorded on one site in Co. Londonderry.

### ***Vegetation condition assessment***

Targets for condition of this habitat were not easy to define as it covers a range of different vegetation types. The sites were often degraded heath, sixteen percent of sites having 5-25% dwarf shrub cover, and therefore could potentially be restored to wet heath. Over half of the sites had some heather present but at <5% cover.

A third of sites had heavy grazing and half of the sites had indicators of moderate grazing. No grazing was noted on the other three sites which were probably undergrazed at time of survey with sward height >50cm. Five sites had frequent bare ground indicating damage due to poaching. A quarter of sites surveyed had supplementary stock feeding sites that may cause local damage if not moved frequently.

Half of the sites had trees or shrubs present, of these four had frequent gorse or willow. One site had occasional occurrences of spruce trees.

Over half of the sites were actively drained either by manmade or natural ditches. There had been new ditches dug on or adjacent to two sites, otherwise drains were old.

### **3.4. Lowland raised bog**

#### ***Habitat description***

A total of 20 lowland raised bog sites were surveyed. These generally had frequent ericoid dwarf-shrubs, cotton-grasses (*Eriophorum* spp.) and *Sphagnum* mosses. Peat depth was usually greater than 1m, only four sites had depth less than 1m. Birch invasion was common with 45% of sites having birch seedlings recorded within quadrats.

In terms of NVC communities, 40% of the sites were best classified as M18 (*Erica tetralix-Sphagnum papillosum* raised and blanket mire). These were generally those sites with at least some intact surface remaining. A further 25% of sites were a better fit to M17 (*Scirpus cespitosus- Eriophorum vaginatum* blanket mire). Drier bogs (20%) were best described as M15 (*Scirpus cespitosus-Erica tetralix* wet heath).

#### ***Species diversity and composition***

A total of 113 plant species were recorded, which included 50 bryophyte and lichen species. The mean number of species recorded per site was comparable to blanket bog (Table 8). Sites were dominated by heather (*Calluna vulgaris*) often with abundant cross-leaved heath (*Erica tetralix*), cotton-grasses (*Eriophorum* spp.), purple moor grass (*Molinia caerulea*), deer-grass (*Scirpus cespitosus*) and the lichen *Cladonia portentosa*. Frequently occurring bryophytes were *Sphagnum capillifolium*, *S. papillosum*, *S. tenellum* and *Hypnum cupressiforme*.

Local or declining species recorded were cranberry (*Vaccinium oxycoccus*), recorded on three sites, and grass of parnassus (*Parnassia palustris*), recorded on one 'fen' site in Fermanagh.

#### ***Vegetation condition assessment***

The target for dwarf-shrub cover of >33% was met on 70% of the sites. Three sites had less than 5% cover and a further three sites had 5-33%. (N.B. In wetter areas cover can be naturally lower where *Sphagnum* species are abundant). A range of dwarf-shrub species, i.e. more than one species frequent and widespread, were present on 75% of sites.

Bryophytes, including *Sphagnum* species, were abundant on 85% of sites surveyed. In general the higher the cover of *Sphagnum*, the better the condition of the bog.

Certain species may become abundant under unsympathetic management regimes, grazing or burning. The cover of graminoids, e.g. purple moor-grass, cotton-grasses or deer-grass, should ideally be less than 50%. This was met by 45% of the sites with the others being unfavourable in terms of this criteria. There was very little grazing of raised bog sites. CMS prescriptions do not allow grazing on intact areas of raised bog but restricted grazing is permitted on associated habitats. One site that had heavy grazing by cattle was on an area of wet heath on the edge of a raised bog. A further site had moderate grazing impacts by sheep and cattle.

Under CMS prescriptions burning is not permitted on raised bogs as it can destroy sensitive species, especially *Sphagnum* species. Past burning was noted at only two sites.

Half of sites had bare ground present or frequent and were therefore in unfavourable condition. However only three sites had considerable bare areas, two associated with mechanical peat cutting and one with heavy cattle grazing. Five sites had some active peat extraction. Two of these had extensive peat cutting by machine and so were badly degraded. (N.B. One of these was on an area that would have better classified as blanket bog). Active drainage was also noted on the sites where peat cutting was occurring.

Trees, mainly birch (*Betula pubescens*), were present on all but one of the sites and were abundant or frequent on half. Trees or scrub on the peat body indicates drying out of peat.

Four sites were in favourable condition except for some birch colonisation. Overall 80% of sites were in unfavourable condition at baseline based on assessment criteria, with four of these in very poor condition, i.e. scoring 6 points or more.

### 3.5. Farm woodland

#### ***Habitat description***

There were 63 farm woodland sites surveyed. Due to the number and the diverse nature of the woodland sites surveyed a classification tool (TWINSPAN) was used to group woodland sites with similar vegetation characteristics. This resulted in the four woodland types described below:

#### *i) Ash/hazel woodland (29% of sites)*

This woodland was usually dominated by ash and/or hazel, often with an understorey including hawthorn, rowan and holly. Typical woodland ground flora species were common including bluebell, wood anemone, wood sorrel and dog violet. These were usually semi-natural woodlands closest to NVC type W9 (*Fraxinus excelsior-Sorbus aucuparia-Mercurialis perennis* woodland) and corresponding to HAP Priority Habitat 'mixed ashwoods'. Beech woods with a ground flora dominated by bluebells were included in this group.

#### *ii) Wet woodland (29% of sites)*

Damp woodland generally with alder, ash and/or willow, often on lake or river edge on fertile soils. Ground flora included tall herbs such as meadowsweet, cow parsley, nettle and wood avens. Sites usually showed no signs of current or recent grazing. Woodlands were generally closest to NVC type W7 (*Alnus-Fraxinus*) and corresponding to HAP Priority Habitat 'wet woodlands'. Some of the wetter sites could be described as fen carr, equivalent to NVC W5 (*Alnus-Carex*). Four sites included were ungrazed sycamore/ash woods with tall herb ground flora.

#### *iii) Plantation woodland (21% of sites)*

Woodland with ground flora dominated by grasses, creeping bent and rough meadow-grass, and with few typical woodland indicators. Ground flora was not necessarily species-poor but plants were more typical of fertile agricultural grassland, e.g. creeping buttercup, chickweed, nettle and mouse-ear. Sites were often plantations with ash dominant and other trees including larch, sycamore and beech. Most sites had a history of being grazed. They were not

generally semi-natural and so do not have good affinity to NVC type or BAP priority habitat.

*iv) Birch woodland (22% of sites)*

Birch woodlands on peaty acid soils, which have often developed on cut-over raised bogs. These had a species-poor ground flora generally grassy with velvet bent, purple moor-grass and sweet-vernal grass, also common were tormentil, broad-buckler fern and bramble. Sites were often ungrazed as they have developed on land not used for agriculture. These woods were equivalent to NVC W4 (*Betula-Molinia*) and BAP priority habitat 'wet woodlands'.

***Species diversity and composition***

In total 133 higher plant species were recorded on all woodland sites. There was a mean number of 11.0 ( $\pm 0.7$ ) species per 4m<sup>2</sup> but species-richness was quite variable with between 2 and 28 species recorded. The most frequent ground flora species (occurring on >25% of sites) were rough meadow-grass (*Poa trivialis*), lesser celandine (*Ranunculus ficaria*), creeping bent (*Agrostis stolonifera*), yorkshire fog (*Holcus lanatus*), creeping buttercup (*Ranunculus repens*), ivy (*Hedera helix*) and bluebell (*Hyacinthoides non-scripta*).

The mean number of species per 200m<sup>2</sup> was 27.9 ( $\pm 1.3$ ), including ground flora and woody species. Ash (*Fraxinus excelsior*) was the most common tree species, occurring in the canopy of almost half of sites. Other frequent trees recorded were birch (*Betula pubescens*), hazel (*Corylus avellana*) and alder (*Alnus glutinosa*). Most frequent understorey shrubs were bramble (*Rubus fruticosus*), hawthorn (*Crataegus monogyna*), holly (*Ilex aquifolium*) and willow (*Salix cinerea*). Frequently occurring ground flora species within the 200m<sup>2</sup> quadrat were broad-buckler fern (*Dryopteris dilatata*) and nettle (*Urtica dioica*), in addition to those noted above.

In terms of percentage cover of herb species within the ground flora, bluebell (*Hyacinthoides non-scripta*), lesser celandine (*Ranunculus ficaria*), creeping buttercup (*Ranunculus repens*), meadowsweet (*Filipendula ulmaria*) and

golden saxifrage (*Chrysosplenium oppositifolium*) were the most abundant. At some sites these species accounted for 70% or more cover.

There were no rare plant species noted at any site although toothwort (*Lathraea squamaria*), an uncommon parasitic plant was recorded in one Co. Tyrone wood, a new 10km record.

Invasive non-native species including snowberry (*Symphoricarpos alba*), Japanese knotweed (*Fallopia japonica*) and cherry laurel (*Prunus laurocerasus*) were present on a few sites in old derelict gardens or estates.

### **Management**

Of 63 sites surveyed, 45 were fenced with 18 remaining unfenced (partially or wholly). Of the fenced woods 80% had no grazing at time of survey, 18% had light/occasional grazing and 2% (one site) had heavy grazing. The unfenced woods generally had more grazing with five sites heavily grazed, however 44% of these did not have any signs of current grazing.

Some sites, both fenced and unfenced, appeared to have not been grazed for many years (i.e. pre-CMS scheme). For example very wet woods, old derelict farm gardens or those next to roads may never have been actively grazed. Of all woods, 54% had no indications of past or recent livestock presence. Where animals were recorded, cattle were the most common (28% of sites) followed by sheep (22%). Widespread poaching by livestock, usually cattle, was present on 19% of all woods.

Of the woodland sites 59% had some bare ground recorded in 4m<sup>2</sup> quadrat. The mean cover of bare ground recorded was 4.5%, varying from none to 70%. Only 11 sites (17%) had greater than 10% bare ground within the quadrat. In 6 of these sites recent cattle poaching appeared to have resulted in bare ground. High bare ground cover is not necessarily an indication of poor condition but may suggest an inappropriate grazing level in some woods.

### ***Tree and shrub regeneration***

Most woods had regeneration of at least one species with the exception of three sites. Ash showed the most regeneration in terms of numbers of sites with seedlings (54%) and saplings (22%). There were often 100 or more seedlings within the 200m<sup>2</sup> quadrat. These were mainly in their first year but presence of saplings on some sites suggests successful establishment. On the 36 sites where ash was regenerating there were more saplings recorded on sites with no grazing (mean = 3.8 per 200m<sup>2</sup>) than on sites with current or recent grazing (mean = 0.75 per 200m<sup>2</sup>). This is despite more seedlings being recorded on the grazed sites suggesting that exclusion of grazing will eventually result in more saplings becoming established.

Sycamore was also commonly regenerating, with 27% of sites having seedlings present. Only 17% of sites had sycamore recorded in the canopy, but trees may have been present outside the quadrat. This demonstrates the success of sycamore in invasion of woodlands. Beech, another non-native species, had seedlings present on 14% of sites although only 1 site had any saplings.

Oak was present in the canopy of 14% sites but only 5% had any seedlings and/or saplings recorded. For light-demanding species such as oak few seedlings would be expected where there is a dense canopy but may be found around the edge of a wood.

Of 18 woods with birch present or dominating the canopy only 6 had any seedlings within the quadrat. However in some cases birch was noted to be regenerating around the edges of the site where it was spreading onto bogs. Birch appears to require bare or disturbed ground for regeneration.

Hawthorn and blackthorn showed good regeneration with seedlings present on >20% of sites. Other tree and shrub species showed very few seedling or saplings, some of these were species that often regenerate from suckers or stools, e.g. hazel, alder and willow.

### **3.6. Farm scrub**

#### ***Habitat description***

There were 28 farm scrub sites surveyed, often on moderate or steep slopes. Most sites had light or occasional grazing although four sites were recorded as being heavily grazed. On five sites no signs of recent grazing were apparent. Recent management of shrubs by cutting or coppicing was noted on only 14% of sites.

There were three main types of scrub recorded:

#### *i) Gorse/bramble scrub (46% of sites)*

Scrub dominated by gorse and usually with some bramble and occasional small trees. Sites were generally species-poor for shrub species. Shrubs were often invading grassland, usually unimproved or species-rich dry. Patches were often dense and inaccessible with very little ground flora beneath bushes. Grazing was usually light around edges of patches. Generally equivalent to NVC type W23 (*Ulex europaeus-Rubus fruticosus* scrub).

#### *ii) Hawthorn/blackthorn scrub (40% of sites)*

Scrub dominated by hawthorn and/or blackthorn often with occasional hazel and ash trees. A woodland ground flora was often present particularly where the canopy was taller. Vegetation was usually equivalent to NVC types W21 (*Crataegus monogyna-Hedera helix* scrub) and W22 (*Prunus spinosa-Rubus fruticosus* scrub). At some sites hazel was abundant and these were close to NVC type W9 (*Fraxinus* woodland).

#### *iii) Wet scrub (14% of sites)*

Scrub/woodland dominated by alder, birch and /or willow. Canopy height was generally around 10m, so these sites may have been better classified as woodland, NVC types W7 or W4.

#### ***Species diversity and composition***

A total of 181 higher plant species were recorded. The mean number of species recorded per 4m x 4m quadrat was 19.7 ( $\pm 0.7$ ). Within the 200m<sup>2</sup> the mean number was 33.5 ( $\pm 1.4$ ) species. The species-diversity for scrub was

high due to the fact that scrub often occurs in a mosaic with different habitat types. Plants include both typical woodland and grassland species.

The most frequent woody species occurring on scrub sites were bramble (*Rubus fruticosus*), gorse (*Ulex europaeus*), hawthorn (*Crataegus monogyna*), blackthorn (*Prunus spinosa*), willow (*Salix cinerea*), ash (*Fraxinus excelsior*) and hazel (*Corylus avellana*). Shrub cover over the whole site varied from 50% to almost 100%.

The most frequently occurring ground flora species (on >50% of sites) were grasses (*Agrostis stolonifera*, *Holcus lanatus*, *Poa trivialis*, *Agrostis capillaris*), creeping buttercup (*Ranunculus repens*) and common sorrel (*Rumex acetosa*). In terms of mean cover per 4m x 4m quadrat the most abundant species were the shrubs, gorse (23%), bramble (10%) and blackthorn (12%). Mean shrub cover per quadrat was 48%. Other plants with relatively high cover (>5%) were grass species, bluebell (*Hyacinthoides non-scripta*), creeping buttercup (*Ranunculus repens*) and wood sorrel (*Oxalis acetosella*). Grass cover ranged from 2 to 90%, with the mean cover per site being 43%.

Where scrub was dense there was often virtually no ground flora, except for mosses, beneath bushes due to the influence of shade. Herbaceous vegetation was confined to margins and open areas. This was sometimes species-rich where grazing occurred but more rank grassy vegetation was present on land with little or no grazing.

### 3.7. Arable fields managed for wildlife

A total of 122 higher plant species were recorded from all arable options surveyed. Variation in species diversity, composition and vegetation structure, between sites and options on different farms was comparatively high. Species richness for each option surveyed was calculated (Table 10).

**Table 10.** Numbers of higher plant species recorded on arable habitats.

<i>Arable option</i>	<i>n</i>	<i>Mean no. of species per 0.25m<sup>2</sup> (se)</i>	<i>Total no. of species recorded</i>
RWS	9	5.6 (1.1)	56
AFW/CGW	16	8.7 (0.7)	93
RGF	8	9.6 (0.8)	73

#### 3.7.1. Retention of winter stubble

##### ***Habitat description***

The nine sites surveyed in the summer included six fields of barley, two of wheat and one of oats. (N.B. Results from a follow-up winter survey will be presented at a later date.)

##### ***Species diversity and composition***

The most widespread species that had naturally regenerated were grasses annual meadow-grass (*Poa annua*), rough meadow-grass (*Poa trivialis*), creeping bent (*Agrostis stolonifera*) and marsh foxtail (*Alopecurus geniculatus*), and dicotyledonous weed species knotgrass (*Polygonum aviculare*) and chickweed (*Stellaria media*). No rare arable species were observed although an interesting blue form of scarlet pimpernel (*Anagallis arvensis*) was found on one site in Co. Down.

The numbers of species recorded was generally lower than in the other two options as there is no restriction on herbicide use during the growing season (Table 10). There were also fewer sown species. In particular the mean number of dicotyledons per site was reduced. It is expected that winter surveys may show an increase in these species as no herbicide application or cultivation allowed from harvesting until March 1<sup>st</sup>.

As expected most of the cover component came from the sown crop with cover of monocotyledons and dicotyledons being much lower. However one site had a particularly high cover of dicotyledons that may have been related to limited herbicide use. On some other sites weed cover was high on the quadrats recorded nearest the field boundary but much lower within the field.

### **3.7.2. Wild-bird cover as arable crop margin or on improved grassland**

#### ***Habitat description***

There were 16 sites in total for this option including 12 on improved grassland (CGW) and 4 arable crop margins (AFW) plots. Results for these two types were analysed together as no differences in species diversity were observed. The main differences between all sites come from the seed mixture used and the time since sowing. Most of the sites had been sown in the spring before the survey, generally March or April but in a few cases farmers had not sown the crop until May, possibly due to wet soils. Four sites had wild-bird cover established the previous year, which was still in place. Several of the sites particularly in Co. Down were on estates where pheasants were reared so there was an additional use as game cover.

Vegetation height was variable, ranging from 10cm on late sown areas up to 2m where tall mature species such as sunflowers, maize and brassicas occurred.

#### ***Species diversity and composition***

The relatively high species-richness was due to sowing of mixtures and the high incidence of arable weed species (Table 10). The most commonly sown species were brassicas, occurring on 75% of sites. Other sown species included quinoa (*Chenopodium quinoa*), phacelia (*Phacelia tanacetifolia*), white mustard (*Sinapsis alba*), maize (*Zea mays*) and barley (*Hordeum* sp.), each found on around a quarter of sites surveyed. There was an average of three sown species per site. It appears in some cases that only one species was sown, e.g. maize or flax, but it may be that other species did not

successfully establish. On other sites there was a diverse mixture of up to nine sown species. Sown species accounted for around 50% of cover on most sites. Areas that had been established the previous year were dominated by tall brassicas with other sown species infrequent. The exception to this was one CGW site where perennial grasses had become dominant and virtually no sown species persisted.

Widespread naturally regenerated dicotyledon species were creeping buttercup (*Ranunculus repens*), common mouse-ear (*Cerastium fontanum*), chickweed (*Stellaria media*), broadleaved dock (*Rumex obtusifolius*), redshank (*Polygonum persicaria*) and nettle (*Urtica dioica*), all occurring on more than two-thirds of sites. The most frequent grasses/monocotyledons were rough meadow-grass (*Poa trivialis*), creeping bent (*Agrostis stolonifera*), annual meadow-grass (*Poa annua*), toad rush (*Juncus bufonius*) and yorkshire fog (*Holcus lanatus*).

The high cover of dicotyledons (34 %) resulted from the absence of herbicide or fertiliser and the relatively open structure of the vegetation. In general mean dicotyledon cover was higher on CGW sites (38%) as opposed to AFW sites (25%). Species included those associated with arable/disturbed ground as well as typical grassland species.

### **3.7.3. Rough grass field margins**

#### ***Habitat description***

This option requires the creation of a strip of land at least 2m wide around arable fields on which a suitable grass mixture is sown. A total of eight sites were surveyed on six farms. These included margins sown with grass and other margins that appeared to have regenerated naturally or had been in place for at least two years. Therefore there was variation in the vegetation composition and structure. Width of the margins was between 2 and 4m, with the exception of one site with a wider margin of around 12m.

The mean vegetation height was 42cm with most sites having tall rank vegetation with the exception of two sites recently mown or sown.

Correspondingly there was virtually no bare ground on most margins except for these two sites where vegetation was sparse. The desired tussocky structure had developed on some older margins with good tussocks of cocksfoot grass present. Other sites had tall vegetation but few tussocks present.

### ***Species diversity and composition***

The species diversity of sown grass margins would be expected to be low, but this was not the case for many of the sites (Table 10). Frequent grass species were creeping bent (*Agrostis stolonifera*), red fescue (*Festuca rubra*), rough meadow-grass (*Poa trivialis*) and cocksfoot (*Dactylis glomerata*). In some cases these species had been sown but at other sites appeared to have naturally spread. The most widespread dicotyledon species were white clover (*Trifolium repens*), spear thistle (*Cirsium vulgare*), prickly sow-thistle (*Sonchus asper*), broad-leaved plantain (*Plantago major*) and creeping buttercup (*Ranunculus repens*), occurring on 75% of sites. The number of naturally regenerated dicotyledons recorded was similar to that on wild-bird cover but more species were perennials.

The abundance of grasses was obviously high with a mean cover of 57% per quadrat, including sown and unsown species. However the cover of dicotyledons was also high at a mean of 43% per quadrat.

### **3.8. Buffers for ASSI's/NNR's, woodlands, streams and rivers**

#### ***Habitat description***

There were six buffer strips surveyed on improved grassland (BUI) and five on unimproved grassland (BUU). Of these sites, seven were adjacent to watercourses, three were adjacent to woodlands and one was adjacent to dune/shore vegetation (Dundrum Bay ASSI). Grasses and agricultural 'weeds' dominated most sites but there were also rushes and some typical wetland species, e.g. *Filipendula*, particularly on sites next to watercourses. Two of sites adjacent to water were next to Lough Foyle ASSI.

The width of the buffers varied from 5m to around 25m. Under management prescriptions buffer strips must be fenced and no grazing is normally permitted. All sites were fenced except one where fencing was in progress at the time of the survey. All sites were ungrazed by livestock but at least three had rabbit grazing noted.

With the exception of buffers next to woods, strips must be mown 1 in every 3 years, between the 1<sup>st</sup> August and 15<sup>th</sup> September. There were no indications of sites having been recently mown but most were visited before this time. Mean vegetation height was generally quite high, greater on BUU (58cm) than BUI (42cm) sites.

On buffers around woodland trees may be planted to increase the area of habitat. At one site trees had been planted but most had died, although planted birch and dogwood had successfully established. Gorse and willow also appeared to be spreading on this site.

#### ***Species diversity and composition***

A total of 92 higher plant species were recorded from buffer strips. The mean number of species per site was 20.1 ( $\pm$  2.2), with species richness for BUI and BUU very similar.

The most frequent species (occurring on >70% of sites) were yorkshire fog (*Holcus lanatus*), rough meadow-grass (*Poa trivialis*), soft rush (*Juncus*

*effusus*), white clover (*Trifolium repens*) and creeping buttercup (*Ranunculus repens*). There was little difference in the main species found on BUI and BUU sites although soft rush was more frequent on BUU and perennial rye grass (*Lolium perenne*) and white clover slightly more frequent on BUI.

In terms of mean percentage cover per quadrat, creeping bent, creeping buttercup and soft rush were the most abundant species, all with >20% cover. Total grass cover was generally high, up to 100% in some cases. Mean cover was 73% for all sites, with 61% and 83% for BUU and BUI respectively.

### **3.9. Field boundary restoration**

#### ***Hedge structure and management***

Of the 25 hedges sampled, 4 had been recently coppiced (all or part of the hedge), 2 had interplanting of gaps with whips and 5 had been both coppiced and interplanted. The remaining 14 hedges had no recent management (under 2yrs) carried out at time of survey, although some showed signs of old coppicing or trimming. Only one of these had hedge laying as management plan. Of the 7 sites that had been interplanted, 5 sites had hawthorn whips and 2 had mixture of hawthorn and blackthorn.

The mean height of unmanaged hedges was 3.9m. They were generally overgrown and often leggy with large gaps at the base. The mean percentage of gaps over the 30m length was 28%.

The mean height of the coppiced hedges was 0.8m. On interplanted sections whips were 0.2 - 0.5m height. The mean percentage of gaps recorded was 40%, although this was difficult to assess in recently managed hedges as whips and stumps had not yet grown or thickened out.

Most of the sampled hedges (64%) were adjacent to improved pasture. The recently coppiced hedges had new permanent fences erected with the exception of two sites, one with an electric fence and another next to arable field. In the case of unmanaged hedges with no fencing livestock sheltering below hedge accounted for high amounts of bare ground. High bare ground cover was also recorded on two managed hedges due to spraying/disturbance when planting new shrubs.

#### ***Species diversity and composition***

In total 14 species of trees and shrubs were recorded. One of the criteria for hedges to be defined as species-rich is that five or more native woody species are present in a 30m length (NIBG, 2003). Five of the CMS hedges had five woody species. (N.B. Bramble was not included as a woody indicator species). However 11 sites were species-poor with only one or two shrubs present. The mean number of woody species was 3.6 ( $\pm 0.34$ ).

Hawthorn (*Crataegus monogyna*) was the most frequent shrub, present on all sites. Abundance varied from 5% to 100% but generally it was the most dominant species. The mean cover of hawthorn was 54% of the 30m sample length. The other most frequent woody species were bramble (*Rubus fruticosus*) (68% of sites) and dog rose (*Rosa canina*) (40% of sites). Over a quarter of the sites surveyed had mature ash trees present.

The hedge base or bank was usually dominated by tall grass and agricultural 'weed' species. There were 84 higher plant species recorded in the ground flora. The mean number of species recorded per 2m x 1m quadrat was 10.9 ( $\pm$  0.6). The most frequent species were grasses, yorkshire fog (*Holcus lanatus*), creeping bent (*Agrostis stolonifera*), cocksfoot (*Dactylis glomerata*) and rough meadow-grass (*Poa trivialis*). Typical herb species present (on >25% of sites) were nettle (*Urtica dioica*), common sorrel (*Rumex acetosa*), creeping thistle (*Cirsium arvense*), creeping buttercup (*Ranunculus repens*) and cleavers (*Galium aparine*). In terms of herb abundance, nettle had the greatest mean cover (6%).

Those hedgerows with fewer than five woody species but a rich basal flora with woodland species such as primrose (*Primula vulgaris*), bluebell (*Hyacinthoides non-scripta*), dog violet (*Viola riviniana*) and herb robert (*Geranium robertianum*), can also be defined as species-rich (NIBG, 2003). Dog violet, for example, occurred on five sites but few of the sampled sites had one or more indicator species. Only three of the hedges could be described as having a species-rich bank or base. The most diverse of these was on a high bank alongside a track, which was not likely to have ever been affected by spraying.

## 4. INVERTEBRATE RESULTS

### 4.1. Carabid beetles

#### *Species diversity*

A total of 36,838 individuals of 78 species were recorded in two consecutive field seasons in 2002 and 2003, from 137 sites on CMS participant farms. Species diversity and abundance for each sampled habitat has been calculated (Tables 11 & 12).

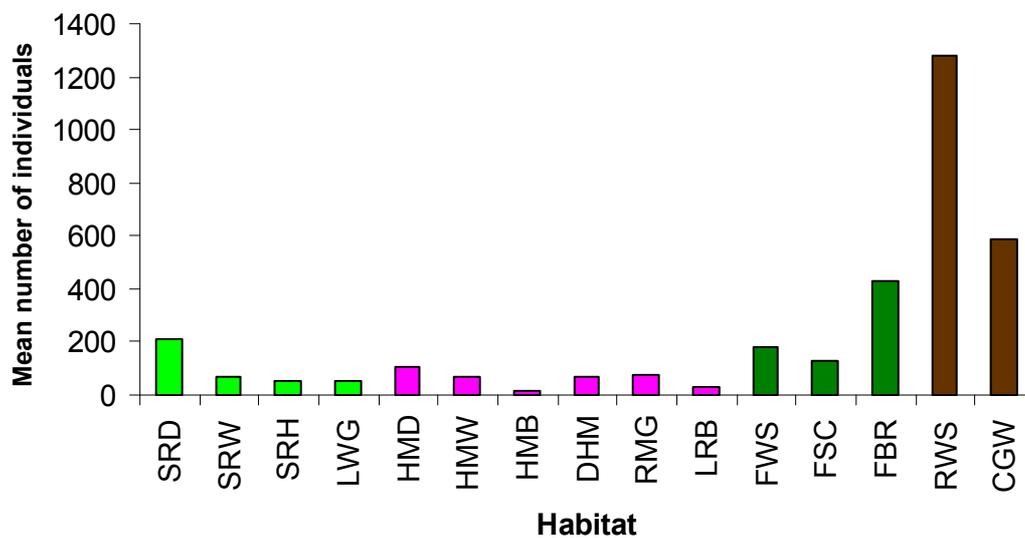
**Table 11.** Total number of beetle individuals and species captured in 2002 and 2003 from habitats on CMS farms.

Habitat	n	Number of beetle species	Number of beetle individuals
Species-rich dry grassland	8	41	1692
Species-rich wet grassland	10	26	676
Species-rich hay meadow	6	21	334
Lowland-wet grassland	12	26	626
Dry heath	6	28	652
Wet heath	12	30	811
Blanket bog	2	13	27
Degraded heather moorland	9	31	631
Rough moorland grazing	9	25	693
Lowland raised bog	8	17	231
Farm woodland	11	43	2016
Farm scrub	8	43	1000
Field boundary restoration	13	54	5554
Retained winter stubble	12	50	15341
Conversion of grassland to bird cover	11	42	6496

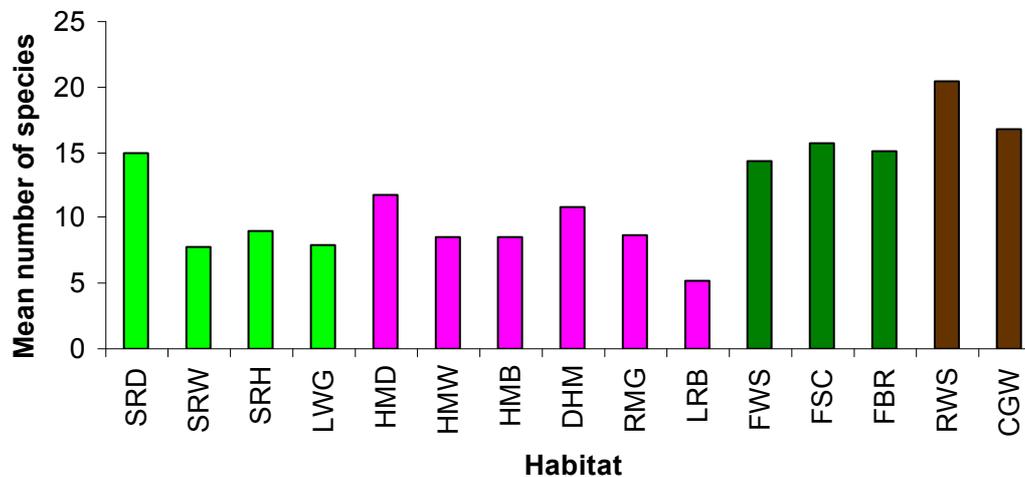
**Table 12.** Mean number of beetle individuals and species per site captured in 2002 and 2003 from habitats on CMS farms.

<i>Habitat</i>	<i>Mean number individuals/site</i>	<i>Mean number species/site</i>	<i>Mean Alpha diversity/site</i>
Species-rich dry grassland	212	15	7.6
Species-rich wet grassland	68	8	5.1
Species-rich hay meadow	56	9	5.0
Lowland-wet grassland	52	8	5.7
Dry heath	109	12	6.2
Wet heath	68	9	6.1
Blanket bog	14	9	9.8
Degraded heather moorland	70	11	7.1
Rough moorland grazing	77	9	5.1
Lowland raised bog	29	5	4.2
Farm woodland	183	14	7.7
Field boundary restoration	427	15	8.5
Retained winter stubble	1278	21	6.5
Conversion of grassland to bird cover	591	17	6.3

The diversity of carabid species and individuals across the various CMS habitats is shown (Figures 1 & 2). (For habitat key see Table 2).



**Figure 1.** Mean number of beetle individuals per site captured in 2002 and 2003 from CMS habitats.



**Figure 2.** Mean number of beetle species per site captured in 2002 and 2003 from CMS habitats.

**Species composition**

Species frequency lists for each habitat have been compiled (Appendix 4). Generalist species such as *Pterostichus niger*, *Pterostichus nigrita*, and *Carabus granulatus* were found in comparatively high numbers across a range of habitats. Other almost equally abundant species include *Nebria*

*brevicollis*, *Pterostichus melanarius* and *Pterostichus strenuous*. These species tend towards the drier more open habitats and consequently have been found in greater abundances in retained winter stubble and field boundary sites.

There were fairly distinct groups of species found on similar habitats. Carabid beetle assemblages can be grouped using the following four broad habitat types:

*i) Grassland habitats*

Species-rich wet grassland, hay meadows and lowland wet grassland are characteristically damp habitats with their own compliment of species. The current survey indicates that the scarce species *Carabus clatratus* is extant in suitable wet pastures in Co. Londonderry in an area between Garvagh and Limavady. Another declining species *Chlaenius nigricornis* was also found on wet grassland sites.

*ii) Moorland habitats*

The combination of altitude, wetness and the dwarf-shrub community on these habitats gave a unique compliment of carabid species, including the larger *Carabus* species. Some species such as *Carabis arvensis* were rarely found on other habitats whilst others such as *Carabus nitens* were found almost exclusively on areas of upland peat. The uncommon *Carabus nitens* was recorded on wet and degraded heath sites.

*iii) Woodland habitats*

Farm woodland, scrub and boundary restoration sites (i.e. hedges), harboured relatively high numbers of carabid species and individuals.

*iv) Arable habitats*

Retained winter stubble (RWS) was sampled as a cereal crop during the summer and was found to have more carabid beetles than any other habitat (Figure 1). The habitat harboured the highest mean number of individuals and species per site. Of the beetles recorded on RWS, 70% comprised of only five species; *Agonum muelleri*, *Pterostichus niger*, *Pterostichus melanarius*,

*Nebria brevicollis* and *Pterostichus nigrita*. Wild bird cover (CGW) also had a high number of species and individuals recorded.

Species recorded on these habitats that have a localised distribution included *Trechus discus* and *Harpalus affinis*. *Trechus discus* was recorded from a cereal field beside the River Roe near Limavady. *Harpalus affinis* was recorded from a well-drained cereal field on the Ards peninsula.

## 4.2. Spiders

### ***Species diversity***

Data presented was recorded from two consecutive field seasons in 2002 and 2003 (Tables 13 & 14). Species diversity and abundance for each sampled habitat has been calculated. A total of 11,966 spiders of 135 species were captured from 137 sites on CMS participant farms. Diversity indices and quality scores were calculated for each habitat (Table 15).

**Table 13.** Total number of spider individuals and species captured in 2002 and 2003 from habitats on CMS farms.

<i>Habitat</i>	<i>n</i>	<i>Number of spider species</i>	<i>Number of spider individuals</i>
Species-rich dry grassland	8	41	1640
Species-rich wet grassland	10	38	745
Species-rich hay meadow	6	35	1098
Lowland wet grassland	12	48	556
Dry heath	6	44	491
Wet heath	12	54	714
Blanket bog	2	17	95
Degraded heather moorland	10	52	1072
Rough moorland grazing	9	51	430
Lowland raised bog	8	30	363
Farm woodland	11	46	370
Farm scrub	8	39	458
Field boundary restoration	11	46	602
Retained winter stubble	12	37	1670
Conversion of grassland to bird cover	12	28	1662

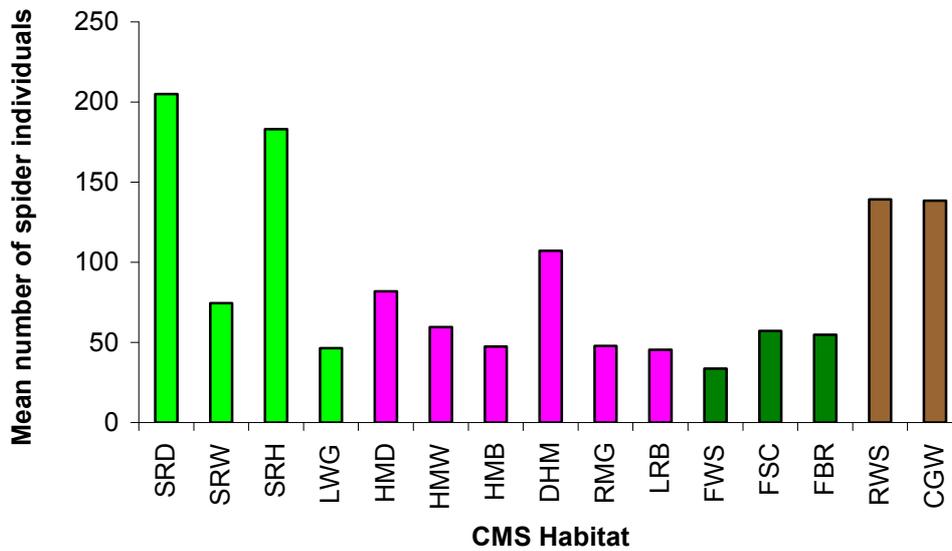
**Table 14.** Mean number of spider individuals and species per site captured in 2002 and 2003 from habitats on CMS farms.

<i>Habitat</i>	<i>Mean number individuals/site (se)</i>	<i>Mean number species/site (se)</i>
Species-rich dry grassland	205 (41.7)	16.8 (1.94)
Species-rich wet grassland	75 (16.3)	12.4 (1.54)
Species-rich hay meadow	183 (44.9)	14.2 (2.43)
Lowland wet grassland	46 (11.5)	12.0 (2.07)
Dry heath	82 (18.0)	15.3 (1.80)
Wet heath	60 (8.3)	13.5 (1.61)
Blanket bog	48 (10.5)	10.5 (0.5)
Degraded heather moorland	107 (15.8)	14.7 (1.73)
Rough moorland grazing	48 (8.3)	14.0 (1.95)
Lowland raised bog	45 (6.8)	9.3 (0.94)
Farm woodland	34 (6.2)	10.1 (1.10)
Farm scrub	57 (14.9)	9.8 (2.14)
Field boundary restoration	55 (12.7)	12.6 (1.53)
Retained winter stubble	139 (31.3)	10.8 (1.18)
Conversion of grassland to bird cover	139 (23.0)	9.5 (1.56)

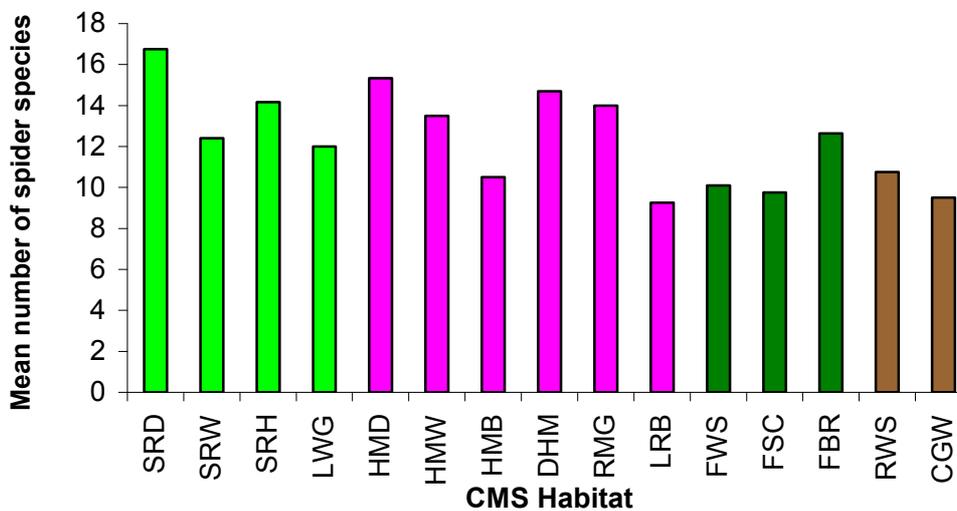
**Table 15.** Mean Alpha diversity and mean species quality score for spider species captured in 2002 and 2003 from habitats on CMS farms.

<i>Habitat</i>	<i>Mean Species Quality score per site (se)</i>	<i>Mean Alpha Diversity per site (se)</i>
Species-rich dry grassland	54.2 (12.4)	4.78 (0.79)
Species-rich wet grassland	96.2 (40.1)	4.81 (0.55)
Species-rich hay meadow	70.0 (26.1)	4.02 (1.01)
Lowland wet grassland	89.5 (32.9)	7.90 (1.67)
Dry heath	49.3 (7.9)	6.03 (0.70)
Wet heath	98.2 (25.3)	5.74 (0.73)
Blanket bog	51.5 (2.5)	4.26 (0.24)
Degraded heather moorland	103.7 (34.1)	5.07 (0.83)
Rough moorland grazing	97.3 (33.6)	13.19 (6.43)
Lowland raised bog	62.2 (17.5)	4.48 (0.67)
Farm woodland	83.4 (21.6)	7.1 (1.34)
Farm scrub	44.7 (16.6)	6.29 (2.07)
Field boundary restoration	148.5 (43.4)	6.81 (1.18)
Retained winter stubble	82.7 (17.8)	3.12 (0.35)
Conversion of grassland to bird cover	30.4 (8.7)	2.56 (0.47)

Diversity of spider species and individuals across the sampled CMS habitats is shown (Figures 3 & 4). (For habitat key see Table 2).



**Figure 3.** Mean number of spider individuals per site captured in 2002 and 2003 from CMS habitats

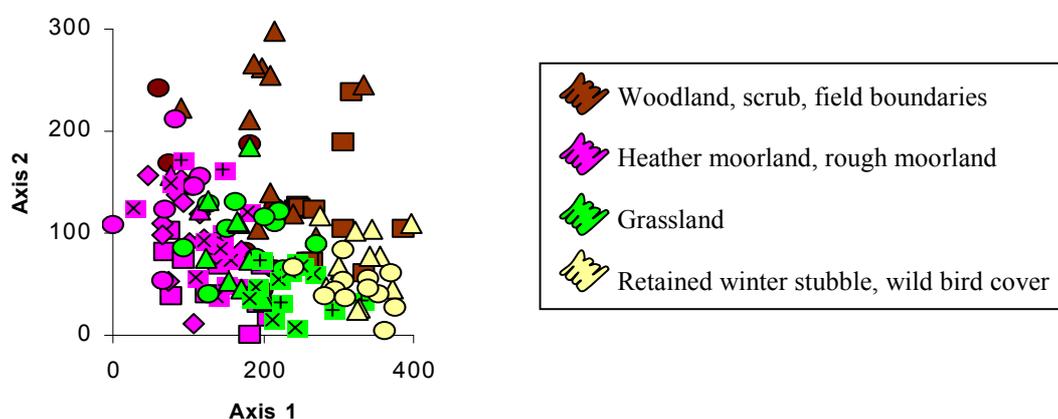


**Figure 4.** Mean number of spider individuals per site captured in 2002 and 2003 from CMS habitats.

***Species composition***

Species frequency lists for each habitat have been compiled (Appendix 5). Ordination of spider data using DECORANA indicated four distinct spider species assemblages on (i) woodland, scrub and field boundaries, (ii) heather

moorland and rough moorland grazing, (iii) grassland, and (iv) retained winter stubble and wild bird cover (Figure 5). Spider species assemblages are sensitive to changes in habitat structure. Future monitoring will determine changes in spider species assemblages and provide a measure of change in habitat value.



**Figure 5.** Ordination of monitoring sites according to spider species presence/absence data recorded in 2002 and 2003 from various habitats on farms participating in CMS.

There were no significant differences in spider composition for each individual habitat shown in this baseline survey. Therefore species assemblages are grouped using the four broad habitat types:

*i) Grassland habitats*

Species-rich wet grassland and lowland wet grassland had high proportions of *Pardosa pullata* and *P. amentata*, which occur most abundantly on wet, well-vegetated habitats. Rare species trapped on these sites included *Pelecopsis mengei* and *Tallusia experta*, both of which prefer wet habitats, and *Erigonella ignobilis*, another wetland species that has only been recorded from Counties Fermanagh and Galway in Ireland.

Species-rich hay meadows and species-rich dry grassland had a large abundance of *Erigone* species, small money spiders, and the wolf spider *Pardosa amentata*. Species-rich hay meadows also had a number of hydrophilic species such as *Pirata piraticus*. Two uncommon species were

trapped *Taraneucnus setosus* and *Kaestneria pullata*, both of which prefer wet, undisturbed habitats.

Species-rich dry grassland had an abundance of *Pachygnatha degeeri* and *Alopecosa pulverulenta* which are commonly found on dry habitats, as well as several Linyphiid species common to dry, grassy habitats.

#### ii) Moorland habitats

Several spider species were abundant on these habitat types. *Trochosa terricola*, *Alopecosa pulverulenta* and *Pardosa nigriceps* have shown preferences for heathland and were common on all CMS heather moorland habitats. Other species included *Pardosa pullata* and *Pirata piraticus*, which prefer wet, well-vegetated habitats.

Wet heath, degraded heath and rough moorland grazing habitats had more hydrophilic species such as *Pachygnatha clercki* and *Antistea elegans*. These habitats also hosted more uncommon species such as *Araneus quadratus*, *Walckenaeria nodosa* and *Sintula cornigera*. The latter species has only been recorded recently in Northern Ireland from two other heathland sites (Johnston & Cameron, 2002). *Pirata uliginosus*, a species that generally prefers dry habitats, was captured on lowland raised bog and blanket bog.

#### iii) Woodland habitats

Farm wood, scrub and field boundaries each had large numbers of *Pardosa amentata*, a wolf spider common in undisturbed sites. Farm scrub and field boundary restoration sites had high numbers of more generalist species. Field boundary restoration sites in particular had several uncommon species; *Gongylidium rufipes*, *Clubiona lutescens* and *Ceratinella scabrousa*, all of which show preference to living in bushes and trees. *Milleriana inerrans*, a species that has not been recorded in Ireland before, was also trapped at a field boundary site in Co. Down.

Farm woodland had a more specific complement of spider species than scrub and hedgerows. *Diplocephalus latifrons*, *Lepthyphantes tenebricola* and *Monocephalus fuscipes* were relatively abundant and all are common to

wooded habitats. Farm woodland also had a number of rare species including *Gongylidium rufipes* and *Clubiona compta*, both of which are typical woodland species.

*iv) Arable habitats*

*Erigone* species typically indicate an open vegetation structure and accounted for 71% of spiders trapped on retained winter stubble and wild bird cover. Both these habitats were very similar in terms of species and abundance, consisting of generalist species and a combination of spiders with preferences to open habitats and tall vegetation. *Milleriana inerrans* was trapped from eleven sites, which is a significant capture of a species not found before in Ireland (Appendix 6).

## 5. SOIL ANALYSIS

The results of chemical analysis of soil samples from CMS habitats are presented (Table 16). (N.B. No analysis of magnesium levels was carried out in 2003).

**Table 16.** Mean pH and soil nutrient levels (mg/l) from analysis of sampled CMS habitats in 2002 and 2003.

<i>Habitat</i>	<i>n</i>	<i>pH</i>	<i>P</i>	<i>K</i>	<i>Mg</i>
Species-rich dry grassland	16	5.33 (0.05)	4.81 (0.63)	155.0 (23.8)	-
Species-rich wet grassland	32	5.28 (0.07)	6.41 (0.86)	84.4 (5.35)	197.5 (31.1)
Species-rich hay meadow	7	5.41 (0.12)	9.71 (1.15)	116.6 (11.9)	154.2 (33.0)
Species-rich acid grassland	5	4.98 (0.18)	5.20 (0.80)	104.6 (20.9)	171.6 (37.0)
Lowland wet grassland	19	5.50 (0.08)	9.53 (2.23)	97.9 (16.0)	197.7 (25.9)
Enhanced breeding wader	3	5.59 (0.37)	7.67 (1.86)	87.7 (25.8)	-
Farm woodland	29	4.97 (0.14)	11.59 (1.76)	112.8 (18.9)	-
Buffers: improved grassland	6	6.02 (0.36)	15.00 (3.07)	92.3 (15.1)	-
Buffers: unimproved grassland	4	5.05 (0.07)	15.00 (4.36)	112.8 (18.9)	-

## **6. DISCUSSION**

### **6.1. Species-rich grassland**

#### ***Species-rich dry grassland***

Overall, species-rich dry grassland sites were not of high quality in terms of positive indicators or condition. However over half of the sites had potential to improve with appropriate management. Some sites were on more acid soils and as such have inherently lower plant diversity. Several sites had invasive species, either agricultural weeds and/or scrub. Over half the sites were probably undergrazed as vegetation was above the desirable height, often being rank and neglected. Most of sites were ungrazed at time of survey in June. If there is no grazing or levels are very low an increase in coarse grasses and invasion by scrub is likely to occur. This will result in eventual loss of plant species diversity. Therefore it is essential that grazing is maintained and sites are not neglected. Management prescriptions should improve grassland condition and increase potential for biodiversity.

'Lowland meadows' are a BAP priority habitat. These are defined as unimproved neutral grassland, with NVC community MG5 being the main vegetation type (UKBG, 1998). They are not restricted to those cut for hay but include pastures where livestock grazing is the main land use. Therefore appropriate management of CMS species-rich dry grassland sites corresponding to MG5 should contribute to the delivery of BAP targets for 'lowland meadows'.

#### ***Species-rich wet grassland***

Overall about one third of species-rich wet grassland sites appeared to be in unfavourable condition due to lack of positive management. Tall sward height and dense litter layer indicate undergrazing of several sites. Build up of dead plant material due to insufficient removal of biomass by grazing (or cutting) can eventually lead to loss of plant species unable to regenerate in dense litter. Minimum grazing levels may be needed on some habitats. Scrub invasion and increase in rush cover may also be a potential problem. Therefore the introduction of appropriate stocking levels and scrub/rush

control should mean improvement in the condition of sites and enhancement of habitat quality.

Although many of the sample sites had frequent positive indicator species they were not of high quality in terms of targets for designated sites. However management should generally contribute to the delivery of targets for the BAP priority habitat 'purple moor grass and rush pastures'.

The ground beetle species *Carabus clatratus* and *Chlaenius nigricornis* recorded on species-rich wet grassland (and also damp hay meadows) were once described as common and widespread (Johnson & Halbert 1902) but are now highly restricted in their distribution. This is thought to be due to drainage and reclamation operations and loss of habitat. *Carabus clatratus* is an amphibious species feeding in bog pools and shallow lake waters as well as in terrestrial habitats (Thiele 1977). There are relatively few recent records and the species was thought extinct in other counties and restricted to lakeshore pastures and hay meadows in Co. Fermanagh.

### ***Species-rich hay meadow***

There was a small sample of hay meadows as uptake for this habitat was generally low. This may be due to the fact that this habitat is traditionally found in Co. Fermanagh, much of which comes under the ESA scheme. Most sites had positive indicators for wet grassland and had potential to improve through good management.

Hay meadows represent a particular type of management rather than a grassland type. Most of the hay meadows under CMS agreement are likely to be damp and as such correspond most closely to BAP priority habitat 'purple-moor grass and rush pastures'.

Species-rich hay meadows (and also species-rich dry grassland) had a high abundance of *Erigone* species. These small money spiders captured in such high numbers indicate grassland that has an open vegetation structure. The wolf spider *Pardosa amentata* was also found in substantial numbers and has previously shown a preference for undisturbed hay meadows.

### ***Species-rich acid grassland***

The small sample of survey sites was variable in terms of vegetation composition. Since baseline monitoring, much of the acid grassland habitat has been reclassified by DARD as either species-rich wet or dry grassland. Therefore at resurvey these sites will be assigned to the relevant grassland type.

'Lowland dry acid grassland' (i.e. below 300m) is a BAP priority habitat but none of the surveyed sites could be described as this vegetation type. Wetter sites with frequent *Molinia caerulea* may often correspond to 'purple-moor grass and rush pasture'. Those sites on basalts in Co. Antrim may be closest to priority habitat 'calcareous grassland'.

## **6.2. Wetlands**

### ***Lowland wet grassland / enhanced breeding wader***

Targets relating to vegetation were not the priority for these habitats as the main CMS objective is to improve habitat for breeding waders. However the objective is also to maintain and increase characteristic wetland plants. Many of the sites were species-rich or had potential, although others were species-poor agricultural grassland. Similar targets for condition assessment were used as for species-rich wet grassland but some sites are not likely to meet these.

Sites were generally undergrazed and often neglected. At least 30% of sites appeared ungrazed at any time. In some cases this was probably due to the sites being too wet for any management, as they often grade into fen/swamp and carr. Grazing by cattle is desirable as they control rushes and create a mosaic of vegetation height and structure. Over half of the sample sites had been grazed by cattle. There was very little poaching with only four sites showing moderate trampling/poaching damage.

Lowland wet grassland is the most common habitat on farms under CMS agreement, although it is an optional habitat for inclusion. Management of lowland wet grassland may contribute to delivering BAP targets for 'purple moor grass and rush-pastures'. A small proportion of sites may be closer to

fen vegetation (both species-rich and species-poor) and therefore will correspond to BAP priority habitat of 'fens'.

The main objective of management of lowland wet grassland is to provide feeding and nesting habitats for declining wading bird species, such as lapwing, snipe, curlew and redshank. The curlew in particular is a Northern Ireland BAP priority species (EHS, 2000).

### ***Fen, swamp and reedbeds***

These wetland habitats often occur in a mosaic which includes carr woodland. 'Fens' and 'reedbeds' are BAP priority habitats. Northern Ireland has a large proportion of the UK resource of fen habitat and widespread but limited reedbeds.

Wetlands are vulnerable to changes in water conditions and therefore threatened by nutrient enrichment and land drainage. Several of the monitored sites have been previously affected in the past by these factors. Future monitoring will determine if plant species diversity is being maintained and enhanced since management under CMS. In particular changes in abundance of plant species that are indicators of changes in fertility and water quality will be looked at. Nutrient management and pollution control are important features of CMS agreements.

### ***Carr***

Carr is included in the BAP priority habitat 'wet woodlands'. There was overlap of vegetation type between carr and some farm woodland sites. The management prescription for exclusion of livestock is the same for both CMS habitats. The small sample size makes it difficult to assess the overall condition of carr. It is likely that most of the woods have not been actively grazed in the past due to the waterlogged conditions. Therefore sites are unlikely to show many changes in species composition due to absence of livestock grazing.

Carr can be affected by nutrient run-off from adjacent agricultural land, leading to changes in ground flora. Certain plant species are an indicator of local

enrichment, e.g. nettle, and future monitoring should determine any changes in their abundance.

### **6.3. Heather moorland**

#### ***Dry heath***

Positive management of dry heath will contribute to delivery of targets for BAP priority habitats of 'upland heathland' and 'lowland heathland' (NIBG, 2003). Overgrazing is the main factor affecting much of the heathland in Northern Ireland. Heavy grazing leads to poor vegetation condition and eventually loss of dwarf-shrub cover. Only one quarter of sites met the condition assessment target of >75% dwarf-shrub cover. Many of the sites showed signs of moderate or heavy grazing, such as drumstick heather. Reduction of stocking densities through CMS agreements should improve condition of dry heaths.

Uncontrolled, large-scale burning of heathland also results in loss of quality and diversity. Occasional small-scale burning can be beneficial for maintaining habitat quality. None of the sample sites showed any signs of past burning. Heather regeneration of small areas through burning or flailing is a CMS management option on sites where heather is all in a late mature or degenerate state. However many sites exist within a mosaic of areas of wetter peat that are not suitable for burning. Burning for restorative purposes should therefore be considered carefully before any remedial work commences.

#### ***Wet heath***

Wet heath under CMS agreement contributes to delivering targets for BAP priority habitats of 'upland heathland' (>300m altitude), 'lowland heathland' (<300m altitude) and also 'blanket bog'. Some heath sites on deeper peats are technically blanket bog.

Wet heath can be highly variable with dwarf-shrub cover from 25% to as high as 90%. However 50-75% is typical for wet heaths in good condition (NIBG, 2003). At present 60% of sites have heather cover below 50%, probably due to a history of overgrazing. Around a quarter of sites had indicators of heavy grazing. Many sites had a high cover of graminoids, which is indicative of poor vegetation condition due to past or current inappropriate agricultural

management. Resurveys should determine whether heather is recovering due to the reduction of grazing levels.

None of the wet heath sites met all targets for favourable condition at baseline survey. However the assessment criteria were based on those devised for designated sites (i.e. SSSIs) and many CMS sites will not by nature be of such high quality or good condition. Future assessment will determine if the condition of wet heaths under CMS agreement is improving.

The combination of altitude, wetness and the dwarf-shrub community gives a unique compliment of ground beetle species on wet heather moorland habitats, including the larger *Carabus* species. The loss of this habitat through reclamation or degradation would undoubtedly have an adverse affect on these specialist populations. The species *Carabus nitens* is widespread but not common in suitable peatlands in Northern Ireland. It is primarily a montane species and was found in the present survey on wet and degraded heath sites although others report a tolerance of both wet and dry conditions (Lindroth 1992).

### ***Blanket bog***

The small sample of monitored sites makes it difficult to assess blanket bog but heavy grazing, burning and peat cutting were observed at baseline monitoring. These are factors that have a significant negative effect on the condition of blanket bog vegetation. Management under CMS aims to improve condition through lower stocking levels and the prevention of burning and peat cutting.

'Blanket bog' is a BAP priority habitat and Northern Ireland has a high proportion of the UK and Irish resource. The action plan suggests that it is likely that the majority of heather moorland in agri-environment schemes will be blanket bog with a smaller proportion of wet heath (NIBG, 2003). However there is 1566ha of blanket bog under CMS agreement as opposed to 9545ha of wet heath. This may be due to differences in classification of these two habitats where plant communities can be very similar.

### ***Degraded heath***

Appropriate management of degraded heath can contribute to delivery of BAP targets for the priority habitats of 'upland heathland', 'blanket bog' and possibly 'lowland heathland'. One of the action plan targets for upland heathland is to increase dwarf shrubs to >25% cover where cover has been reduced through inappropriate management (NIBG, 2003). The CMS management prescriptions aim to achieve this target on areas under agreement.

At present all sites were in poor condition due to heavy grazing. In the longer term degraded areas should improve and approach favourable heathland condition. Further monitoring of degraded heath should help determine if stocking levels are low enough for heather cover to significantly increase.

### ***Rough moorland grazing***

Rough moorland grazing includes a range of different habitat types. Therefore management of sites may contribute to delivery of targets for several BAP priority habitats including 'upland heathland', 'blanket bog', and 'purple moor grass and rush pastures'.

Those CMS sites classified as heath or blanket bog were generally in poor condition, with past grazing damage apparent. These have potential to be restored to heathland, although when classified as rough moorland grazing there is no requirement to restore heather cover to >25%. However, CMS prescriptions aim to prevent overgrazing so dwarf-shrub cover may be expected to increase over time.

## **6.4. Lowland raised bog**

Several factors affecting the condition of lowland raised bog sites were apparent. These included peat cutting, drainage, burning, scrub encroachment and dumping. All the sites had had at least some hand cutting for peat at some time in the past. Therefore they were damaged to some extent and often drying out. Five sites had some active peat extraction as one area could be set aside for peat extraction per agreement. However in future tranches this will be prohibited.

Birch scrub/woodland often develops around cuttings and around edges of bogs. Invasion onto open areas appears to be widespread due to drying out of the bog surface caused by past peat cutting. Resurveys should assess whether scrub is spreading. Control of scrub must be undertaken under CMS to prevent further encroachment.

'Lowland raised bog' is a BAP priority habitat and a large proportion of the UK resource is in Northern Ireland (NIBG, 2003). Degraded bogs are those that have been affected to the extent that vegetation composition has been changed. The restoration of degraded areas is an action plan target. The majority of lowland raised bog in Northern Ireland has been damaged to some extent with little completely intact bog remaining. Therefore the unfavourable condition of many of the monitored CMS sites is not unusual. Management prescriptions aim to maintain and improve the condition of bogs.

#### **6.5. Farm woodland**

Monitoring aims to determine the effect of the CMS management prescription for fencing of woods. The main objective of fencing farm woodland is to allow natural regeneration of native trees and shrubs by exclusion of livestock. It also prevents overgrazing and poaching that can lead to loss of diversity of ground flora.

The baseline survey has shown that certain tree species (including non-natives) appear to be regenerating well in certain fenced and unfenced woods. Sapling establishment of ash appeared to be more successful in woods where no recent grazing was recorded. Long-term monitoring will be necessary to determine if regeneration and establishment of woody species is occurring in woods where grazing has been excluded. Regeneration of some species also depends on other factors such as canopy gaps and presence of bare ground (Piggott, 1983). In previous monitoring of ESA woods an increase of bramble in the understorey of ungrazed woods was reported (Cameron *et al*, 2001). This can result in loss of ground flora species and may be a potential problem for tree regeneration. Therefore the introduction of a

management option for controlled grazing rather than complete exclusion may be suitable for certain woods.

Classification of woods into different types will be important when determining the effect of management prescriptions on species-diversity and regeneration. The sample sites are variable in terms of plant diversity and composition. Some are species-rich semi-natural woods whereas others are small plantations with poor ground flora. Many sites for example wet woodland with birch or willow had no previous history of grazing and tended to have species-poor ground flora. Future monitoring will determine if indicator species have increased due to absence or control of grazing and if so which types of woodland have improved.

Invasive non-native shrub species, including cherry laurel, rhododendron, snowberry and Japanese knotweed, were present on very few sites, generally old farm gardens and estates. Thus there does not appear to be a widespread problem within the sample of monitored woods. Sites should be evaluated on an individual basis to determine if these species are spreading and out-competing native ground flora. Sycamore and beech are non-native trees that were regenerating within many woods. CMS guidelines advocate the removal of sycamore and beech if they are less than 20% of the canopy or control if they are spreading. However they can be seen as acceptable naturalised species if they are not having a negative effect on the flora.

To qualify as a BAP site a wood must be greater than 0.5ha, have 50% or more native trees or shrubs and/or a typical woodland ground flora (NIBG, 2003). Farm woodlands under CMS management must be less than 1ha in size and so are often small fragments or trees planted next to farmhouses. In some cases they do form part of a larger area of woodland for example a corridor along a river or around a lake edge. Most are important for wildlife and will contribute to delivery of appropriate BAP targets. Many of the woods can be classified as corresponding to the priority habitats of 'mixed ashwoods' and 'wet woodlands'.

## **6.6. Farm scrub**

Appropriate management of scrub is essential for maintaining wildlife diversity. The aim of cutting or coppicing small areas of scrub in rotation is to maintain a mosaic of scrub and grassland. Open areas within scrub give a high edge to area ratio. The increase in edge enhances the species and structural diversity and therefore the wildlife value of scrub (Hopkins, 1996). Cutting also regenerates shrub species where they have become dense and old. This leads to diversity of structure and age of shrub species. At the time of survey very few sites had been subject to any cutting. Grazing restricts the encroachment of scrub into grassland and so is necessary for effective management. Under CMS management prescriptions scrub must be grazed. The effects of any management of cutting and/or grazing should be apparent when sites are resurveyed.

Structurally diverse habitats such as scrub offer a range of habitats to species with differing food and shelter needs and therefore offer various feeding opportunities to ground beetles and spiders. In most instances these habitat types are small or are shaped in such a way that they have a high edge to area ratio. This is desirable as it increases structural diversity and therefore the opportunities for different invertebrate species with varying niche requirements.

Scrub is of benefit for birds and invertebrates but may have an adverse effect on flora. Therefore cutting may be necessary to control the spread of scrub onto priority habitats. For example the spread of species-poor scrub, i.e. gorse and brambles, can be a threat to species-rich dry grassland. On CMS sites where cutting had occurred bare disturbed patches resulted. This may lead to growth of weed species in the short term due to soil nutrient enrichment under previously dense scrub. The clearance of closed scrub does not normally result in species-rich grassland, so management should be carried out before the canopy becomes dense.

On sites where a woodland ground flora exists and some mature trees are present it may be more desirable to allow these sites to develop through

succession into woodland. Some cutting may still be beneficial to open up canopy gaps which will allow trees to regenerate.

Farm scrub is not a BAP priority habitat, although there may be some CMS sites where hazel is abundant that could be defined as 'mixed ashwoods'. Scrub provides an important habitat for certain birds, mammals and invertebrates, including some UK or Northern Ireland priority species such as yellowhammer and linnet.

### **6.7. Arable fields managed for wildlife**

It is expected that uptake of CMS arable options will make a significant contribution to BAP. There is a clear link to the objectives of the HAP for 'cereal field margins' and potential benefits for several BAP priority species, e.g. yellowhammer and Irish hare. Only certain areas of Northern Ireland are suitable for arable farming, mainly east Down and in the Foyle Basin, so RWS and RGF options will be important here. The CGW option could be applied on a wider scale.

On wild bird cover where brassicas had been sown they were dominant in the second year and provided seed. If practical, certain patches could be sown with another mixture in the spring of the second year, e.g. barley/quinoa, as demonstrated on one farm surveyed. This would increase the variety of plants available for insects and birds. Many of the species sown in mixtures are annuals and so will not persist the following year unless they have regenerated from seed. It may be that if wild bird cover is not resown after each year that perennial grasses will dominate. Annual cultivation should therefore be recommended, depending on mixture used.

Rough grass field margins (and also conservation crop margins) closely correspond to the BAP priority habitat 'cereal field margins'. The objectives of providing forage and nesting for wild birds and the provision of habitat for overwintering insects are the same. The UK HAP defines one type of margin as 6m wide uncropped 'wildlife strips' (UK Biodiversity Group, 1998). As well as minimum width being greater the main difference being that these wildlife strips are cultivated once a year. Regular cultivation of arable field margins is

necessary if they are to support a wide diversity of annual arable plants. The Arable Stewardship (AS) Scheme in England has an option for annual cultivation that may be useful to introduce to CMS if there are areas where rare arable species are known to occur.

The high cover of perennial 'weeds' on rough grass field margins may be explained by the fact that no herbicide or fertiliser can be used. Domination of margins by perennials would be expected after two or more years of regeneration. The development of grass tussocks within field margins is desirable as they provide shelter for over-wintering insects. It may be that this structure will not develop in the 3-5 years that margins are required to stay in place. Studies of AS in England suggested that tall rank vegetation developed rather than a tussocky structure due to high residual soil fertility (ADAS, 2001).

No bird monitoring on CMS habitats has yet taken place but studies in pilot areas of AS in England showed that in winter there were higher numbers of certain groups, e.g. granivorous passerines, on farms within the scheme than on those outside (ADAS, 2001). In the CMS winter stubbles and wild bird cover crops are predicted to provide plentiful grain and dicotyledonous weed seed food resources for birds. Results of winter surveys of RWS option (not yet analysed) will determine the success of this habitat in providing food in terms of spilt grain and weed seeds. Some species, such as yellowhammer, also take grass seeds so may benefit from the presence of rough grass field margins. Many of the naturally regenerated weed species recorded from the habitats are of known benefit for seed eating birds, e.g. redshank, fat-hen and chickweed (Wilson, 1999). In summer, weed seeds and insects are important for foraging birds. The wider range of food types and sources provided by CMS arable options should allow more individuals to survive and also encourage a wider range of bird species.

The retained winter stubble option is aimed primarily at the provision of food for birds such as the barn owl, yellowhammer, lapwing, linnet and skylark. It was sampled as a cereal crop during the summer and was found to have an abundance of carabid beetles, in excess of any other CMS habitat. Carabid

beetles and spiders have been shown to be an important dietary component of many farmland bird species (Wilson *et al.*, 1999). In general it is the larger carabid species from the genera *Agonum*, *Amara*, *Carabus*, *Harpalus* and *Pterostichus* that are most frequently recorded as being eaten by birds (Laroche, 1980). Small diurnal carabid beetles (e.g. *Trechus quadristriatus*, *Bembidion* spp.) are an important component in the diet of pheasant chicks (Hill, 1985). These species were all found in abundance in the cereal fields over the summer. Results from re-sampling during the winter will determine food availability at this time. Wild bird cover similarly is aimed at conservation of farmland birds. This option also provided diversity and abundance of carabid beetle and spider species shown to be important in the diet of farmland birds.

Carabid beetle species recorded on arable habitats in the baseline survey that have a localised distribution included *Trechus discus* and *Harpalus affinis*. *Trechus discus* is largely coastal in Ireland and is very localised and rare, previously recorded from only two sites in Northern Ireland. *Harpalus affinis* is restricted in its distribution due to the scarcity of free-draining soils, particularly in the west and its range appears to be almost entirely coastal.

The spider species *Milleriana inerrans*, not recorded, before in Ireland, was also trapped on a significant number of arable sites. The abundance of this species on these particular habitats is likely to be due to the fact that it is a frequent aeronaut, which often colonises newly created habitats such as arable land.

#### **6.8. Buffers for ASSI's / NNR's, woodlands, streams and rivers**

Buffer strips were not generally of high interest in terms of botanical diversity. Future monitoring of sites will aim to determine whether semi-natural vegetation is establishing. In the absence of grazing an increase in coarse grasses and rushes is expected. Regular management, i.e. annual mowing, may be necessary to control taller competitive species if floristic interest is to be increased. However, tall, dense vegetation will provide cover and nesting sites for a variety of birds and shelter for mammals, particularly the Irish hare. Some sites adjacent to watercourses had a narrow strip of tall herbs such as

meadowsweet along the waters edge. Any increase in the riparian vegetation and wetland species will also depend on the soil conditions of the site. In the longer term there may be an increase in plant species diversity in buffers if herbicide use is also prevented or minimised.

Plant species diversity is negatively correlated with soil fertility. Studies on sown buffer strips in England suggest that it may be decades rather than years before vegetation becomes diverse, due to high residual soil fertility (Leeds-Harrison *et al*, 1996). As no fertiliser is permitted and cut vegetation must be removed after mowing, a gradual decrease in soil nutrients in CMS buffers adjacent to watercourses may be expected. However in addition to this buffers are likely to be affected by run-off from adjacent fields so may show little change. By acting as nutrient sinks they will be achieving an important objective in reducing nutrient inputs into rivers, streams and other watercourses.

On the three buffers adjacent to woodlands, scrub and tree species appeared to be naturally regenerating and spreading. One of the sites had been ungrazed for several years and was colonised by willow, alder, bramble and gorse. On another site on which grazing had recently been prevented, bramble and blackthorn already appeared to be spreading onto grassland from the edges. Therefore increasing the area of semi-natural woodland using buffer strips may be successful but should be a long-term objective due to the nature of woodland development.

### **6.9. Field boundary restoration**

The main objective of hedge restoration is to encourage regeneration of mature gappy hedges to enhance wildlife and landscape value and improve agricultural uses. Once hedgerows have been successfully restored they must then be managed according to the Hedgerow Code of Practise to maintain and enhance hedge biodiversity. As well as the diversity of shrubs and richness of associated ground flora, hedges must have desirable shape and structure to be in favourable condition (NIBG, 2003). Species-rich hedgerows are a BAP priority habitat. Only 20% of the randomly sampled hedges met all the criteria to be defined as species-rich. In terms of woody species most of

the hedges were poor being dominated by hawthorn. Gaps should be interplanted with a variety of tree and shrub species to increase diversity. The main interplanted species at present is hawthorn.

Coppicing and laying temporarily change the structure of a hedge considerably but are essential in restoring the dense structure of an old or neglected hedge and making it stock-proof. Further surveys of CMS hedges will determine if cut hedges are regenerating successfully and if biodiversity is increasing. Wildlife value should increase in the long term due to improved structure for invertebrates, birds and mammals.

Studies on hedge management found that coppicing and laying increased species diversity of hedge base plants in the short term, probably in response to disturbance and increased light levels (Marshall *et al*, 2001). However a species-rich ground flora will not necessarily develop through hedge regeneration but depends on several factors such as adjacent land-use and soil fertility. The presence of species such as nettles and tall grasses in many of the sample sites indicates that spraying or enrichment of hedge bases has previously occurred. The requirement for a 1m unsprayed and uncultivated strip along hedges should gradually decrease fertility and increase plant diversity. Herbicide treatments applied to hedge-bottom vegetation have also been shown to reduce diversity and abundance of surface-dwelling invertebrates, particularly carabid beetles (Asteraki *et al*, 1995).

The erection of protective fencing on newly restored hedges prevents livestock grazing and browsing. However it also allows competitive grasses to dominate, which will reduce diversity of ground flora. Once a hedge has established fencing should be removed to allow some grazing of the hedge base so reducing the dominance of competitive grasses.

High botanical diversity in hedges equates to high invertebrate diversity compared to other agricultural habitats. Restorative hedge management that increases plant diversity, such as gapping up with new shrub species, will thus have positive effects for invertebrate diversity. Hedge laying appears to be particularly beneficial for invertebrate communities (McAdam *et al*, 1994). In

contrast coppicing, with a drastic reduction in the vegetation structure, appears to be detrimental to hedgerow invertebrates, at least in the short term (Maudsley, 2000).

Field boundary restoration sites in particular had several uncommon spider species, all of which show preference to living in bushes and trees. *Milleriana inerrans*, a species that has not been recorded in Ireland before, was also trapped at a field boundary site in Co. Down. It is described as uncommon in Britain and has been recorded from moss, grass, open and wooded areas inland as well as sand dunes, burnt heathland and arable land.

## 7. CONCLUSIONS

Since DARD introduced the CMS in 2000, the scheme has attracted over 2000 farmers and landowners, bringing around 86,000 ha of land under CMS agreement. The Rural Development Plan target of 4000 farms by 2006, equivalent to 150,000 ha of land under agreement, therefore appears to be achievable.

The species diversity and composition of vegetation and invertebrate communities have been described and documented to provide an assessment of the biodiversity value of each habitat or option under agreement. A baseline record has been established for habitats at the time that management under CMS commenced. This will provide a benchmark by which to monitor change through resurveys.

There is a wide range of habitats under CMS agreement, the condition and quality of which varies considerably. Condition assessment was carried out for grassland and peatland habitats and provides a further benchmark. Condition assessment compares each site to pristine examples of that habitat type to determine the current condition. As this is a countrywide scheme many of the sites surveyed would never be expected to attain targets for designated sites. However, this still provides a valuable method of assessment and will be used at re-survey to determine if sites have moved closer to this goal. In particular condition assessment should help determine if targets for Northern Ireland BAP priority habitats are being met. The monitoring programme will evaluate the contribution of the Countryside Management Scheme in meeting objectives and delivering targets for many BAP priority habitats and species.

In general the greatest influence on semi-natural habitat condition was level of grazing. On heather moorland habitats over-grazing in the past caused loss of heather cover and the combination of heavy grazing and trampling has led to areas of bare ground in the severest of cases. On semi-natural grasslands under-grazing has led in some cases to dominance of the habitat by tall rank grasses of little conservation value. These were often under-grazed due to inherent management difficulties such as topography and wetness.

Paradoxically it is these factors that have influenced the development and retention of the habitat. Management according to CMS prescriptions should, however, lead to improvement in the condition of these habitat types.

The arable options are aimed mainly at the provision of food for birds over winter. Arable options harboured a surprisingly high diversity of plant and invertebrate species when sampled during the summer. Results of sampling over the winter should determine the value of these options over this critical period.

The main problems affecting woodlands in Northern Ireland are livestock grazing and invasion by non-native species. The monitoring programme aims to determine the effect of CMS management prescriptions regarding these factors as well as changes in species diversity.

Hedge restoration will lead to better hedgerow structure and should lead to increases in botanical and invertebrate diversity if management continues in the long term. Sensitive hedgerow management will also aid biodiversity targets for bird species such as yellowhammer and tree sparrow. Appropriate management of all hedges on CMS farms as well as those identified for hedge restoration will contribute to delivery of BAP objectives.

Landscape surveys may be used in future to provide information on the wider countryside compared to land under CMS agreement. The Northern Ireland Countryside Survey (NICS) gives a general overview of habitat changes in the wider countryside and could be used to provide appropriate data (Cooper & McCann, 2000).

An interpretation of the effectiveness of the scheme at this stage is limited as only baseline data is available. Monitoring will be carried out again in 2006/7 to provide a mid-term assessment of the scheme. This future monitoring of diversity and condition of habitats will provide a feedback mechanism for the refinement of management prescriptions. Long-term biological monitoring should determine whether the Countryside Management Scheme is meeting the objective of maintaining and enhancing biodiversity.

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## APPENDICES

### **Appendix 1.**

Positive and negative plant indicator species for use in grassland vegetation condition assessment.

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### **Appendix 2.**

List of NVC community types.

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Percentage frequency of plant species recorded in 2002/2003 on sampled habitats from farms participating in the Countryside Management Scheme.

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Percentage frequency of carabid beetle species captured in 2002/2003 on sampled habitats from farms participating in the Countryside Management Scheme.

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Percentage frequency of spider species captured in 2002/2003 on sampled habitats from farms participating in the Countryside Management Scheme.

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### **Appendix 6.**

New county records of spiders

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**Appendix 1.** Positive and negative plant indicator species for use in grassland vegetation condition assessment.

*Indicator species for species-rich dry grassland.*

<b>Positive indicator species</b>	<b>Negative indicator species</b>
<i>Alchemilla</i> spp.	<i>Cirsium arvense</i>
<i>Anemone nemorosa</i>	<i>Cirsium vulgare</i>
<i>Carex</i> spp.	<i>Galium aparine</i>
<i>Centaurea nigra</i>	<i>Plantago major</i>
<i>Conopodium majus</i>	<i>Senecio jacobea</i>
<i>Euphrasia</i> spp.	<i>Rumex crispus</i>
<i>Galium verum</i>	<i>Rumex obtusifolius</i>
<i>Hypochaeris radicata</i>	<i>Urtica dioica</i>
<i>Lathyrus pratensis</i>	
<i>Leontodon autumnalis</i>	
<i>Leucanthemum vulgare</i>	
<i>Lotus corniculatus</i>	
Orchidaceae spp.	
<i>Polygala</i> spp.	
<i>Potentilla erecta</i>	
<i>Prunella vulgaris</i>	
<i>Rhinanthus minor</i>	

*Indicator species for species-rich wet grassland.*

<b>Positive indicator species</b>	<b>Negative indicator species</b>
<i>Ajuga reptans</i>	<i>Cirsium arvense</i>
<i>Caltha palustris</i>	<i>Cirsium vulgare</i>
<i>Cardamine pratensis</i>	<i>Rumex crispus</i>
<i>Carex</i> spp.	<i>Rumex obtusifolius</i>
<i>Cirsium dissectum</i>	<i>Senecio aquaticus</i> (if abundant)
<i>Filipendula ulmaria</i>	<i>Senecio jacobea</i>
<i>Galium palustre</i>	<i>Urtica dioica</i>
<i>Hydrocotyle vulgaris</i>	
<i>Lotus uliginosus</i>	
<i>Lychnis flos-cuculi</i>	
<i>Mentha aquatica</i>	
Orchidaceae spp.	
<i>Potentilla palustris</i>	
<i>Ranunculus flammula</i>	
<i>Succisa pratensis</i>	
<i>Viola palustris</i>	

*Indicator species for species-rich acid grassland.*

<b>Positive indicator species</b>	<b>Negative indicator species</b>
<i>Carex</i> spp.	<i>Cirsium arvense</i>
<i>Euphrasia</i> spp.	<i>Cirsium vulgare</i>
<i>Galium saxatile</i>	<i>Plantago major</i>
<i>Lathyrus linifolius</i>	<i>Senecio jacobea</i>
<i>Pedicularis sylvatica</i>	<i>Urtica dioica</i>
<i>Polygala serpyllifolia</i>	
<i>Potentilla erecta</i>	
<i>Thymus praecox</i>	
<i>Viola riviniana</i>	

## Appendix 2. List of NVC community types.

### Grasslands:

- MG1 *Arrhenatherum elatius* grassland
- MG4 *Alopecurus pratensis* - *Sanguisorba officinalis* grassland
- MG5 *Cynosurus cristatus* - *Centaurea nigra* grassland
- MG8 *Cynosurus cristatus* - *Caltha palustris* grassland.
- MG10 *Holcus lanatus* - *Juncus effusus* rush-pasture
- U4 *Festuca ovina* - *Agrostis capillaris* - *Galium saxatile* grassland
- U5 *Nardus stricta* - *Galium saxatile* grassland
- CG10 *Festuca ovina* - *Agrostis capillaris* - *Thymus praecox* grassland

### Mires and heaths:

- M6 *Carex echinata* - *Sphagnum recurvum* / *auriculatum* mire
- M9 *Carex rostrata* - *Calliergon cuspidatum* / *giganteum* mire
- M15 *Scirpus cespitosus* - *Erica tetralix* wet heath
- M17 *Scirpus cespitosus* - *Eriophorum vaginatum* blanket mire
- M18 *Erica tetralix* - *Sphagnum papillosum* raised and blanket mire
- M19 *Calluna vulgaris* - *Eriophorum vaginatum* blanket mire
- M23 *Juncus effusus* / *acutiflorus* - *Galium palustre* rush pasture
- M24 *Molinia caerulea* - *Cirsium dissectum* fen-meadow
- M25 *Molinia caerulea* - *Potentilla erecta* mire
- M27 *Filipendula ulmaria* - *Angelica sylvestris* mire
- H10 *Calluna vulgaris* - *Erica cinerea* heath
- H21 *Calluna vulgaris* - *Vaccinium myrtillus* - *Sphagnum capillifolium* heath
- S10 *Equisetum fluviatile* swamp

### Woodlands and scrub:

- W2 *Salix cinerea* - *Betula pubescens* - *Phragmites australis* woodland
- W4 *Betula pubescens* - *Molinia caerulea* woodland
- W5 *Alnus glutinosa* - *Carex paniculata* woodland
- W6 *Alnus glutinosa* - *Urtica dioica* woodland
- W7 *Alnus glutinosa* - *Fraxinus excelsior* - *Lysimachia nemorum* woodland
- W9 *Fraxinus excelsior* - *Sorbus aucuparia* - *Mercurialis perennis* woodland
- W21 *Crataegus monogyna* - *Hedera helix* scrub
- W22 *Prunus spinosa* - *Rubus fruticosus* scrub
- W23 *Ulex europaeus* - *Rubus fruticosus* scrub

**Appendix 3.** Percentage frequency of plant species recorded in 2002/2003 on sampled habitats from farms participating in the Countryside Management Scheme.

Species-rich dry grassland n=18 Plant species	Frequency %	Species-rich dry grassland n=18 Plant species	Frequency %
<i>Achillea millefolium</i>	50	<i>Euphrasia officinalis</i> agg.	6
<i>Achillea ptarmica</i>	6	<i>Festuca ovina</i>	28
<i>Agrostis canina</i>	11	<i>Festuca rubra</i>	89
<i>Agrostis capillaris</i>	100	<i>Filipendula ulmaria</i>	17
<i>Agrostis stolonifera</i>	67	<i>Fraxinus excelsior</i>	17
<i>Ajuga reptans</i>	6	<i>Galeopsis tetrahit</i>	6
<i>Alchemilla vulgaris</i> agg.	11	<i>Galium palustre</i>	17
<i>Alnus glutinosa</i>	6	<i>Galium saxatile</i>	22
<i>Alopecurus geniculatus</i>	17	<i>Glyceria fluitans</i>	6
<i>Alopecurus pratensis</i>	17	<i>Heracleum sphondylium</i>	17
<i>Angelica sylvestris</i>	6	<i>Holcus lanatus</i>	100
<i>Anthoxanthum odoratum</i>	100	<i>Holcus mollis</i>	17
<i>Arrhenatherum elatius</i>	17	<i>Hyacinthoides non-scripta</i>	6
<i>Avenula pubescens</i>	11	<i>Hypericum pulchrum</i>	6
<i>Bellis perennis</i>	17	<i>Hypochaeris radicata</i>	50
<i>Cardamine flexuosa</i>	6	<i>Isolepis setacea</i>	11
<i>Cardamine pratensis</i>	22	<i>Juncus acutiflorus</i>	33
<i>Carex binervis</i>	11	<i>Juncus bufonius</i>	11
<i>Carex demissa</i>	17	<i>Juncus bulbosus</i>	6
<i>Carex flacca</i>	28	<i>Juncus conglomeratus</i>	22
<i>Carex hirta</i>	11	<i>Juncus effusus</i>	56
<i>Carex hostiana</i>	11	<i>Lathyrus montanus</i>	17
<i>Carex nigra</i>	22	<i>Lathyrus pratensis</i>	61
<i>Carex ovalis</i>	22	<i>Leontodon autumnalis</i>	44
<i>Carex panicea</i>	22	<i>Lolium perenne</i>	33
<i>Carex pilulifera</i>	17	<i>Lotus corniculatus</i>	44
<i>Carex pulicaris</i>	11	<i>Lotus uliginosus</i>	22
<i>Centaurea nigra</i>	44	<i>Luzula campestris</i>	67
<i>Cerastium fontanum</i>	72	<i>Molinia caerulea</i>	11
<i>Cirsium arvense</i>	28	<i>Myosotis arvensis</i>	6
<i>Cirsium dissectum</i>	11	<i>Myosotis discolor</i>	6
<i>Cirsium palustre</i>	33	<i>Nardus stricta</i>	6
<i>Cirsium vulgare</i>	11	<i>Odontites verna</i>	6
<i>Conopodium majus</i>	11	<i>Pedicularis sylvatica</i>	6
<i>Crepis capillaris</i>	17	<i>Phleum pratense</i>	11
<i>Cynosurus cristatus</i>	61	<i>Pimpinella saxifraga</i>	6
<i>Dactylis glomerata</i>	44	<i>Plantago lanceolata</i>	78
<i>Dactylorhiza fuchsii</i>	6	<i>Plantago major</i>	6
<i>Dactylorhiza maculata</i>	6	<i>Platanthera bifolia</i>	6
<i>Danthonia decumbens</i>	22	<i>Poa pratensis</i>	83
<i>Deschampsia cespitosa</i>	17	<i>Poa trivialis</i>	83
<i>Epilobium obscurum</i>	11	<i>Polygonum persicaria</i>	6
<i>Epilobium palustre</i>	11	<i>Potentilla anserina</i>	22
<i>Equisetum palustre</i>	11	<i>Potentilla erecta</i>	67
<i>Equisetum sylvatica</i>	6	<i>Potentilla reptans</i>	17
<i>Eriophorum angustifolium</i>	6	<i>Prunella vulgaris</i>	50

Species-rich dry grassland n=18 Plant species	Frequency %
<i>Prunus spinosa</i>	11
<i>Pteridium aquilinum</i>	17
<i>Ranunculus acris</i>	78
<i>Ranunculus bulbosus</i>	11
<i>Ranunculus flammula</i>	17
<i>Ranunculus repens</i>	72
<i>Rhinanthus minor</i>	11
<i>Rubus fruticosus</i>	39
<i>Rumex acetosa</i>	94
<i>Rumex crispus</i>	11
<i>Senecio aquaticus</i>	17
<i>Senecio jacobea</i>	44
<i>Stachys sylvatica</i>	11
<i>Stellaria alsine</i>	6
<i>Stellaria graminea</i>	33
<i>Stellaria media</i>	6

Species-rich dry grassland n=18 Plant species	Frequency %
<i>Succisa pratensis</i>	11
<i>Taraxacum officinale</i> agg.	39
<i>Trifolium pratense</i>	56
<i>Trifolium repens</i>	83
<i>Ulex europaeus</i>	11
<i>Urtica dioica</i>	11
<i>Vaccinium myrtillus</i>	11
<i>Veronica chamaedrys</i>	44
<i>Veronica serpyllifolia</i>	6
<i>Vicia cracca</i>	22
<i>Vicia sepium</i>	6
<i>Viola riviniana</i>	22

Species-rich wet grassland n=32 Plant species	Frequency %
<i>Agrostis canina</i>	88
<i>Agrostis capillaris</i>	66
<i>Agrostis stolonifera</i>	94
<i>Ajuga reptans</i>	9
<i>Alopecurus geniculatus</i>	6
<i>Alopecurus pratensis</i>	16
<i>Angelica sylvestris</i>	13
<i>Anthoxanthum odoratum</i>	97
<i>Arrhenatherum elatius</i>	13
<i>Bellis perennis</i>	22
<i>Betula pubescens</i>	13
<i>Blechnum spicant</i>	3
<i>Briza media</i>	6
<i>Bromus mollis</i>	6
<i>Callitriche stagnalis</i>	6
<i>Calluna vulgaris</i>	16
<i>Caltha palustris</i>	6
<i>Cardamine flexuosa</i>	13
<i>Cardamine pratensis</i>	75
<i>Carex binervis</i>	6
<i>Carex demissa</i>	44
<i>Carex disticha</i>	6
<i>Carex echinata</i>	56
<i>Carex flacca</i>	19
<i>Carex hirta</i>	9
<i>Carex hostiana</i>	19

Species-rich wet grassland n=32 Plant species	Frequency %
<i>Carex laevigata</i>	3
<i>Carex nigra</i>	88
<i>Carex ovalis</i>	50
<i>Carex pallescens</i>	3
<i>Carex panicea</i>	56
<i>Carex paniculata</i>	3
<i>Carex pilulifera</i>	9
<i>Carex pulicaris</i>	25
<i>Carex riparia</i>	3
<i>Carex rostrata</i>	16
<i>Carex vesicaria</i>	6
<i>Centaurea nigra</i>	6
<i>Cerastium fontanum</i>	56
<i>Chrysosplenium oppositifolium</i>	3
<i>Cirsium dissectum</i>	19
<i>Cirsium palustre</i>	72
<i>Crataegus monogyna</i>	3
<i>Crepis capillaris</i>	6
<i>Crepis paludosa</i>	3
<i>Cynosurus cristatus</i>	56
<i>Dactylis glomerata</i>	3
<i>Dactylorhiza fuchsii</i>	16
<i>Dactylorhiza maculata</i>	25
<i>Danthonia decumbens</i>	9
<i>Deschampsia cespitosa</i>	22

Species-rich wet grassland n=32 Plant species	Frequency %
<i>Deschampsia flexuosa</i>	3
<i>Drosera rotundifolia</i>	3
<i>Eleocharis palustris</i>	6
<i>Epilobium obscurum</i>	22
<i>Epilobium palustre</i>	41
<i>Epilobium parviflorum</i>	6
<i>Equisetum fluviatile</i>	22
<i>Equisetum palustre</i>	47
<i>Erica tetralix</i>	9
<i>Eriophorum angustifolium</i>	34
<i>Eriophorum vaginatum</i>	3
<i>Festuca arundinacea</i>	3
<i>Festuca ovina</i>	9
<i>Festuca pratensis</i>	13
<i>Festuca rubra</i>	84
<i>Filipendula ulmaria</i>	59
<i>Fraxinus excelsior</i>	22
<i>Galium palustre</i>	56
<i>Galium saxatile</i>	19
<i>Glyceria fluitans</i>	19
<i>Holcus lanatus</i>	97
<i>Holcus mollis</i>	31
<i>Hydrocotyle vulgaris</i>	6
<i>Hypericum tetrapterum</i>	6
<i>Hypochaeris radicata</i>	19
<i>Iris pseudocorus</i>	16
<i>Isolepis setacea</i>	16
<i>Juncus acutiflorus</i>	97
<i>Juncus bufonius</i>	3
<i>Juncus bulbosus</i>	28
<i>Juncus conglomeratus</i>	34
<i>Juncus effusus</i>	88
<i>Juncus inflexus</i>	16
<i>Juncus squarrosus</i>	3
<i>Lathyrus pratensis</i>	34
<i>Leontodon autumnalis</i>	9
<i>Lolium perenne</i>	6
<i>Lotus corniculatus</i>	3
<i>Lotus uliginosus</i>	13
<i>Luzula campestris</i>	72
<i>Lychnis flos-cuculi</i>	25
<i>Lysimachia nemorum</i>	3
<i>Mentha aquatica</i>	19
<i>Molinia caerulea</i>	28
<i>Myosotis discolor</i>	6
<i>Myosotis laxa</i>	3
<i>Myosotis secunda</i>	6
<i>Nardus stricta</i>	22

Species-rich wet grassland n=32 Plant species	Frequency %
<i>Narthecium ossifragum</i>	3
<i>Pedicularis sylvatica</i>	13
<i>Phalaris arundinacea</i>	3
<i>Phleum pratense</i>	6
<i>Phleum pratensis</i>	3
<i>Plantago lanceolata</i>	31
<i>Poa pratensis</i>	59
<i>Poa trivialis</i>	59
<i>Polygala serpyllifolia</i>	9
<i>Potentilla anserina</i>	25
<i>Potentilla erecta</i>	81
<i>Potentilla palustris</i>	9
<i>Prunella vulgaris</i>	31
<i>Quercus sp.</i>	3
<i>Ranunculus acris</i>	78
<i>Ranunculus flammula</i>	63
<i>Ranunculus repens</i>	53
<i>Rubus fruticosus</i>	16
<i>Rumex acetosa</i>	78
<i>Rumex obtusifolius</i>	3
<i>Sagina procumbens</i>	6
<i>Salix aurita</i>	3
<i>Salix cinerea</i>	25
<i>Senecio aquaticus</i>	47
<i>Senecio jacobea</i>	3
<i>Stachys palustris</i>	3
<i>Stachys sylvatica</i>	3
<i>Stellaria alsine</i>	16
<i>Stellaria graminea</i>	19
<i>Succisa pratensis</i>	38
<i>Taraxacum officinale</i> agg.	25
<i>Trifolium dubium</i>	3
<i>Trifolium pratense</i>	22
<i>Trifolium repens</i>	75
<i>Triglochin palustris</i>	9
<i>Ulex europaeus</i>	9
<i>Vaccinium myrtillus</i>	6
<i>Veronica beccabunga</i>	3
<i>Veronica scutellata</i>	3
<i>Vicia cracca</i>	3
<i>Vicia sepium</i>	6
<i>Viola palustris</i>	34
<i>Viola riviniana</i>	3

Species-rich hay meadow n=9 Plant species	Frequency %
<i>Achillea ptarmica</i>	11
<i>Agrostis canina</i>	56
<i>Agrostis capillaris</i>	78
<i>Agrostis stolonifera</i>	100
<i>Ajuga reptans</i>	11
<i>Alopecurus geniculatus</i>	33
<i>Alopecurus pratensis</i>	56
<i>Angelica sylvestris</i>	11
<i>Anthoxanthum odoratum</i>	89
<i>Anthoxanthum odoratum</i>	11
<i>Bellis perennis</i>	44
<i>Briza media</i>	11
<i>Bromus mollis</i>	44
<i>Caltha palustre</i>	11
<i>Cardamine flexuosa</i>	11
<i>Cardamine pratensis</i>	89
<i>Carex curta</i>	11
<i>Carex demissa</i>	11
<i>Carex disticha</i>	11
<i>Carex echinata</i>	22
<i>Carex flacca</i>	11
<i>Carex hirta</i>	33
<i>Carex hostiana</i>	11
<i>Carex nigra</i>	89
<i>Carex ovalis</i>	44
<i>Carex panicea</i>	44
<i>Carex rostrata</i>	11
<i>Centaurea nigra</i>	33
<i>Cerastium fontanum</i>	67
<i>Cirsium palustre</i>	33
<i>Cynosurus cristatus</i>	78
<i>Dactylorhiza maculata</i>	11
<i>Epilobium obscurum</i>	33
<i>Epilobium palustre</i>	22
<i>Equisetum fluviatile</i>	33
<i>Equisetum palustre</i>	11
<i>Euphrasia officinalis</i> agg.	22
<i>Festuca arundinacea</i>	11
<i>Festuca pratensis</i>	56
<i>Festuca rubra</i>	100
<i>Filipendula ulmaria</i>	67
<i>Fraxinus excelsior</i>	11
<i>Galium palustre</i>	33
<i>Glyceria fluitans</i>	44
<i>Holcus lanatus</i>	89
<i>Hypericum tetrapterum</i>	11
<i>Hypochaeris radicata</i>	22

Species-rich hay meadow n=9 Plant species	Frequency %
<i>Isolepis setacea</i>	22
<i>Juncus acutiflorus</i>	100
<i>Juncus conglomeratus</i>	33
<i>Juncus effusus</i>	100
<i>Lathyrus pratensis</i>	56
<i>Leontodon autumnalis</i>	11
<i>Lolium perenne</i>	44
<i>Lotus uliginosus</i>	22
<i>Luzula campestris</i>	89
<i>Lychnis flos-cuculi</i>	44
<i>Mentha aquatica</i>	11
<i>Montia fontana</i>	22
<i>Myosotis discolor</i>	44
<i>Myosotis laxa</i>	56
<i>Myosotis secunda</i>	11
<i>Phleum pratense</i>	22
<i>Plantago lanceolata</i>	44
<i>Poa pratensis</i>	22
<i>Poa trivialis</i>	100
<i>Potentilla erecta</i>	22
<i>Potentilla palustris</i>	11
<i>Prunella vulgaris</i>	33
<i>Ranunculus acris</i>	100
<i>Ranunculus ficaria</i>	11
<i>Ranunculus flammula</i>	56
<i>Ranunculus repens</i>	100
<i>Rhinanthus minor</i>	11
<i>Rumex acetosa</i>	89
<i>Rumex crispus</i>	11
<i>Sagina procumbens</i>	33
<i>Senecio aquaticus</i>	56
<i>Stellaria alsine</i>	56
<i>Stellaria graminea</i>	11
<i>Succisa pratensis</i>	22
<i>Taraxacum officinale</i> agg.	67
<i>Trifolium dubium</i>	22
<i>Trifolium pratense</i>	67
<i>Trifolium repens</i>	89
<i>Veronica beccabunga</i>	11
<i>Veronica chamaedrys</i>	11
<i>Vicia cracca</i>	11
<i>Vicia sepium</i>	22
<i>Viola palustris</i>	11

Species-rich acid grassland n=7 Plant species	Frequency %
<i>Agrostis canina</i>	86
<i>Agrostis capillaris</i>	86
<i>Agrostis stolonifera</i>	29
<i>Alchemilla vulgaris</i> agg.	14
<i>Alopecurus geniculatus</i>	14
<i>Anthoxanthum odoratum</i>	114
<i>Bellis perennis</i>	43
<i>Blechnum spicant</i>	29
<i>Botrychium lunaria</i>	14
<i>Calluna vulgaris</i>	57
<i>Cardamine pratensis</i>	29
<i>Carex binervis</i>	57
<i>Carex demissa</i>	71
<i>Carex echinata</i>	100
<i>Carex flacca</i>	29
<i>Carex hostiana</i>	29
<i>Carex nigra</i>	86
<i>Carex panicea</i>	100
<i>Carex pilulifera</i>	43
<i>Carex pulicaris</i>	29
<i>Cerastium fontanum</i>	71
<i>Cirsium arvense</i>	14
<i>Cirsium dissectum</i>	14
<i>Cirsium palustre</i>	86
<i>Crepis paludosa</i>	14
<i>Cynosurus cristatus</i>	57
<i>Dactylorhiza maculata</i>	29
<i>Danthonia decumbens</i>	57
<i>Deschampsia cespitosa</i>	14
<i>Deschampsia flexuosa</i>	29
<i>Erica cinerea</i>	14
<i>Erica tetralix</i>	43
<i>Eriophorum angustifolium</i>	43
<i>Eriophorum vaginatum</i>	14
<i>Euphrasia officinalis</i> agg.	43
<i>Festuca ovina</i>	86
<i>Festuca rubra</i>	71
<i>Fraxinus excelsior</i>	14
<i>Galium saxatile</i>	71
<i>Galium verum</i>	14
<i>Holcus lanatus</i>	100
<i>Hypericum pulchrum</i>	14
<i>Hypochaeris radicata</i>	43
<i>Isolepis setacea</i>	14
<i>Juncus acutiflorus</i>	86
<i>Juncus bulbosus</i>	57
<i>Juncus conglomeratus</i>	29

Species-rich acid grassland n=7 Plant species	Frequency %
<i>Juncus effusus</i>	43
<i>Juncus squarrosus</i>	43
<i>Leontodon autumnalis</i>	29
<i>Linum catharticum</i>	29
<i>Lolium perenne</i>	14
<i>Lotus corniculatus</i>	14
<i>Luzula campestris</i>	71
<i>Lysimachia nemorum</i>	14
<i>Molinia caerulea</i>	100
<i>Montia fontana</i>	14
<i>Myrica gale</i>	29
<i>Nardus stricta</i>	100
<i>Narthecium ossifragum</i>	14
<i>Oxalis acetosella</i>	14
<i>Pedicularis sylvatica</i>	71
<i>Pilosella officinarum</i>	14
<i>Plantago lanceolata</i>	43
<i>Poa annua</i>	14
<i>Poa pratensis</i>	43
<i>Poa trivialis</i>	43
<i>Polygala serpyllifolia</i>	57
<i>Polygala vulgaris</i>	14
<i>Potentilla erecta</i>	100
<i>Potentilla sterilis</i>	14
<i>Prunella vulgaris</i>	43
<i>Ranunculus acris</i>	43
<i>Ranunculus flammula</i>	43
<i>Ranunculus repens</i>	14
<i>Rumex acetosa</i>	14
<i>Sagina procumbens</i>	14
<i>Scirpus cespitosus</i>	29
<i>Senecio aquaticus</i>	14
<i>Stellaria alsine</i>	14
<i>Succisa pratensis</i>	43
<i>Taraxacum officinale</i> agg.	43
<i>Thymus praecox</i>	14
<i>Trifolium repens</i>	71
<i>Urtica dioica</i>	14
<i>Vaccinium myrtillus</i>	57
<i>Veronica officinalis</i>	14
<i>Viola palustris</i>	29
<i>Viola riviniana</i>	29

Lowland wet grassland n=34 (LWG/EBW) Plant species	Frequency %
<i>Achillea ptarmica</i>	9
<i>Agrostis canina</i>	68
<i>Agrostis capillaris</i>	18
<i>Agrostis stolonifera</i>	88
<i>Ajuga reptans</i>	6
<i>Alnus glutinosa</i>	3
<i>Alopecurus geniculatus</i>	18
<i>Alopecurus pratensis</i>	6
<i>Angelica sylvestris</i>	9
<i>Anthoxanthum odoratum</i>	91
<i>Arrhenatherum elatius</i>	9
<i>Bellis perennis</i>	9
<i>Berula erecta</i>	3
<i>Blechnum spicant</i>	3
<i>Callitriche stagnalis</i>	3
<i>Calluna vulgaris</i>	9
<i>Caltha palustris</i>	9
<i>Cardamine flexuosa</i>	12
<i>Cardamine pratensis</i>	68
<i>Carex binervis</i>	3
<i>Carex demissa</i>	6
<i>Carex diandra</i>	3
<i>Carex dioica</i>	3
<i>Carex disticha</i>	9
<i>Carex echinata</i>	29
<i>Carex flacca</i>	15
<i>Carex hirta</i>	18
<i>Carex hostiana</i>	6
<i>Carex lepidocarpa</i>	3
<i>Carex nigra</i>	71
<i>Carex ovalis</i>	47
<i>Carex panicea</i>	35
<i>Carex pulicaris</i>	6
<i>Carex rostrata</i>	18
<i>Carum verticillatum</i>	6
<i>Centaurea nigra</i>	3
<i>Cerastium fontanum</i>	38
<i>Cirsium arvense</i>	3
<i>Cirsium dissectum</i>	6
<i>Cirsium palustre</i>	38
<i>Crepis capillaris</i>	3
<i>Cynosurus cristatus</i>	35
<i>Dactylis glomerata</i>	3
<i>Dactylorhiza maculata</i>	6
<i>Danthonia decumbens</i>	3
<i>Deschampsia cespitosa</i>	21
<i>Deschampsia flexuosa</i>	3

Lowland wet grassland n=34 (LWG/EBW) Plant species	Frequency %
<i>Eleocharis palustris</i>	6
<i>Elymus repens</i>	3
<i>Epilobium obscurum</i>	41
<i>Epilobium palustre</i>	41
<i>Epilobium parviflorum</i>	3
<i>Equisetum fluviatile</i>	44
<i>Equisetum palustre</i>	38
<i>Erica tetralix</i>	6
<i>Eriophorum angustifolium</i>	15
<i>Eriophorum vaginatum</i>	6
<i>Festuca pratensis</i>	9
<i>Festuca rubra</i>	56
<i>Filipendula ulmaria</i>	44
<i>Fraxinus excelsior</i>	6
<i>Galium aparine</i>	6
<i>Galium palustre</i>	59
<i>Galium saxatile</i>	12
<i>Geum rivale</i>	6
<i>Glechoma hederacea</i>	3
<i>Glyceria declinata</i>	9
<i>Glyceria fluitans</i>	32
<i>Hippuris vulgaris</i>	3
<i>Holcus lanatus</i>	100
<i>Holcus mollis</i>	44
<i>Hydrocotyle vulgaris</i>	9
<i>Hypericum tetrapterum</i>	3
<i>Hypochaeris radicata</i>	6
<i>Iris pseudacorus</i>	3
<i>Iris pseudocorus</i>	3
<i>Isolepis setacea</i>	9
<i>Juncus acutiflorus</i>	74
<i>Juncus articulatus</i>	6
<i>Juncus bufonius</i>	21
<i>Juncus bulbosus</i>	9
<i>Juncus conglomeratus</i>	9
<i>Juncus effusus</i>	88
<i>Juncus inflexus</i>	3
<i>Juncus squarrosus</i>	3
<i>Lathyrus pratensis</i>	26
<i>Leontodon autumnalis</i>	21
<i>Lolium perenne</i>	29
<i>Lonicera periclymenum</i>	3
<i>Lotus uliginosus</i>	29
<i>Luzula campestris</i>	21
<i>Luzula multiflora</i>	12
<i>Lychnis flos-cuculi</i>	6
<i>Lysimachia nummularia</i>	3
<i>Lythrum salicaria</i>	3

Lowland wet grassland n=34 (LWG/EBW) Plant species	Frequency %
<i>Mentha aquatica</i>	9
<i>Menyanthes trifoliata</i>	3
<i>Molinia caerulea</i>	15
<i>Montia fontana</i>	3
<i>Myosotis laxa</i>	9
<i>Myosotis secunda</i>	6
<i>Myrica gale</i>	3
<i>Nardus stricta</i>	12
<i>Narthecium ossifragum</i>	3
<i>Pedicularis palustris</i>	3
<i>Pedicularis sylvatica</i>	6
<i>Phalaris arundinacea</i>	12
<i>Phleum pratense</i>	12
<i>Plantago lanceolata</i>	15
<i>Poa annua</i>	6
<i>Poa pratensis</i>	56
<i>Poa trivialis</i>	76
<i>Polygala serpyllifolia</i>	6
<i>Polygonum aviculare</i>	3
<i>Polygonum persicaria</i>	6
<i>Potentilla anserina</i>	18
<i>Potentilla erecta</i>	32
<i>Potentilla palustris</i>	18
<i>Potentilla reptans</i>	3
<i>Prunella vulgaris</i>	21
<i>Ranunculus acris</i>	59
<i>Ranunculus flammula</i>	41
<i>Ranunculus repens</i>	68
<i>Rhinanthus minor</i>	12
<i>Rubus fruticosus</i>	3
<i>Rumex acetosa</i>	79
<i>Rumex acetosella</i>	3

Lowland wet grassland n=34 (LWG/EBW) Plant species	Frequency %
<i>Rumex crispus</i>	6
<i>Rumex obtusifolius</i>	12
<i>Sagina procumbens</i>	9
<i>Salix cinerea</i>	9
<i>Scirpus cespitosus</i>	3
<i>Senecio aquaticus</i>	35
<i>Senecio jacobea</i>	3
<i>Sorbus acuparia</i>	3
<i>Stachys palustris</i>	3
<i>Stellaria alsine</i>	35
<i>Stellaria graminea</i>	12
<i>Stellaria holostea</i>	3
<i>Stellaria media</i>	6
<i>Succisa pratensis</i>	24
<i>Taraxacum officinale</i> agg.	15
<i>Trifolium pratense</i>	9
<i>Trifolium repens</i>	62
<i>Urtica dioica</i>	15
<i>Vaccinium myrtillus</i>	6
<i>Valeriana officinalis</i>	3
<i>Veronica chamaedrys</i>	3
<i>Veronica scutellata</i>	15
<i>Vicia cracca</i>	6
<i>Vicia sepium</i>	3
<i>Viola palustris</i>	9

Fen/swamp/reedbed n=9 Plant species	Frequency %
<i>Agrostis canina</i>	33
<i>Agrostis stolonifera</i>	89
<i>Ajuga reptans</i>	11
<i>Alopecurus geniculatus</i>	22
<i>Alopecurus pratensis</i>	11
<i>Angelica sylvestris</i>	33
<i>Anthoxanthum odoratum</i>	56
<i>Arrhenatherum elatius</i>	33
<i>Caltha palustris</i>	11
<i>Cardamine pratensis</i>	56

Fen/swamp/reedbed n=9 Plant species	Frequency %
<i>Carex disticha</i>	22
<i>Carex echinata</i>	22
<i>Carex nigra</i>	33
<i>Carex rostrata</i>	44
<i>Deschampsia cespitosa</i>	33
<i>Eleocharis palustris</i>	11
<i>Epilobium hirsutum</i>	11
<i>Epilobium obscurum</i>	33
<i>Epilobium palustre</i>	67
<i>Equisetum fluviatile</i>	67

Fen/swamp/reedbed n=9 Plant species	Frequency %
<i>Equisetum palustre</i>	11
<i>Eriophorum angustifolium</i>	33
<i>Festuca pratensis</i>	11
<i>Festuca rubra</i>	44
<i>Filipendula ulmaria</i>	78
<i>Galium palustre</i>	67
<i>Galium saxatile</i>	11
<i>Glyceria fluitans</i>	44
<i>Holcus lanatus</i>	67
<i>Holcus mollis</i>	33
<i>Juncus acutiflorus</i>	67
<i>Juncus articulatus</i>	11
<i>Juncus conglomeratus</i>	11
<i>Juncus effusus</i>	89
<i>Juncus squarrosus</i>	11
<i>Lathyrus pratensis</i>	56
<i>Leontodon autumnalis</i>	11
<i>Lotus uliginosus</i>	11
<i>Luzula campestris</i>	22
<i>Luzula multiflora</i>	11
<i>Lysimachia nummularia</i>	11
<i>Mentha aquatica</i>	11
<i>Molinia caerulea</i>	11
<i>Myosotis laxa</i>	11
<i>Phalaris arundinacea</i>	22
<i>Plantago lanceolata</i>	33
<i>Poa pratensis</i>	44
<i>Poa trivialis</i>	78
<i>Polygonum amphibium</i>	11
<i>Polygonum hydropiper</i>	11
<i>Polygonum persicaria</i>	11

Fen/swamp/reedbed n=9 Plant species	Frequency %
<i>Potentilla anserina</i>	11
<i>Potentilla erecta</i>	33
<i>Potentilla palustris</i>	22
<i>Ranunculus acris</i>	33
<i>Ranunculus flammula</i>	44
<i>Ranunculus repens</i>	56
<i>Rumex acetosa</i>	67
<i>Rumex conglomeratus</i>	22
<i>Salix cinerea</i>	11
<i>Senecio aquaticus</i>	11
<i>Sparganium erectum</i>	11
<i>Stachys palustris</i>	11
<i>Stellaria alsine</i>	33
<i>Stellaria graminea</i>	11
<i>Stellaria holostea</i>	22
<i>Taraxacum officinale</i> agg.	11
<i>Trifolium repens</i>	22
<i>Triglochin palustris</i>	11
<i>Typha latifolia</i>	11
<i>Urtica dioica</i>	22
<i>Valeriana officinalis</i>	11
<i>Veronica chamaedrys</i>	11
<i>Veronica scutellata</i>	22
<i>Vicia cracca</i>	22
<i>Viola palustris</i>	11

Carr n=5 Plant species	Frequency %
<i>Acer pseudoplatanus</i> (sapling)	20
<i>Acer pseudoplatanus</i> (seedling)	20
<i>Agrostis canina</i>	20
<i>Agrostis stolonifera</i>	80
<i>Alnus glutinosa</i>	60
<i>Alnus glutinosa</i> (sapling)	20
<i>Angelica sylvestris</i>	60
<i>Anthoxanthum odoratum</i>	60
<i>Anthriscus sylvestris</i>	20
<i>Apium nodiflorum</i>	40
<i>Betula pubescens</i>	60

Carr n=5 Plant species	Frequency %
<i>Caltha palustris</i>	40
<i>Calystegia sepium</i>	20
<i>Cardamine flexuosa</i>	20
<i>Cardamine pratensis</i>	60
<i>Carex nigra</i>	20
<i>Carex panicea</i>	20
<i>Carex remota</i>	40
<i>Carex rostrata</i>	40
<i>Cerastium fontanum</i>	20
<i>Chrysosplenium oppositifolium</i>	20
<i>Cirsium arvense</i>	20

Carr n=5 Plant species	Frequency %
<i>Cirsium vulgare</i>	20
<i>Crataegus monogyna</i>	20
<i>Dactylorhiza fuchsii</i>	20
<i>Deschampsia cespitosa</i>	20
<i>Dryopteris dilatata</i>	40
<i>Epilobium hirsutum</i>	20
<i>Epilobium obscurum</i>	40
<i>Epilobium palustre</i>	20
<i>Equisetum fluviatile</i>	60
<i>Equisetum palustre</i>	20
<i>Eriophorum angustifolium</i>	20
<i>Fagus sylvatica</i> (seedling)	20
<i>Festuca rubra</i>	40
<i>Filipendula ulmaria</i>	80
<i>Fraxinus excelsior</i>	20
<i>Fraxinus excelsior</i> (sapling)	20
<i>Fraxinus excelsior</i> (seedling)	20
<i>Galium palustre</i>	80
<i>Geum urbanum</i>	20
<i>Glyceria fluitans</i>	20
<i>Holcus lanatus</i>	40
<i>Hydrocotyle vulgaris</i>	20
<i>Ilex aquifolium</i> (seedling)	20
<i>Iris pseudacorus</i>	20
<i>Juncus bufonius</i>	20
<i>Juncus conglomeratus</i>	20
<i>Juncus effusus</i>	40
<i>Lotus uliginosus</i>	20
<i>Lychnis flos-cuculi</i>	20
<i>Lycopus europaeus</i>	20
<i>Mentha aquatica</i>	40
<i>Menyanthes trifoliata</i>	20
<i>Molinia caerulea</i>	40
<i>Myosotis laxa</i>	20
<i>Myosotis scorpiodes</i>	20
<i>Myosotis</i> sp.	20
<i>Oenanthe croccata</i>	40

Carr n=5 Plant species	Frequency %
<i>Phalaris arundinacea</i>	60
<i>Poa pratensis</i>	20
<i>Poa trivialis</i>	60
<i>Polygonum aviculare</i>	20
<i>Potentilla erecta</i>	20
<i>Potentilla palustris</i>	20
<i>Ranunculus acris</i>	40
<i>Ranunculus flammula</i>	20
<i>Ranunculus repens</i>	40
<i>Rorippa sylvestris</i>	20
<i>Rubus fruticosus</i>	80
<i>Rumex acetosa</i>	40
<i>Rumex obtusifolius</i>	20
<i>Rumex sanguineus</i>	60
<i>Salix cinerea</i>	60
<i>Salix cinerea</i> (sapling)	20
<i>Senecio aquatica</i>	20
<i>Silene dioica</i>	20
<i>Solanum dulcamara</i>	60
<i>Sonchus asper</i>	20
<i>Stachys sylvatica</i>	20
<i>Stellaria alsine</i>	20
<i>Stellaria media</i>	20
<i>Succisa pratensis</i>	20
<i>Taraxacum officinale</i>	20
<i>Trifolium repens</i>	40
<i>Typha latifolia</i>	40
<i>Urtica dioica</i>	40
<i>Vicia cracca</i>	20
<i>Viola palustris</i>	20

Dry heath n=8 Plant species	Frequency %
<i>Achillea millefolium</i>	13
<i>Agrostis canina</i>	75
<i>Agrostis capillaris</i>	75
<i>Agrostis stolonifera</i>	13
<i>Anemone nemorosa</i>	13
<i>Anthoxanthum odoratum</i>	88
<i>Aulacomnium palustre</i>	38
<i>Blechnum spicant</i>	13
<i>Brachythecium rutabulum</i>	25
<i>Bryum capillare</i>	25
<i>Calliergon cuspidatum</i>	25
<i>Calluna vulgaris</i>	100
<i>Calypogeia muelleriana</i>	38
<i>Campylopus introflexus</i>	38
<i>Campylopus paradoxus</i>	50
<i>Cardamine pratensis</i>	13
<i>Carex binervis</i>	63
<i>Carex demissa</i>	13
<i>Carex echinata</i>	38
<i>Carex nigra</i>	50
<i>Carex ovalis</i>	13
<i>Carex panicea</i>	63
<i>Carex pilulifera</i>	38
<i>Cerastium fontanum</i>	63
<i>Cirsium palustre</i>	25
<i>Cladonia portentosa</i>	50
<i>Cladonia pxyidata</i>	13
<i>Cladonia subcervicornis</i>	13
<i>Cynosurus cristatus</i>	38
<i>Danthonia decumbens</i>	25
<i>Deschampsia flexuosa</i>	25
<i>Dicranum scoparium</i>	50
<i>Diplophyllum albicans</i>	13
<i>Dryopteris</i> sp.	13
<i>Epilobium nerterioides</i>	13
<i>Epilobium palustre</i>	13
<i>Erica cinerea</i>	50
<i>Erica tetralix</i>	88
<i>Eriophorum angustifolium</i>	88
<i>Eriophorum vaginatum</i>	50
<i>Euphrasia officinalis</i> agg.	13
<i>Eurhynchium praelongum</i>	13
<i>Festuca ovina</i>	63
<i>Festuca rubra</i>	13
<i>Galium saxatile</i>	50
<i>Holcus lanatus</i>	75
<i>Hylocomium splendens</i>	88

Dry heath n=8 Plant species	Frequency %
<i>Hypericum pulchrum</i>	13
<i>Hypnum cupressiforme</i>	88
<i>Hypochaeris radicata</i>	13
<i>Juncus acutiflorus</i>	25
<i>Juncus bulbosus</i>	25
<i>Juncus effusus</i>	25
<i>Juncus squarrosus</i>	13
<i>Lathyrus linifolius</i>	13
<i>Leucobryum glaucum</i>	13
<i>Listera cordata</i>	13
<i>Lophocolea bidentata</i>	38
<i>Lophozia ventricosa</i>	38
<i>Lotus corniculatus</i>	13
<i>Luzula multiflora</i>	63
<i>Mnium</i> sp.	13
<i>Molinia caerulea</i>	100
<i>Mylia taylorii</i>	13
<i>Myrica gale</i>	25
<i>Nardus stricta</i>	25
<i>Narthecium ossifragum</i>	13
<i>Pedicularis sylvatica</i>	25
<i>Peltigera canina</i>	25
<i>Philonotis fontana</i>	13
<i>Plagiomnium undulatum</i>	13
<i>Plagiothecium undulatum</i>	38
<i>Plantago lanceolata</i>	13
<i>Pleurozium schreberi</i>	50
<i>Poa annua</i>	13
<i>Poa pratensis</i>	13
<i>Poa trivialis</i>	25
<i>Polygala serpyllifolia</i>	63
<i>Polytrichum alpestre</i>	13
<i>Polytrichum commune</i>	50
<i>Polytrichum juniperinum</i>	13
<i>Potentilla erecta</i>	100
<i>Prunella vulgaris</i>	13
<i>Pseudoscleropodium purum</i>	63
<i>Pteridium aquilinum</i>	25
<i>Ranunculus acris</i>	13
<i>Rhytidiadelphus loreus</i>	75
<i>Rhytidiadelphus squarrosus</i>	63
<i>Riccardia multifida</i>	13
<i>Rubus fruticosus</i>	13
<i>Rumex acetosa</i>	13
<i>Sagina procumbens</i>	25
<i>Salix</i> sp.	25
<i>Scapania gracilis</i>	25
<i>Scirpus cespitosus</i>	63

Dry heath n=8 Plant species	Frequency %
<i>Senecio aquaticus</i>	13
<i>Senecio jacobea</i>	13
<i>Sphagnum auriculatum</i>	25
<i>Sphagnum capillifolium</i>	63
<i>Sphagnum compactum</i>	13
<i>Sphagnum cuspidatum</i>	25
<i>Sphagnum papillosum</i>	38
<i>Sphagnum recurvum</i>	38
<i>Sphagnum subnitens</i>	63

Dry heath n=8 Plant species	Frequency %
<i>Sphagnum tenellum</i>	25
<i>Succisa pratensis</i>	38
<i>Taraxacum officinale</i> agg.	13
<i>Thuidium tamariscinum</i>	50
<i>Trifolium repens</i>	25
<i>Vaccinium myrtillus</i>	50
<i>Veronica chamaedrys</i>	13
<i>Veronica officinalis</i>	13
<i>Viola riviniana</i>	13

Wet heath n=33 Plant species	Frequency %
<i>Agrostis canina</i>	67
<i>Agrostis capillaris</i>	21
<i>Agrostis stolonifera</i>	3
<i>Anthoxanthum odoratum</i>	39
<i>Aulacomnium palustre</i>	36
<i>Betula pubescens</i>	12
<i>Betula pubescens</i> (sapling)	3
<i>Blechnum spicant</i>	3
<i>Breutelia chrysocoma</i>	18
<i>Calliergon cuspidatum</i>	3
<i>Calluna vulgaris</i>	100
<i>Calypogeia muelleriana</i>	61
<i>Calypogeia</i> sp.	3
<i>Campylium stellatum</i>	3
<i>Campylopus introflexus</i>	36
<i>Campylopus paradoxus</i>	67
<i>Carex binervis</i>	24
<i>Carex demissa</i>	12
<i>Carex echinata</i>	45
<i>Carex flacca</i>	3
<i>Carex hostiana</i>	6
<i>Carex nigra</i>	61
<i>Carex panicea</i>	64
<i>Carex pilulifera</i>	6
<i>Carex pulicaris</i>	6
<i>Cephalozia bicuspidata</i>	6
<i>Cerastium fontanum</i>	3
<i>Cirsium dissectum</i>	6
<i>Cladonia coccifera</i>	15
<i>Cladonia fimbriata</i>	3
<i>Cladonia furcata</i>	3
<i>Cladonia furcata</i>	3
<i>Cladonia gracilis</i>	3

Wet heath n=33 Plant species	Frequency %
<i>Cladonia portentosa</i>	67
<i>Cladonia squamosa</i>	3
<i>Cladonia uncialis</i>	6
<i>Ctenidium molluscum</i>	3
<i>Dactylorhiza maculata</i>	3
<i>Danthonia decumbens</i>	12
<i>Deschampsia flexuosa</i>	52
<i>Dicranum scoparium</i>	70
<i>Diplophyllum albicans</i>	36
<i>Drosera rotundifolia</i>	21
<i>Dryopteris</i> sp.	3
<i>Empetrum nigrum</i>	9
<i>Epilobium obscurum</i>	3
<i>Erica cinerea</i>	24
<i>Erica tetralix</i>	94
<i>Eriophorum angustifolium</i>	88
<i>Eriophorum vaginatum</i>	79
<i>Euphrasia officinalis</i> agg.	3
<i>Eurhynchium praelongum</i>	3
<i>Festuca ovina</i>	12
<i>Festuca rubra</i>	3
<i>Fissidens taxifolius</i>	3
<i>Galium saxatile</i>	21
<i>Holcus lanatus</i>	9
<i>Huperzia selago</i>	3
<i>Hylocomium splendens</i>	61
<i>Hypericum pulchrum</i>	3
<i>Hypnum cupressiforme</i>	100
<i>Hypochaeris radicata</i>	6
<i>Juncus acutiflorus</i>	21
<i>Juncus bufonius</i>	3
<i>Juncus bulbosus</i>	36
<i>Juncus conglomeratus</i>	3

Wet heath n=33 Plant species	Frequency %
<i>Juncus effusus</i>	27
<i>Juncus squarrosus</i>	58
<i>Kurzia pauciflora</i>	18
<i>Leucobryum glaucum</i>	12
<i>Listera cordata</i>	15
<i>Lophocolea bidentata</i>	33
<i>Lophozia ventricosa</i>	61
<i>Luzula multiflora</i>	39
<i>Molinia caerulea</i>	85
<i>Mylia anomala</i>	6
<i>Mylia taylorii</i>	9
<i>Myrica gale</i>	15
<i>Nardus stricta</i>	33
<i>Narthecium ossifragum</i>	52
<i>Odontoschisma sphagni</i>	45
<i>Pedicularis sylvatica</i>	15
<i>Pellia epiphylla</i>	3
<i>Pinus sylvestris</i>	3
<i>Plagiothecium undulatum</i>	39
<i>Plantago lanceolata</i>	3
<i>Pleurozia purpurea</i>	3
<i>Pleurozium schreberi</i>	73
<i>Poa pratensis</i>	3
<i>Polygala serpyllifolia</i>	39
<i>Polytrichum alpestre</i>	6
<i>Polytrichum commune</i>	70
<i>Potentilla erecta</i>	88
<i>Prunella vulgaris</i>	3
<i>Pseudoscleropodium purum</i>	6
<i>Pteridium aquilinum</i>	3
<i>Racomitrium lanuginosum</i>	21
<i>Ranunculus flammula</i>	3

Wet heath n=33 Plant species	Frequency %
<i>Rhynchospora alba</i>	3
<i>Rhytidiadelphus loreus</i>	70
<i>Rhytidiadelphus squarrosus</i>	45
<i>Rhytidiadelphus loreus</i>	3
<i>Rumex acetosa</i>	3
<i>Scapania gracilis</i>	27
<i>Scirpus cespitosus</i>	67
<i>Sorbus acuparia</i>	3
<i>Sphagnum auriculatum</i>	39
<i>Sphagnum capillifolium</i>	91
<i>Sphagnum compactum</i>	18
<i>Sphagnum cuspidatum</i>	61
<i>Sphagnum magellanicum</i>	12
<i>Sphagnum palustre</i>	33
<i>Sphagnum papillosum</i>	73
<i>Sphagnum recurvum</i>	61
<i>Sphagnum subnitens</i>	39
<i>Sphagnum tenellum</i>	52
<i>Splachnum sphaericum</i>	3
<i>Succisa pratensis</i>	18
<i>Thuidium tamariscinum</i>	45
<i>Trifolium repens</i>	3
<i>Ulex europaeus</i>	3
<i>Vaccinium myrtillus</i>	48

Blanket bog n=5 Plant species	Frequency %
<i>Aulacomnium palustre</i>	40
<i>Blechnum spicant</i>	20
<i>Calluna vulgaris</i>	100
<i>Calypogeia muelleriana</i>	60
<i>Calypogeia sphagnicola</i>	20
<i>Campylopus introflexus</i>	60
<i>Campylopus paradoxus</i>	60
<i>Carex panicea</i>	20
<i>Cladonia floerkeana</i>	20
<i>Cladonia portentosa</i>	60

Blanket bog n=5 Plant species	Frequency %
<i>Cladonia pyxidata</i>	20
<i>Deschampsia flexuosa</i>	40
<i>Dicranum scoparium</i>	60
<i>Diplophyllum albicans</i>	20
<i>Drosera rotundifolia</i>	60
<i>Empetrum nigrum</i>	40
<i>Erica tetralix</i>	100
<i>Eriophorum angustifolium</i>	100
<i>Eriophorum vaginatum</i>	100
<i>Hypnum cupressiforme</i>	100

Blanket bog n=5 Plant species	Frequency %
<i>Juncus squarrosus</i>	20
<i>Kurzia pauciflora</i>	40
<i>Leucobryum glaucum</i>	20
<i>Lophozia ventricosa</i>	60
<i>Molinia caerulea</i>	80
<i>Myrica gale</i>	20
<i>Narthecium ossifragum</i>	80
<i>Odontoschisma sphagni</i>	80
<i>Plagiothecium undulatum</i>	20
<i>Pleurozia purpurea</i>	20
<i>Pleurozium schreberi</i>	40
<i>Polygala serpyllifolia</i>	20
<i>Polytrichum alpestre</i>	60
<i>Polytrichum commune</i>	60
<i>Potentilla erecta</i>	60
<i>Racomitrium lanuginosum</i>	20

Blanket bog n=5 Plant species	Frequency %
<i>Rhytidiadelphus loreus</i>	20
<i>Rhytidiadelphus squarrosus</i>	20
<i>Scirpus cespitosus</i>	100
<i>Sphagnum auriculatum</i>	20
<i>Sphagnum capillifolium</i>	100
<i>Sphagnum cuspidatum</i>	60
<i>Sphagnum magellanicum</i>	60
<i>Sphagnum palustre</i>	20
<i>Sphagnum papillosum</i>	100
<i>Sphagnum recurvum</i>	20
<i>Sphagnum subnitens</i>	40
<i>Sphagnum tenellum</i>	80
<i>Vaccinium myrtillus</i>	60
<i>Vaccinium oxycoccos</i>	20

Degraded heath n=22 Plant species	Frequency %
<i>Achillea millefolium</i>	5
<i>Agrostis canina</i>	100
<i>Agrostis capillaris</i>	45
<i>Agrostis stolonifera</i>	23
<i>Ajuga reptans</i>	5
<i>Aneura pinguis</i>	5
<i>Anthoxanthum odoratum</i>	86
<i>Aulacomnium palustre</i>	36
<i>Blechnum spicant</i>	5
<i>Breutelia chrysocoma</i>	23
<i>Bryum capillare</i>	5
<i>Bryum pseudotriquetrum</i>	5
<i>Calliargon cuspidatum</i>	9
<i>Calluna vulgaris</i>	100
<i>Calypogeia muelleriana</i>	36
<i>Campanula rotundifolia</i>	5
<i>Campylopus atrovirens</i>	5
<i>Campylopus introflexus</i>	41
<i>Campylopus paradoxus</i>	59
<i>Campylopus pyriformis</i>	5
<i>Cardamine pratensis</i>	9
<i>Carex binervis</i>	36
<i>Carex demissa</i>	9
<i>Carex echinata</i>	64
<i>Carex flacca</i>	5
<i>Carex nigra</i>	64

Degraded heath n=22 Plant species	Frequency %
<i>Carex ovalis</i>	5
<i>Carex panicea</i>	77
<i>Carex pilulifera</i>	18
<i>Cirsium dissectum</i>	5
<i>Cladonia coccifera</i>	5
<i>Cladonia fimbriata</i>	5
<i>Cladonia floerkeana</i>	5
<i>Cladonia portentosa</i>	50
<i>Cladonia pyxidata</i>	14
<i>Cladonia squamosa</i>	5
<i>Cladonia uncialis</i>	14
<i>Cladonia verticillata</i>	5
<i>Cynosurus cristatus</i>	14
<i>Dactylorhiza maculata</i>	5
<i>Danthonia decumbens</i>	23
<i>Deschampsia cespitosa</i>	9
<i>Deschampsia flexuosa</i>	41
<i>Dicranum scoparium</i>	59
<i>Diplophyllum albicans</i>	23
<i>Drosera rotundifolia</i>	23
<i>Dryopteris carthusiana</i>	5
<i>Dryopteris sp.</i>	5
<i>Epilobium palustre</i>	5
<i>Erica cinerea</i>	27
<i>Erica tetralix</i>	77
<i>Eriophorum angustifolium</i>	77

Degraded heath n=22	Frequency %
Plant species	
<i>Eriophorum vaginatum</i>	68
<i>Euphrasia officinalis</i> agg.	5
<i>Eurhynchium praelongum</i>	5
<i>Festuca ovina</i>	41
<i>Festuca rubra</i>	14
<i>Fissidens adianthoides</i>	5
<i>Galium palustre</i>	5
<i>Galium saxatile</i>	36
<i>Holcus lanatus</i>	50
<i>Holcus mollis</i>	5
<i>Hylocomium splendens</i>	86
<i>Hypericum pulchrum</i>	5
<i>Hypnum cupressiforme</i>	95
<i>Hypochaeris radicata</i>	9
<i>Juncus acutiflorus</i>	50
<i>Juncus bulbosus</i>	41
<i>Juncus conglomeratus</i>	14
<i>Juncus effusus</i>	36
<i>Juncus squarrosus</i>	77
<i>Kurzia pauciflora</i>	9
<i>Lathyrus montanus</i>	5
<i>Leontodon autumnalis</i>	5
<i>Leucobryum glaucum</i>	27
<i>Lophocolea bidentata</i>	14
<i>Lophozia ventricosa</i>	41
<i>Luzula multiflora</i>	64
<i>Mnium hornum</i>	5
<i>Molinia caerulea</i>	86
<i>Mylia anomala</i>	5
<i>Mylia taylorii</i>	14
<i>Myrica gale</i>	23
<i>Nardus stricta</i>	55
<i>Narthecium ossifragum</i>	73
<i>Odontoschisma sphagni</i>	23
<i>Pedicularis sylvatica</i>	32
<i>Pinguicula vulgaris</i>	5
<i>Plagiomnium undulatum</i>	14
<i>Plagiothecium undulatum</i>	50
<i>Plantago lanceolata</i>	14
<i>Pleurozia purpurea</i>	5
<i>Pleurozium schreberi</i>	77
<i>Poa annua</i>	5
<i>Poa pratensis</i>	14
<i>Pohlia nutans</i>	5
<i>Polygala serpyllifolia</i>	55
<i>Polytrichum alpestre</i>	5
<i>Polytrichum alpestre</i>	9

Degraded heath n=22	Frequency %
Plant species	
<i>Polytrichum commune</i>	50
<i>Polytrichum piliferum</i>	5
<i>Potentilla erecta</i>	100
<i>Prunella vulgaris</i>	5
<i>Pseudoscleropodium purum</i>	41
<i>Ptilidium ciliare</i>	5
<i>Racomitrium lanuginosum</i>	32
<i>Ranunculus acris</i>	5
<i>Ranunculus flammula</i>	14
<i>Ranunculus repens</i>	5
<i>Rhytidiadelphus loreus</i>	73
<i>Rhytidiadelphus squarrosus</i>	86
<i>Riccardia multifida</i>	5
<i>Rumex acetosa</i>	5
<i>Scapania gracilis</i>	27
<i>Scirpus cespitosus</i>	68
<i>Senecio aquaticus</i>	5
<i>Senecio jacobea</i>	5
<i>Sorbus aucuparia</i>	5
<i>Sphagnum auriculatum</i>	59
<i>Sphagnum capillifolium</i>	82
<i>Sphagnum compactum</i>	5
<i>Sphagnum cuspidatum</i>	64
<i>Sphagnum magellanicum</i>	5
<i>Sphagnum palustre</i>	50
<i>Sphagnum papillosum</i>	68
<i>Sphagnum recurvum</i>	55
<i>Sphagnum subnitens</i>	27
<i>Sphagnum tenellum</i>	50
<i>Stellaria alsine</i>	5
<i>Succisa pratensis</i>	41
<i>Taraxacum officinale</i> agg.	9
<i>Thuidium tamariscinum</i>	73
<i>Trifolium repens</i>	9
<i>Vaccinium myrtillus</i>	36
<i>Viola palustris</i>	18

Rough moorland grazing n=18 Plant species	Frequency %
<i>Achillea millefolium</i>	6
<i>Agrostis canina</i>	89
<i>Agrostis capillaris</i>	56
<i>Agrostis stolonifera</i>	17
<i>Anthoxanthum odoratum</i>	94
<i>Aulacomnium palustre</i>	39
<i>Barbula</i> sp.	6
<i>Blechnum spicant</i>	11
<i>Brachythecium rutabulum</i>	22
<i>Breutelia chrysocoma</i>	11
<i>Calliergon cuspidatum</i>	33
<i>Calluna vulgaris</i>	61
<i>Calypogeia muelleriana</i>	33
<i>Campylopus introflexus</i>	33
<i>Campylopus paradoxus</i>	28
<i>Cardamine flexuosa</i>	6
<i>Cardamine pratensis</i>	28
<i>Carex binervis</i>	33
<i>Carex demissa</i>	22
<i>Carex echinata</i>	56
<i>Carex flacca</i>	17
<i>Carex hostiana</i>	6
<i>Carex nigra</i>	72
<i>Carex ovalis</i>	6
<i>Carex panicea</i>	83
<i>Carex pilulifera</i>	11
<i>Carex pulicaris</i>	33
<i>Carex rostrata</i>	6
<i>Carum verticillatum</i>	6
<i>Cerastium fontanum</i>	28
<i>Cirsium dissectum</i>	11
<i>Cirsium palustre</i>	33
<i>Cladonia floerkeana</i>	6
<i>Cladonia portentosa</i>	17
<i>Cladonia pyxidata</i>	17
<i>Cladonia squamosa</i>	6
<i>Cynosurus cristatus</i>	17
<i>Dactylorhiza maculata</i>	6
<i>Danthonia decumbens</i>	17
<i>Deschampsia cespitosa</i>	11
<i>Deschampsia flexuosa</i>	33
<i>Dicranella heteromalla</i>	6
<i>Dicranum scoparium</i>	56
<i>Diplophyllum albicans</i>	17
<i>Drosera rotundifolia</i>	11
<i>Epilobium obscurum</i>	6
<i>Epilobium palustre</i>	11
<i>Equisetum fluviatile</i>	6

Rough moorland grazing n=18 Plant species	Frequency %
<i>Equisetum palustre</i>	22
<i>Erica tetralix</i>	61
<i>Eriophorum angustifolium</i>	56
<i>Eriophorum vaginatum</i>	50
<i>Eurhynchium praelongum</i>	39
<i>Festuca ovina</i>	28
<i>Festuca rubra</i>	33
<i>Funaria hygrometrica</i>	6
<i>Galium palustre</i>	11
<i>Galium saxatile</i>	61
<i>Holcus lanatus</i>	67
<i>Holcus mollis</i>	11
<i>Hydrocotyle vulgaris</i>	6
<i>Hylocomium splendens</i>	78
<i>Hypnum cupressiforme</i>	61
<i>Hypochaeris radicata</i>	11
<i>Isolepis setacea</i>	6
<i>Juncus acutiflorus</i>	61
<i>Juncus bufonius</i>	6
<i>Juncus bulbosus</i>	28
<i>Juncus conglomeratus</i>	22
<i>Juncus effusus</i>	61
<i>Juncus squarrosus</i>	50
<i>Kurzia pauciflora</i>	11
<i>Leontodon autumnalis</i>	11
<i>Lophocolea bidentata</i>	33
<i>Lophozia ventricosa</i>	17
<i>Lotus corniculatus</i>	6
<i>Luzula multiflora</i>	67
<i>Molinia caerulea</i>	83
<i>Mylia anomala</i>	6
<i>Mylia taylorii</i>	6
<i>Myrica gale</i>	6
<i>Nardus stricta</i>	67
<i>Narthecium ossifragum</i>	39
<i>Odontoschisma sphagni</i>	11
<i>Pedicularis sylvatica</i>	22
<i>Philonotis fontana</i>	6
<i>Plagiomnium undulatum</i>	22
<i>Plagiothecium undulatum</i>	28
<i>Plantago lanceolata</i>	17
<i>Pleurozium schreberi</i>	56
<i>Poa annua</i>	6
<i>Poa pratensis</i>	28
<i>Poa trivialis</i>	11
<i>Polygala serpyllifolia</i>	17
<i>Polytrichum alpestre</i>	11
<i>Polytrichum commune</i>	78

Rough moorland grazing n=18 Plant species	Frequency %
<i>Potentilla erecta</i>	100
<i>Prunella vulgaris</i>	6
<i>Pseudoscleropodium purum</i>	44
<i>Racomitrium fasciculare</i>	6
<i>Ranunculus acris</i>	33
<i>Ranunculus flammula</i>	33
<i>Rhytidiadelphus loreus</i>	33
<i>Rhytidiadelphus squarrosus</i>	83
<i>Rhytidiadelphus squarrosus</i>	6
<i>Riccardia multifida</i>	6
<i>Rumex acetosa</i>	22
<i>Sagina procumbens</i>	11
<i>Salix cinerea</i>	11
<i>Scapania gracilis</i>	6
<i>Scirpus cespitosus</i>	39
<i>Senecio aquaticus</i>	11
<i>Sphagnum auriculatum</i>	33
<i>Sphagnum capillifolium</i>	50
<i>Sphagnum cuspidatum</i>	39
<i>Sphagnum magellanicum</i>	6

Rough moorland grazing n=18 Plant species	Frequency %
<i>Sphagnum palustre</i>	33
<i>Sphagnum papillosum</i>	44
<i>Sphagnum recurvum</i>	44
<i>Sphagnum subnitens</i>	28
<i>Sphagnum tenellum</i>	22
<i>Splachnum ampullaceum</i>	6
<i>Stellaria alsine</i>	6
<i>Stellaria media</i>	11
<i>Succisa pratensis</i>	33
<i>Taraxacum officinale</i> agg.	11
<i>Thuidium tamariscinum</i>	50
<i>Trifolium repens</i>	28
<i>Vaccinium myrtillus</i>	39
<i>Viola palustris</i>	11
<i>Viola riviniana</i>	17

Lowland raised bog n=20 Plant species	Frequency %
<i>Agrostis canina</i>	20
<i>Agrostis stolonifera</i>	15
<i>Alnus glutinosa</i>	5
<i>Angelica sylvestris</i>	5
<i>Anthoxanthum odoratum</i>	30
<i>Aulacomnium palustre</i>	45
<i>Betula pubescens</i> (seedling)	45
<i>Blechnum spicant</i>	5
<i>Briza media</i>	5
<i>Calliergon cuspidatum</i>	5
<i>Calluna vulgaris</i>	90
<i>Caltha palustris</i>	5
<i>Calypogeia muelleriana</i>	30
<i>Campylium stellatum</i>	5
<i>Campylopus introflexus</i>	45
<i>Campylopus paradoxus</i>	55
<i>Cardamine pratensis</i>	5
<i>Carex demissa</i>	5
<i>Carex echinata</i>	15
<i>Carex hostiana</i>	5
<i>Carex nigra</i>	30
<i>Carex panicea</i>	55

Lowland raised bog n=20 Plant species	Frequency %
<i>Carex pulicaris</i>	5
<i>Carex rostrata</i>	5
<i>Chamerion angustifolium</i>	5
<i>Cirsium dissectum</i>	10
<i>Cladonia coccifera</i>	15
<i>Cladonia floerkeana</i>	15
<i>Cladonia furcata</i>	20
<i>Cladonia portentosa</i>	60
<i>Cladonia pyxidata</i>	25
<i>Cladonia squamosa</i>	5
<i>Cladonia uncialis</i>	15
<i>Ctenidium molluscum</i>	5
<i>Dactylorhiza</i> sp.	5
<i>Deschampsia flexuosa</i>	15
<i>Dicranum scoparium</i>	40
<i>Diplophyllum albicans</i>	5
<i>Drepanocladus revolvens</i>	5
<i>Drosera rotundifolia</i>	35
<i>Dryopteris</i> sp.	15
<i>Epilobium palustre</i>	10
<i>Equisetum fluviatile</i>	5
<i>Equisetum palustre</i>	5

Lowland raised bog n=20 Plant species	Frequency %
<i>Erica cinerea</i>	5
<i>Erica tetralix</i>	95
<i>Eriophorum angustifolium</i>	90
<i>Eriophorum vaginatum</i>	90
<i>Eurhynchium praelongum</i>	5
<i>Festuca pratensis</i>	5
<i>Festuca rubra</i>	5
<i>Filipendula ulmaria</i>	5
<i>Fissidens taxifolius</i>	5
<i>Galium palustre</i>	5
<i>Holcus lanatus</i>	5
<i>Hylocomium splendens</i>	15
<i>Hypnum cupressiforme</i>	95
<i>Juncus acutiflorus</i>	10
<i>Juncus articulatus</i>	5
<i>Juncus bulbosus</i>	5
<i>Juncus effusus</i>	20
<i>Juncus inflexus</i>	5
<i>Juncus squarrosus</i>	10
<i>Kurzia pauciflora</i>	20
<i>Leucobryum glaucum</i>	5
<i>Lophocolea bidentata</i>	5
<i>Lophozia ventricosa</i>	35
<i>Luzula multiflora</i>	20
<i>Menyanthes trifoliata</i>	5
<i>Molinia caerulea</i>	55
<i>Mylia anomala</i>	10
<i>Mylia taylorii</i>	5
<i>Myrica gale</i>	20
<i>Narthecium ossifragum</i>	55
<i>Odontoschisma sphagni</i>	65
<i>Parnassia palustris</i>	5
<i>Pedicularis sylvatica</i>	5
<i>Plagiothecium undulatum</i>	5
<i>Pleurozium schreberi</i>	15
<i>Poa trivialis</i>	5
<i>Polygala serpyllifolia</i>	20

Lowland raised bog n=20 Plant species	Frequency %
<i>Polytrichum alpestre</i>	25
<i>Polytrichum commune</i>	40
<i>Potentilla erecta</i>	45
<i>Potentilla palustris</i>	5
<i>Pseudoscleropodium purum</i>	10
<i>Racomitrium lanuginosum</i>	5
<i>Ranunculus flammula</i>	5
<i>Rhododendron ponticum</i>	5
<i>Rhynchospora alba</i>	30
<i>Rhytidiadelphus loreus</i>	10
<i>Rhytidiadelphus squarrosus</i>	35
<i>Rubus fruticosus</i>	5
<i>Salix cinerea</i>	10
<i>Scapania gracilis</i>	10
<i>Scirpus cespitosus</i>	65
<i>Sphagnum auriculatum</i>	15
<i>Sphagnum capillifolium</i>	95
<i>Sphagnum cuspidatum</i>	50
<i>Sphagnum fimbriatum</i>	5
<i>Sphagnum magellanicum</i>	45
<i>Sphagnum palustre</i>	40
<i>Sphagnum papillosum</i>	70
<i>Sphagnum recurvum</i>	35
<i>Sphagnum subnitens</i>	50
<i>Sphagnum tenellum</i>	65
<i>Succisa pratensis</i>	10
<i>Thuidium tamariscinum</i>	5
<i>Triglochin palustris</i>	5
<i>Vaccinium myrtillus</i>	15
<i>Vaccinium oxycoccos</i>	15

Farm woodland n=63 Plant species	Frequency %
<i>Abies</i> sp.	2
<i>Acer pseudoplatanus</i>	17
<i>Acer pseudoplatanus</i> (sapling)	14
<i>Acer pseudoplatanus</i> (seedling)	27
<i>Aegopodium podagraria</i>	10
<i>Aesculus hippocastaneum</i>	3
<i>Agrostis canina</i>	21
<i>Agrostis capillaris</i>	25
<i>Agrostis stolonifera</i>	73
<i>Ajuga reptans</i>	13
<i>Allium</i> sp.	2
<i>Alnus glutinosa</i>	24
<i>Alopecurus pratensis</i>	5
<i>Anemone nemorosa</i>	27
<i>Angelica sylvestris</i>	10
<i>Anthoxanthum odoratum</i>	40
<i>Anthriscus sylvestris</i>	24
<i>Arctium minus</i>	2
<i>Arrhenatherum elatius</i>	2
<i>Arum maculatum</i>	22
<i>Athyrium filix-femina</i>	25
<i>Bellis perennis</i>	8
<i>Betula</i> sp.	29
<i>Betula</i> sp. (sapling)	14
<i>Betula</i> sp. (seedling)	10
<i>Blechnum spicant</i>	33
<i>Brachypodium sylvaticum</i>	2
<i>Brassica rapa</i>	2
<i>Bromus ramosus</i>	3
<i>Bromus sterilis</i>	2
<i>Callitriche stagnalis</i>	2
<i>Calluna vulgaris</i>	10
<i>Caltha palustris</i>	5
<i>Cardamine flexuosa</i>	38
<i>Cardamine pratensis</i>	21
<i>Carex binervis</i>	3
<i>Carex nigra</i>	8
<i>Carex ovalis</i>	5
<i>Carex panicea</i>	5
<i>Carex pendula</i>	2
<i>Carex pulicaris</i>	2
<i>Carex remota</i>	14
<i>Carex rostrata</i>	5
<i>Carex sylvatica</i>	11
<i>Cerastium fontanum</i>	21
<i>Chamerion angustifolium</i>	8

Farm woodland n=63 Plant species	Frequency %
<i>Chrysosplenium oppositifolium</i>	22
<i>Circaea lutetiana</i>	14
<i>Cirsium arvense</i>	5
<i>Cirsium palustre</i>	11
<i>Cirsium vulgare</i>	8
<i>Conopodium majus</i>	30
<i>Corylus avellana</i>	30
<i>Corylus avellana</i> (seedling)	3
<i>Crataegus monogyna</i>	41
<i>Crataegus monogyna</i> (sapling)	14
<i>Crataegus monogyna</i> (seedling)	22
<i>Cynosurus cristatus</i>	2
<i>Dactylis glomerata</i>	22
<i>Dactylorhiza fuchsii</i>	2
<i>Deschampsia cespitosa</i>	25
<i>Deschampsia flexuosa</i>	2
<i>Digitalis purpurea</i>	11
<i>Dryopteris aemula</i>	2
<i>Dryopteris affinis</i>	13
<i>Dryopteris dilatata</i>	62
<i>Dryopteris filix-mas</i>	24
<i>Dryopteris</i> sp.	3
<i>Epilobium hirsutum</i>	2
<i>Epilobium montanum</i>	16
<i>Epilobium obscurum</i>	22
<i>Equisetum fluviatile</i>	3
<i>Equisetum palustre</i>	8
<i>Equisetum sylvatica</i>	2
<i>Erica tetralix</i>	2
<i>Eriophorum angustifolium</i>	3
<i>Eriophorum vaginatum</i>	5
<i>Fagus sylvatica</i>	16
<i>Fagus sylvatica</i> (sapling)	2
<i>Fagus sylvatica</i> (seedling)	14
<i>Fallopia japonica</i>	2
<i>Festuca ovina</i>	2
<i>Festuca pratensis</i>	2
<i>Festuca rubra</i>	11
<i>Filipendula ulmaria</i>	33
<i>Fragaria vesca</i>	6
<i>Fraxinus excelsior</i>	48
<i>Fraxinus excelsior</i> (sapling)	22
<i>Fraxinus excelsior</i> (seedling)	54
<i>Galianthus nivalis</i>	3
<i>Galium aparine</i>	40

Farm woodland n=63 Plant species	Frequency %
<i>Galium odoratum</i>	5
<i>Galium palustre</i>	13
<i>Galium saxatile</i>	3
<i>Geranium robertianum</i>	38
<i>Geum rivale</i>	2
<i>Geum urbanum</i>	33
<i>Glechoma hederacea</i>	8
<i>Glyceria fluitans</i>	13
<i>Hedera helix</i>	79
<i>Heracleum sphondylium</i>	22
<i>Holcus lanatus</i>	56
<i>Holcus mollis</i>	2
<i>Hyacinthoides hispanica</i>	2
<i>Hyacinthoides non-scripta</i>	40
<i>Hypericum pulchrum</i>	2
<i>Hypericum tetrapterum</i>	3
<i>Hypochaeris radicata</i>	3
<i>Ilex aquifolium</i>	35
<i>Ilex aquifolium</i> (sapling)	11
<i>Ilex aquifolium</i> (seedling)	3
<i>Iris pseudacorus</i>	5
<i>Iris</i> sp.	2
<i>Juncus acutiflorus</i>	5
<i>Juncus bulbosus</i>	3
<i>Juncus conglomeratus</i>	2
<i>Juncus effusus</i>	37
<i>Lamium purpurea</i>	2
<i>Lapsana communis</i>	17
<i>Larix decidua</i>	2
<i>Larix</i> sp.	2
<i>Lathraea squamaria</i>	2
<i>Lathyrus pratensis</i>	5
<i>Leontodon autumnalis</i>	2
<i>Listera ovata</i>	2
<i>Lolium perenne</i>	8
<i>Lonicera periclymenum</i>	35
<i>Lotus uliginosus</i>	3
<i>Luzula campestris</i>	2
<i>Luzula multiflora</i>	8
<i>Luzula pilosa</i>	5
<i>Luzula sylvatica</i>	8
<i>Lychnis flos-cuculi</i>	3
<i>Lysimachia nemorum</i>	11
<i>Mentha aquatica</i>	3
<i>Molinia caerulea</i>	19
<i>Montia sibirica</i>	2
<i>Myosotis</i> sp.	2
<i>Myrica gale</i>	2

Farm woodland n=63 Plant species	Frequency %
<i>Narcissus</i> sp.	5
<i>Orchis mascula</i>	5
<i>Oxalis acetosella</i>	27
<i>Phalaris arundinacea</i>	5
<i>Phyllitis scolopendrium</i>	8
<i>Picea</i> sp.	2
<i>Picea</i> sp. (seedling)	2
<i>Pinus sylvestris</i>	3
<i>Pinus sylvestris</i> (sapling)	2
<i>Plantago lanceolata</i>	3
<i>Plantago major</i>	2
<i>Poa annua</i>	10
<i>Poa pratensis</i>	11
<i>Poa trivialis</i>	70
<i>Polypodium vulgare</i>	11
<i>Polystichum aculeatum</i>	3
<i>Polystichum setiferum</i>	6
<i>Potentilla erecta</i>	22
<i>Potentilla palustris</i>	3
<i>Potentilla sterilis</i>	5
<i>Primula</i> sp.	2
<i>Primula vulgaris</i>	19
<i>Prunella vulgaris</i>	11
<i>Prunus avium</i>	2
<i>Prunus avium</i> (seedling)	3
<i>Prunus domestica</i>	3
<i>Prunus domestica</i> (seedling)	2
<i>Prunus laurocerasus</i>	2
<i>Prunus</i> sp.	2
<i>Prunus spinosa</i>	19
<i>Prunus spinosa</i> (sapling)	16
<i>Prunus spinosa</i> (seedling)	22
<i>Pteridium aquilinum</i>	3
<i>Quercus</i> sp.	14
<i>Quercus</i> sp. (sapling)	2
<i>Quercus</i> sp. (seedling)	5
<i>Ranunculus acris</i>	22
<i>Ranunculus ficaria</i>	59
<i>Ranunculus flammula</i>	10
<i>Ranunculus repens</i>	56
<i>Ribes rubrum</i>	5
<i>Rosa canina</i>	5
<i>Rosa</i> sp.	3
<i>Rubus fruticosus</i>	86
<i>Rubus idaeus</i>	8
<i>Rumex acetosa</i>	27
<i>Rumex obtusifolius</i>	21
<i>Rumex sanguineus</i>	29

Farm woodland n=63 Plant species	Frequency %
<i>Sagina procumbens</i>	3
<i>Salix aurita</i>	2
<i>Salix cinerea</i>	38
<i>Salix cinerea</i> (sapling)	6
<i>Salix pentandra</i>	2
<i>Sambucus nigra</i>	5
<i>Sanicula europaea</i>	8
<i>Scrophularia nodosa</i>	2
<i>Senecio aquatica</i>	8
<i>Senecio jacobea</i>	10
<i>Silene dioica</i>	2
<i>Sisymbrium officinale</i>	2
<i>Smyrniololus satrum</i>	3
<i>Sonchus asper</i>	2
<i>Sorbus aucuparia</i>	25
<i>Sorbus aucuparia</i> (sapling)	8
<i>Sorbus aucuparia</i> (seedling)	5
<i>Stachys sylvatica</i>	5
<i>Stellaria alsine</i>	19
<i>Stellaria graminea</i>	2
<i>Stellaria holostea</i>	10
<i>Stellaria media</i>	19
<i>Succisa pratensis</i>	3

Farm woodland n=63 Plant species	Frequency %
<i>Symphoricarpos alba</i>	6
<i>Symphytum officinale</i>	2
<i>Taraxacum officinale</i>	33
<i>Taxus baccata</i>	2
<i>Tilia</i> sp.	3
<i>Trifolium repens</i>	8
<i>Ulex europaeus</i>	11
<i>Ulmus</i> sp.	3
<i>Ulmus</i> sp.(sapling)	3
<i>Umbilicus rupestris</i>	2
<i>Urtica dioica</i>	51
<i>Vaccinium myrtillus</i>	6
<i>Veronica beccabunga</i>	2
<i>Veronica chamaedrys</i>	40
<i>Veronica hederifolia</i>	2
<i>Veronica montana</i>	11
<i>Veronica serpyllifolia</i>	11
<i>Viburnum opulus</i>	3
<i>Vicia sepium</i>	14
<i>Viola palustris</i>	3
<i>Viola riviniana</i>	40

Farm scrub n=28 Plant species	Frequency %
<i>Acer pseudoplatanus</i>	14
<i>Acer pseudoplatanus</i> (seedling)	18
<i>Achillea millefolium</i>	4
<i>Achillea ptarmica</i>	4
<i>Aegopodium podagraria</i>	4
<i>Agrostis canina</i>	21
<i>Agrostis capillaris</i>	61
<i>Agrostis stolonifera</i>	93
<i>Ajuga reptans</i>	21
<i>Alchemilla vulgaris</i>	4
<i>Alnus glutinosa</i>	18
<i>Alopecurus pratensis</i>	4
<i>Anemone nemorosa</i>	21
<i>Angelica sylvestris</i>	14
<i>Anthoxanthum odoratum</i>	54
<i>Anthriscus sylvestris</i>	4
<i>Arctium minus</i>	4
<i>Arrhenatherum elatius</i>	14
<i>Arum maculatum</i>	7

Farm scrub n=28 Plant species	Frequency %
<i>Athyrium filix-femina</i>	36
<i>Bellis perennis</i>	7
<i>Betula</i> sp.	11
<i>Betula</i> sp. (seedling)	4
<i>Blechnum spicant</i>	18
<i>Brachypodium sylvaticum</i>	7
<i>Calluna vulgaris</i>	7
<i>Caltha palustris</i>	7
<i>Cardamine flexuosa</i>	32
<i>Cardamine pratensis</i>	18
<i>Carex binervis</i>	7
<i>Carex caryophyllea</i>	4
<i>Carex demissa</i>	4
<i>Carex flacca</i>	7
<i>Carex laevigata</i>	4
<i>Carex nigra</i>	14
<i>Carex ovalis</i>	4
<i>Carex pallescens</i>	4
<i>Carex panicea</i>	4

Farm scrub n=28 Plant species	Frequency %
<i>Carex pilulifera</i>	7
<i>Carex remota</i>	4
<i>Carex rostrata</i>	4
<i>Carex sylvatica</i>	18
<i>Centaurea nigra</i>	7
<i>Cerastium fontanum</i>	39
<i>Chamerion angustifolium</i>	7
<i>Chrysosplenium oppositifolium</i>	21
<i>Cirsium arvense</i>	18
<i>Cirsium palustre</i>	18
<i>Cirsium vulgare</i>	18
<i>Conopodium majus</i>	25
<i>Corylus avellana</i>	25
<i>Crataegus monogyna</i>	68
<i>Crepis capillaris</i>	7
<i>Cynosurus cristatus</i>	21
<i>Dactylis glomerata</i>	39
<i>Dactylorhiza fuchsii</i>	11
<i>Deschampsia cespitosa</i>	21
<i>Deschampsia flexuosa</i>	4
<i>Digitalis purpurea</i>	32
<i>Dryopteris affinis</i>	18
<i>Dryopteris dilatata</i>	50
<i>Dryopteris filix-mas</i>	11
<i>Epilobium montanum</i>	4
<i>Epilobium obscurum</i>	18
<i>Equisetum fluviatile</i>	4
<i>Equisetum palustre</i>	7
<i>Eriophorum angustifolium</i>	4
<i>Eriophorum vaginatum</i>	4
<i>Festuca ovina</i>	14
<i>Festuca pratensis</i>	4
<i>Festuca rubra</i>	29
<i>Filipendula ulmaria</i>	29
<i>Fragaria vesca</i>	11
<i>Fraxinus excelsior</i>	39
<i>Fraxinus excelsior</i> (seedling)	36
<i>Galium aparine</i>	50
<i>Galium odoratum</i>	4
<i>Galium palustre</i>	11
<i>Galium saxatile</i>	11
<i>Geranium robertianum</i>	32
<i>Geum urbanum</i>	32
<i>Glyceria fluitans</i>	11
<i>Hedera helix</i>	46
<i>Heracleum sphondylium</i>	32
<i>Holcus lanatus</i>	82
<i>Holcus mollis</i>	11

Farm scrub n=28 Plant species	Frequency %
<i>Hyacinthoides non-scripta</i>	50
<i>Hypericum</i> sp.	4
<i>Hypochaeris radicata</i>	32
<i>Ilex aquifolium</i>	25
<i>Impatiens glandulifera</i>	4
<i>Isolepis setacea</i>	4
<i>Juncus acutiflorus</i>	11
<i>Juncus articulatus</i>	4
<i>Juncus bufonius</i>	4
<i>Juncus bulbosus</i>	4
<i>Juncus conglomeratus</i>	4
<i>Juncus effusus</i>	57
<i>Juncus squarrosus</i>	7
<i>Lapsana communis</i>	4
<i>Lathyrus linifolius</i>	4
<i>Lathyrus pratensis</i>	11
<i>Leontodon autumnalis</i>	14
<i>Leucanthemum vulgare</i>	4
<i>Listera ovata</i>	4
<i>Lolium perenne</i>	14
<i>Lonicera periclymenum</i>	29
<i>Lotus corniculatus</i>	14
<i>Lotus uliginosus</i>	11
<i>Luzula campestris</i>	14
<i>Lysimachia nemorum</i>	25
<i>Mentha aquatica</i>	4
<i>Molinia caerulea</i>	14
<i>Myrica gale</i>	4
<i>Nardus stricta</i>	4
<i>Oxalis acetosella</i>	36
<i>Pedicularis sylvatica</i>	4
<i>Phleum pratense</i>	4
<i>Phyllitis scolopendrium</i>	11
<i>Picea</i> sp.	4
<i>Pinus</i> sp.	4
<i>Plantago lanceolata</i>	29
<i>Platanthera chlorantha</i>	4
<i>Poa annua</i>	4
<i>Poa pratensis</i>	14
<i>Poa trivialis</i>	75
<i>Polystichum setiferum</i>	4
<i>Potentilla erecta</i>	32
<i>Potentilla reptans</i>	4
<i>Potentilla sterilis</i>	14
<i>Primula vulgaris</i>	29
<i>Prunella vulgaris</i>	25
<i>Prunus avium</i> (seedling)	4
<i>Prunus spinosa</i>	54

Farm scrub n=28 Plant species	Frequency %
<i>Pteridium aquilinum</i>	29
<i>Quercus</i> sp.	7
<i>Ranunculus acris</i>	32
<i>Ranunculus auricomus</i>	4
<i>Ranunculus ficaria</i>	32
<i>Ranunculus flammula</i>	14
<i>Ranunculus repens</i>	75
<i>Rhinanthus minus</i>	4
<i>Rosa</i> sp.	18
<i>Rubus fruticosus</i>	96
<i>Rubus idaeus</i>	18
<i>Rumex acetosa</i>	79
<i>Rumex acetosella</i>	4
<i>Rumex crispus</i>	7
<i>Rumex obtusifolius</i>	36
<i>Rumex sanguineus</i>	18
<i>Salix cinerea</i>	36
<i>Sambucus nigra</i>	21
<i>Sanicula europaea</i>	7
<i>Scirpus cespitosus</i>	4
<i>Scrophularia nodosa</i>	4
<i>Senecio aquatica</i>	7
<i>Senecio jacobea</i>	29
<i>Silene dioica</i>	4
<i>Sonchus asper</i>	4
<i>Sorbus aucuparia</i>	18
<i>Sorbus aucuparia</i> (seedling)	7
<i>Sphagnum auriculatum</i>	4

Farm scrub n=28 Plant species	Frequency %
<i>Stachys sylvatica</i>	11
<i>Stellaria alsine</i>	18
<i>Stellaria graminea</i>	11
<i>Stellaria holostea</i>	14
<i>Stellaria media</i>	18
<i>Stellaris alsine</i>	4
<i>Succisa pratensis</i>	7
<i>Taraxacum officinale</i>	39
<i>Teucrium scorodonia</i>	4
<i>Trifolium pratense</i>	11
<i>Trifolium repens</i>	36
<i>Ulex europaeus</i>	68
<i>Umbilicus rupestris</i>	7
<i>Urtica dioica</i>	43
<i>Vaccinium myrtillus</i>	7
<i>Valeriana officinalis</i>	4
<i>Veronica beccabunga</i>	7
<i>Veronica chamaedrys</i>	64
<i>Veronica montana</i>	7
<i>Veronica serpyllifolia</i>	11
<i>Vicia sepium</i>	29
<i>Viola palustris</i>	4
<i>Viola riviniana</i>	46

Retained winter stubble n=9 Plant species	Frequency %
<i>Acer pseudoplatanus</i>	11
<i>Agropyron repens</i>	33
<i>Agrostis stolonifera</i>	78
<i>Alopecurus geniculatus</i>	56
<i>Alopecurus pratensis</i>	11
<i>Anagallis arvensis</i>	22
<i>Anthoxanthum odoratum</i>	11
<i>Aphanes arvensis</i>	11
<i>Arrhenatherum elatius</i>	11
<i>Atriplex patula</i>	11
<i>Avena</i> sp.	11
<i>Bellis perennis</i>	11
<i>Capsella bursa-pastoris</i>	11
<i>Cardamine hirsuta</i>	11

Retained winter stubble n=9 Plant species	Frequency %
<i>Cerastium fontanum</i>	33
<i>Cirsium arvense</i>	33
<i>Cirsium vulgare</i>	22
<i>Festuca rubra</i>	11
<i>Fraxinus excelsior</i>	33
<i>Fumaria</i> sp.	22
<i>Galium aparine</i>	22
<i>Glyceria fluitans</i>	11
<i>Heracleum sphondylium</i>	11
<i>Holcus lanatus</i>	33
<i>Holcus mollis</i>	11
<i>Hordeum</i> sp.	78
<i>Juncus bufonius</i>	22
<i>Juncus bulbosus</i>	11

Retained winter stubble n=9 Plant species	Frequency %
<i>Lamium purpureum</i>	33
<i>Lathyrus pratensis</i>	11
<i>Lolium perenne</i>	33
<i>Lotus uliginosus</i>	11
<i>Matricaria discoidea</i>	22
<i>Myosotis arvensis</i>	33
<i>Plantago major</i>	11
<i>Poa annua</i>	100
<i>Poa trivialis</i>	89
<i>Polygonum aviculare</i>	78
<i>Polygonum hydropiper</i>	11
<i>Polygonum persicaria</i>	22
<i>Ranunculus repens</i>	44
<i>Rubus fruticosus</i>	11
<i>Rumex acetosa</i>	11

Retained winter stubble n=9 Plant species	Frequency %
<i>Rumex crispus</i>	11
<i>Rumex obtusifolius</i>	22
<i>Senecio jacobea</i>	11
<i>Solanum tuberosum</i>	11
<i>Sonchus asper</i>	22
<i>Stellaria media</i>	67
<i>Taraxacum officinale</i> agg.	11
<i>Trifolium repens</i>	11
<i>Triticum</i> sp.	22
<i>Urtica dioica</i>	33
<i>Veronica arvensis</i>	33
<i>Vicia cracca</i>	22
<i>Viola arvensis</i>	11

Wild bird cover (CGW/AFW) n=16 Plant species	Frequency %
<i>Agropyron repens</i>	13
<i>Agrostis stolonifera</i>	75
<i>Alopecurus geniculatus</i>	44
<i>Anagallis arvensis</i>	19
<i>Aphanes arvensis</i>	19
<i>Arctium minus</i>	6
<i>Avena</i> sp.	6
<i>Bellis perennis</i>	6
<i>Brassica nigra</i>	6
<i>Brassica</i> sp.	75
<i>Capsella bursa-pastoris</i>	31
<i>Cardamine flexuosa</i>	13
<i>Cardamine hirsuta</i>	31
<i>Cardamine pratensis</i>	6
<i>Carex</i> sp.	6
<i>Cerastium fontanum</i>	88
<i>Chenopodium album</i>	13
<i>Chenopodium quinoa</i>	25
<i>Cichorium intybus</i>	6
<i>Cirsium arvense</i>	31
<i>Cirsium vulgare</i>	31
<i>Convolvulus arvensis</i>	6
<i>Crepis capillaris</i>	6
<i>Dactylis glomerata</i>	6
<i>Digitalis purpurea</i>	6
<i>Epilobium hirsutum</i>	6
<i>Epilobium obscurum</i>	44

Wild bird cover (CGW/AFW) n=16 Plant species	Frequency %
<i>Euphorbia helioscopia</i>	6
<i>Fagopyrum esculentum</i>	19
<i>Fallopia convolvulus</i>	6
<i>Festuca rubra</i>	6
<i>Fumaria</i> sp.	6
<i>Galeopsis tetrahit</i>	44
<i>Galium aparine</i>	25
<i>Geranium dissectum</i>	6
<i>Geranium molle</i>	6
<i>Glyceria fluitans</i>	25
<i>Gnaphalium uliginosum</i>	13
<i>Hedera helix</i>	13
<i>Helianthus annuus</i>	13
<i>Holcus lanatus</i>	50
<i>Hordeum</i> sp.	19
<i>Hypericum</i> sp.	6
<i>Juncus bufonius</i>	50
<i>Lamium purpureum</i>	13
<i>Lapsana communis</i>	6
<i>Linum usitatissimum</i>	6
<i>Lolium multiflorum</i>	13
<i>Lolium perenne</i>	25
<i>Lotus uliginosus</i>	6
<i>Matricaria discoidea</i>	25
<i>Melilotus officinalis</i>	13
<i>Myosotis arvensis</i>	38
<i>Myosotis discolor</i>	13

Wild bird cover (CGW/AFW) n=16 Plant species	Frequency %
<i>Panicum miliaceum</i>	13
<i>Phacelia tanacetifolia</i>	25
<i>Phleum pratense</i>	13
<i>Plantago lanceolata</i>	6
<i>Plantago major</i>	31
<i>Poa annua</i>	69
<i>Poa trivialis</i>	94
<i>Polygonum aviculare</i>	44
<i>Polygonum hydropiper</i>	31
<i>Polygonum lapathifolium</i>	6
<i>Polygonum persicaria</i>	69
<i>Ranunculus acris</i>	6
<i>Ranunculus repens</i>	94
<i>Raphanus</i> sp.	19
<i>Rubus fruticosus</i>	6
<i>Rumex acetosa</i>	13
<i>Rumex crispus</i>	6
<i>Rumex obtusifolius</i>	69
<i>Sagina procumbens</i>	6
<i>Scrophularia nodosa</i>	6

Wild bird cover (CGW/AFW) n=16 Plant species	Frequency %
<i>Senecio aquaticus</i>	6
<i>Senecio jacobea</i>	6
<i>Senecio vulgaris</i>	19
<i>Sinapsis alba</i>	25
<i>Solanum tuberosum</i>	6
<i>Sonchus asper</i>	38
<i>Spergula arvensis</i>	31
<i>Stachys sylvatica</i>	6
<i>Stellaria media</i>	75
<i>Taraxacum officinale</i> agg.	6
<i>Trifolium repens</i>	63
<i>Triticum</i> sp.	13
<i>Urtica dioica</i>	69
<i>Veronica arvensis</i>	38
<i>Veronica persica</i>	6
<i>Veronica serpyllifolia</i>	38
<i>Vicia cracca</i>	6
<i>Viola arvensis</i>	31
<i>Zea mays</i>	25

Rough grass field margin n=8 Plant species	Frequency %
<i>Achillea millefolium</i>	13
<i>Agropyron repens</i>	38
<i>Agrostis stolonifera</i>	100
<i>Alopecurus geniculatus</i>	50
<i>Alopecurus pratensis</i>	13
<i>Anagallis arvensis</i>	25
<i>Anthoxanthum odoratum</i>	13
<i>Aphanes arvensis</i>	13
<i>Atriplex patula</i>	13
<i>Barbarea vulgaris</i>	13
<i>Brassica rapa</i>	13
<i>Bromus mollis</i>	13
<i>Capsella bursa-pastoris</i>	13
<i>Cardamine hirsuta</i>	13
<i>Centaurea nigra</i>	13
<i>Cerastium fontanum</i>	50
<i>Chrysanthemum leucanthemum</i>	13
<i>Cirsium arvense</i>	50
<i>Cirsium vulgare</i>	88
<i>Cynosurus cristatus</i>	38
<i>Dactylis glomerata</i>	63
<i>Daucus carota</i>	13

Rough grass field margin n=8 Plant species	Frequency %
<i>Epilobium obscurum</i>	25
<i>Equisetum arvense</i>	25
<i>Euphorbia helioscopia</i>	25
<i>Festuca pratensis</i>	25
<i>Festuca rubra</i>	88
<i>Galeopsis tetrahit</i>	13
<i>Galium aparine</i>	13
<i>Geranium dissectum</i>	13
<i>Geranium robertianum</i>	13
<i>Glyceria fluitans</i>	25
<i>Hedera helix</i>	13
<i>Heracleum sphondylium</i>	13
<i>Holcus lanatus</i>	50
<i>Hordeum</i> sp.	25
<i>Juncus bufonius</i>	50
<i>Lamium purpureum</i>	25
<i>Lolium perenne</i>	38
<i>Lotus corniculatus</i>	13
<i>Malva moschata</i>	13
<i>Matricaria discoidea</i>	25
<i>Myosotis arvensis</i>	50
<i>Phleum pratense</i>	25

Rough grass field margin n=8 Plant species	Frequency %
<i>Plantago major</i>	75
<i>Poa annua</i>	38
<i>Poa trivialis</i>	75
<i>Polygonum aviculare</i>	50
<i>Polygonum lapathifolium</i>	13
<i>Polygonum persicaria</i>	38
<i>Potentilla anserina</i>	25
<i>Prunella vulgaris</i>	13
<i>Ranunculus repens</i>	75
<i>Reseda lutea</i>	13
<i>Rubus fruticosus</i>	38
<i>Rumex crispus</i>	13
<i>Rumex obtusifolius</i>	63
<i>Senecio jacobea</i>	50
<i>Sonchus asper</i>	88
<i>Spergula arvensis</i>	38

Rough grass field margin n=8 Plant species	Frequency %
<i>Stachys sylvatica</i>	13
<i>Stellaria media</i>	50
<i>Taraxacum officinale</i> agg.	13
<i>Torilis japonica</i>	13
<i>Trifolium repens</i>	100
<i>Tripleurospermum inodorum</i>	25
<i>Triticum</i> sp.	13
<i>Urtica dioica</i>	25
<i>Veronica arvensis</i>	13
<i>Veronica persica</i>	13
<i>Veronica serpyllifolia</i>	13
<i>Vicia cracca</i>	13
<i>Vicia sepium</i>	13
<i>Viola arvensis</i>	13

Buffers (BUI/BUU) n=11 Plant species	Frequency %
<i>Agropyron repens</i>	27
<i>Agrostis capillaris</i>	27
<i>Agrostis stolonifera</i>	91
<i>Alchemilla mollis</i>	9
<i>Alopecurus geniculatus</i>	18
<i>Anemone nemorosa</i>	9
<i>Angelica sylvestris</i>	9
<i>Anthoxanthum odoratum</i>	55
<i>Anthriscus sylvestris</i>	9
<i>Arrhenatherum elatius</i>	27
<i>Athyrium filix-femina</i>	9
<i>Bellis perennis</i>	9
<i>Blechnum spicant</i>	9
<i>Calystegia sepium</i>	9
<i>Cardamine flexuosa</i>	27
<i>Cardamine pratensis</i>	36
<i>Carex arenaria</i>	9
<i>Carex echinata</i>	9
<i>Carex flacca</i>	9
<i>Carex nigra</i>	9
<i>Carex ovalis</i>	9
<i>Carex panicea</i>	9
<i>Cerastium fontanum</i>	45
<i>Cirsium arvense</i>	64
<i>Cirsium palustre</i>	18
<i>Cirsium vulgare</i>	9

Buffers (BUI/BUU) n=11 Plant species	Frequency %
<i>Cynosurus cristatus</i>	9
<i>Dactylis glomerata</i>	18
<i>Deschampsia cespitosa</i>	9
<i>Epilobium hirsutum</i>	9
<i>Epilobium obscurum</i>	9
<i>Epilobium palustre</i>	9
<i>Equisetum arvense</i>	9
<i>Equisetum palustre</i>	27
<i>Festuca ovina</i>	9
<i>Festuca rubra</i>	36
<i>Filipendula ulmaria</i>	18
<i>Fraxinus excelsior</i>	9
<i>Galium aparine</i>	9
<i>Galium palustre</i>	18
<i>Galium saxatile</i>	9
<i>Galium verum</i>	9
<i>Gallium aparine</i>	9
<i>Glyceria fluitans</i>	18
<i>Heracleum sphondylium</i>	9
<i>Holcus lanatus</i>	100
<i>Holcus mollis</i>	45
<i>Hyacinthoides non-scripta</i>	9
<i>Hypochaeris radicata</i>	18
<i>Jasione montana</i>	9
<i>Juncus acutiflorus</i>	27
<i>Juncus bufonius</i>	9

Buffers (BUI/BUU) n=11 Plant species	Frequency %
<i>Juncus effusus</i>	82
<i>Lathyrus pratensis</i>	27
<i>Lolium perenne</i>	45
<i>Lonicera periclymenum</i>	9
<i>Lotus corniculatus</i>	9
<i>Lotus uliginosus</i>	9
<i>Mentha aquatica</i>	9
<i>Oxalis acetosella</i>	9
<i>Phalaris arundinacea</i>	9
<i>Phleum pratense</i>	18
<i>Phragmites australis</i>	9
<i>Plantago lanceolata</i>	18
<i>Poa pratensis</i>	45
<i>Poa trivialis</i>	91
<i>Potentilla anserina</i>	9
<i>Potentilla erecta</i>	27
<i>Potentilla palustris</i>	9
<i>Prunella vulgaris</i>	9
<i>Pteridium aquilinum</i>	9
<i>Ranunculus acris</i>	36
<i>Ranunculus repens</i>	73

Buffers (BUI/BUU) n=11 Plant species	Frequency %
<i>Rubus fruticosus</i>	27
<i>Rubus idaeus</i>	9
<i>Rumex acetosa</i>	55
<i>Rumex crispus</i>	9
<i>Rumex obtusifolius</i>	45
<i>Rumex sanguineus</i>	9
<i>Senecio jacobea</i>	18
<i>Sonchus arvensis</i>	9
<i>Stellaria alsine</i>	9
<i>Stellaria graminea</i>	18
<i>Stellaria media</i>	9
<i>Taraxacum officinale</i> agg.	36
<i>Trifolium repens</i>	73
<i>Ulex europaeus</i>	9
<i>Urtica dioica</i>	18
<i>Valeriana officinalis</i>	9
<i>Veronica chamaedrys</i>	18
<i>Veronica serpyllifolia</i>	9
<i>Viola riviniana</i>	9

Field boundary restoration (ground flora) n=50 Plant species	Frequency %
<i>Achillea ptarmica</i>	2
<i>Aegopodium podagraria</i>	4
<i>Agropyron repens</i>	14
<i>Agrostis canina</i>	2
<i>Agrostis capillaris</i>	32
<i>Agrostis stolonifera</i>	68
<i>Alopecurus pratensis</i>	4
<i>Angelica sylvestris</i>	2
<i>Anthoxanthum odoratum</i>	22
<i>Anthriscus sylvestris</i>	8
<i>Arrhenatherum elatius</i>	36
<i>Bellis perennis</i>	2
<i>Bromus ramosus</i>	2
<i>Cardamine pratensis</i>	4
<i>Carex sylvatica</i>	2
<i>Cerastium fontanum</i>	28
<i>Chenopodium album</i>	2
<i>Cirsium arvense</i>	32
<i>Cirsium palustre</i>	4
<i>Cirsium vulgare</i>	4
<i>Crataegus monogyna</i> (seedling)	10

Field boundary restoration (ground flora) n=50 Plant species	Frequency %
<i>Crepis capillaris</i>	4
<i>Cynosurus cristatus</i>	8
<i>Dactylis glomerata</i>	64
<i>Digitalis purpurea</i>	12
<i>Dryopteris dilatata</i>	6
<i>Epilobium montanum</i>	2
<i>Equisetum arvense</i>	2
<i>Festuca pratensis</i>	2
<i>Festuca rubra</i>	48
<i>Fraxinus excelsior</i> (seedling)	2
<i>Galium aparine</i>	28
<i>Galium saxatile</i>	10
<i>Geranium robertianum</i>	4
<i>Geum urbanum</i>	2
<i>Glyceria fluitans</i>	2
<i>Hedera helix</i>	26
<i>Heracleum sphondylium</i>	10
<i>Holcus lanatus</i>	82
<i>Holcus mollis</i>	18
<i>Hypochaeris radicata</i>	4
<i>Juncus bufonius</i>	2
<i>Juncus conglomeratus</i>	4

Field boundary restoration (ground flora) n=50	Frequency %
Plant species	
<i>Juncus effusus</i>	4
<i>Lapsana communis</i>	2
<i>Lathyrus pratensis</i>	12
<i>Lolium perenne</i>	38
<i>Lonicera periclymenum</i>	6
<i>Lotus corniculatus</i>	4
<i>Lotus uliginosus</i>	2
<i>Matricaria discoidea</i>	2
<i>Plantago lanceolata</i>	6
<i>Plantago major</i>	2
<i>Poa annua</i>	16
<i>Poa pratensis</i>	32
<i>Poa trivialis</i>	50
<i>Polygonum aviculare</i>	2
<i>Polygonum persicaria</i>	2
<i>Potentilla erecta</i>	2
<i>Potentilla sterilis</i>	2
<i>Primula vulgaris</i>	4
<i>Ranunculus acris</i>	4
<i>Ranunculus repens</i>	30
<i>Rosa</i> sp.	4
<i>Rubus fruticosus</i>	22

Field boundary restoration (ground flora) n=50	Frequency %
Plant species	
<i>Rumex acetosa</i>	34
<i>Rumex acetosella</i>	2
<i>Rumex crispus</i>	6
<i>Rumex obtusifolius</i>	2
<i>Sagina procumbens</i>	6
<i>Senecio jacobea</i>	10
<i>Sonchus asper</i>	6
<i>Stellaria graminea</i>	4
<i>Stellaria holostea</i>	2
<i>Stellaria media</i>	8
<i>Taraxacum officinale</i> agg.	22
<i>Trifolium repens</i>	14
<i>Ulex europaeus</i>	10
<i>Urtica dioica</i>	36
<i>Veronica beccabunga</i>	2
<i>Veronica chamaedrys</i>	10
<i>Veronica serpyllifolia</i>	6
<i>Vicia sepium</i>	18
<i>Viola riviniana</i>	18

**Appendix 4.** Percentage frequency of carabid beetle species captured in 2002/2003 on sampled habitats from farms participating in the Countryside Management Scheme.

Species-rich dry grassland n=8	Frequency %	Species-rich dry grassland n=8	Frequency %
Beetle species		Beetle species	
<i>Abax parallelepipedus</i>	88	<i>Carabus problematicus faeroensis</i>	13
<i>Agonum dorsale</i>	25	<i>Clivina fossor</i>	13
<i>Agonum fuliginosum</i>	38	<i>Cychrus caraboides</i>	25
<i>Agonum muelleri</i>	63	<i>Harpalus latus</i>	25
<i>Amara aenea</i>	38	<i>Leistus rufescens</i>	13
<i>Amara aulica</i>	13	<i>Loricera pilicornis</i>	75
<i>Amara communis</i>	50	<i>Nebria brevicollis</i>	100
<i>Amara lunicollis</i>	25	<i>Notiophilus germinyi</i>	13
<i>Amara ovata</i>	13	<i>Olisthopus rotundatus</i>	13
<i>Amara plebeja</i>	25	<i>Patrobus assimilis</i>	25
<i>Bembidion guttula</i>	13	<i>Pterostichus madidus</i>	38
<i>Bembidion lampros</i>	25	<i>Pterostichus melanarius</i>	88
<i>Bembidion mannerheimi</i>	13	<i>Pterostichus niger</i>	100
<i>Bembidion tetracolum</i>	13	<i>Pterostichus nigrita</i>	75
<i>Calathus fuscipes</i>	38	<i>Pterostichus rhaeticus</i>	13
<i>Calathus melanocephalus</i>	38	<i>Pterostichus strenuus</i>	100
<i>Calathus piceus</i>	13	<i>Pterostichus vernalis</i>	50
<i>Carabus arvensis</i>	13	<i>Synuchus nivalis</i>	25
<i>Carabus granulatus</i>	88	<i>Trechus obtusus</i>	13
<i>Carabus nemoralis</i>	25	<i>Trechus quadristriatus</i>	25
<i>Carabus problematicus</i>	13		

Species -rich wet grassland n=10	Frequency %	Species -rich wet grassland n=10	Frequency %
Beetle species		Beetle species	
<i>Agonum fuliginosum</i>	30	<i>Patrobus assimilis</i>	10
<i>Agonum muelleri</i>	30	<i>Pterostichus anthracinus</i>	10
<i>Agonum viduum</i>	10	<i>Pterostichus diligens</i>	50
<i>Amara aulica</i>	10	<i>Pterostichus melanarius</i>	40
<i>Bembidion lampros</i>	20	<i>Pterostichus minor</i>	20
<i>Carabus clatratus</i>	10	<i>Pterostichus niger</i>	100
<i>Carabus granulatus</i>	80	<i>Pterostichus nigrita</i>	90
<i>Carabus problematicus</i>	30	<i>Pterostichus rhaeticus</i>	10
<i>Chlaenius nigricornis</i>	10	<i>Pterostichus strenuus</i>	30
<i>Clivina fossor</i>	20	<i>Pterostichus vernalis</i>	10
<i>Cychrus caraboides</i>	10	<i>Pterostichus versicolor</i>	10
<i>Elaphrus cupreus</i>	50	<i>Trichocellus placidus</i>	10
<i>Loricera pilicornis</i>	20		
<i>Nebria brevicollis</i>	50		

Species-rich hay meadow n=6	Frequency %
Beetle species	
<i>Agonum assimile</i>	33
<i>Agonum fuliginosum</i>	33
<i>Agonum moestum</i>	33
<i>Agonum muelleri</i>	33
<i>Carabus clatratus</i>	17
<i>Carabus granulatus</i>	50
<i>Carabus nitens</i>	17
<i>Chlaenius nigricornis</i>	17
<i>Elaphrus cupreus</i>	83
<i>Leistus fulvibarbis</i>	17
<i>Loricera pilicornis</i>	67

Species-rich hay meadow n=6	Frequency %
Beetle species	
<i>Nebria brevicollis</i>	67
<i>Pterostichus diligens</i>	67
<i>Pterostichus madidus</i>	33
<i>Pterostichus melanarius</i>	67
<i>Pterostichus minor</i>	17
<i>Pterostichus niger</i>	83
<i>Pterostichus nigrita</i>	50
<i>Pterostichus rhaeticus</i>	83
<i>Pterostichus strenuus</i>	17
<i>Pterostichus versicolor</i>	17

Lowland wet grassland n=12	Frequency %
Beetle species	
<i>Abax parallelepipedus</i>	17
<i>Agonum fuliginosum</i>	67
<i>Agonum muelleri</i>	25
<i>Agonum obscurum</i>	8
<i>Agonum viduum</i>	8
<i>Amara aenea</i>	17
<i>Badister bipustulatus</i>	8
<i>Bembidion aeneum</i>	17
<i>Bembidion mannerheimi</i>	8
<i>Bembidion tetracolum</i>	8
<i>Bradycellus sharpi</i>	8
<i>Calathus piceus</i>	17
<i>Carabus granulatus</i>	75
<i>Clivina fossor</i>	8

Lowland wet grassland n=12	Frequency %
Beetle species	
<i>Elaphrus cupreus</i>	25
<i>Loricera pilicornis</i>	8
<i>Nebria brevicollis</i>	67
<i>Pterostichus anthracinus</i>	8
<i>Pterostichus diligens</i>	75
<i>Pterostichus madidus</i>	8
<i>Pterostichus melanarius</i>	50
<i>Pterostichus minor</i>	8
<i>Pterostichus niger</i>	92
<i>Pterostichus nigrita</i>	83
<i>Pterostichus strenuus</i>	50
<i>Trichocellus placidus</i>	8

Dry heath n=6	Frequency %
Beetle species	
<i>Abax parallelepipedus</i>	67
<i>Agonum fuliginosum</i>	33
<i>Agonum muelleri</i>	17
<i>Amara aenea</i>	17
<i>Amara lunicollis</i>	50
<i>Bembidion lampros</i>	17
<i>Carabus arvensis</i>	67
<i>Carabus glabratus</i>	33

Dry heath n=6	Frequency %
Beetle species	
<i>Carabus granulatus</i>	17
<i>Carabus nemoralis</i>	33
<i>Carabus problematicus</i>	50
<i>Clivina fossor</i>	17
<i>Cychrus caraboides</i>	33
<i>Leistus rufescens</i>	17
<i>Loricera pilicornis</i>	50
<i>Nebria brevicollis</i>	83

Dry heath n=6	Frequency %
Beetle species	
<i>Nebria salina</i>	67
<i>Notiophilus aquaticus</i>	17
<i>Notiophilus biguttatus</i>	33
<i>Notiophilus palustris</i>	17
<i>Patrobus assimilis</i>	17
<i>Pterostichus diligens</i>	67

Dry heath n=6	Frequency %
Beetle species	
<i>Pterostichus melanarius</i>	67
<i>Pterostichus niger</i>	83
<i>Pterostichus nigrita</i>	17
<i>Pterostichus rhaeticus</i>	100
<i>Pterostichus strenuus</i>	50
<i>Pterostichus versicolor</i>	17

Wet heath n=12	Frequency %
Beetle species	
<i>Abax parallelepipedus</i>	25
<i>Agonum muelleri</i>	8
<i>Amara lunicollis</i>	8
<i>Bembidion lampros</i>	8
<i>Calathus melanocephalus</i>	8
<i>Carabus arvensis</i>	50
<i>Carabus clatratus</i>	8
<i>Carabus glabratus</i>	58
<i>Carabus granulatus</i>	75
<i>Carabus nemoralis</i>	8
<i>Carabus nitens</i>	17
<i>Carabus problematicus</i>	83
<i>Cychrus caraboides</i>	25
<i>Elaphrus cupreus</i>	17
<i>Leistus rufescens</i>	8

Wet heath n=12	Frequency %
Beetle species	
<i>Loricera pilicornis</i>	17
<i>Nebria brevicollis</i>	25
<i>Nebria salina</i>	17
<i>Notiophilus biguttatus</i>	17
<i>Notiophilus palustris</i>	8
<i>Olisthopus rotundatus</i>	8
<i>Patrobus assimilis</i>	8
<i>Pterostichus diligens</i>	25
<i>Pterostichus madidus</i>	17
<i>Pterostichus melanarius</i>	42
<i>Pterostichus niger</i>	92
<i>Pterostichus nigrita</i>	67
<i>Pterostichus rhaeticus</i>	83
<i>Pterostichus strenuus</i>	17
<i>Trechus quadristriatus</i>	17

Blanket bog n=2	Frequency %
Beetle species	
<i>Abax parallelepipedus</i>	50
<i>Calathus fuscipes</i>	50
<i>Carabus arvensis</i>	50
<i>Carabus granulatus</i>	100
<i>Carabus problematicus</i>	50
<i>Nebria brevicollis</i>	100
<i>Nebria salina</i>	50
<i>Notiophilus biguttatus</i>	50

Blanket bog n=2	Frequency %
Beetle species	
<i>Olisthopus rotundatus</i>	50
<i>Pterostichus niger</i>	100
<i>Pterostichus nigrita</i>	50
<i>Pterostichus rhaeticus</i>	100
<i>Pterostichus versicolor</i>	50

Degraded heath n=10 Beetle species	Frequency %
<i>Abax parallelepipedus</i>	22
<i>Agonum fuliginosum</i>	11
<i>Agonum muelleri</i>	11
<i>Amara lunicollis</i>	33
<i>Amara plebeja</i>	11
<i>Bembidion aeneum</i>	11
<i>Bembidion mannerheimi</i>	11
<i>Calathus fuscipes</i>	22
<i>Carabus arvensis</i>	33
<i>Carabus glabratus</i>	11
<i>Carabus granulatus</i>	78
<i>Carabus nitens</i>	33
<i>Carabus problematicus</i>	44
<i>Clivina fossor</i>	11
<i>Cychrus caraboides</i>	22
<i>Elaphrus cupreus</i>	11

Degraded heath n=10 Beetle species	Frequency %
<i>Harpalus latus</i>	11
<i>Loricera pilicornis</i>	44
<i>Nebria brevicollis</i>	56
<i>Nebria salina</i>	44
<i>Notiophilus biguttatus</i>	22
<i>Patrobus assimilis</i>	44
<i>Pterostichus diligens</i>	67
<i>Pterostichus madidus</i>	11
<i>Pterostichus melanarius</i>	78
<i>Pterostichus niger</i>	100
<i>Pterostichus nigrita</i>	33
<i>Pterostichus rhaeticus</i>	89
<i>Pterostichus strenuus</i>	22
<i>Pterostichus vernalis</i>	44
<i>Pterostichus versicolor</i>	22

Rough moorland grazing n=9 Beetle species	Frequency %
<i>Abax parallelepipedus</i>	11
<i>Agonum fuliginosum</i>	33
<i>Agonum muelleri</i>	11
<i>Amara aulica</i>	22
<i>Amara lunicollis</i>	33
<i>Carabus arvensis</i>	33
<i>Carabus glabratus</i>	22
<i>Carabus granulatus</i>	56
<i>Carabus nemoralis</i>	11
<i>Carabus problematicus</i>	22
<i>Elaphrus cupreus</i>	11
<i>Leistus rufescens</i>	22
<i>Loricera pilicornis</i>	11

Rough moorland grazing n=9 Beetle species	Frequency %
<i>Nebria brevicollis</i>	56
<i>Nebria salina</i>	11
<i>Notiophilus biguttatus</i>	11
<i>Patrobus assimilis</i>	56
<i>Pterostichus diligens</i>	56
<i>Pterostichus madidus</i>	22
<i>Pterostichus melanarius</i>	56
<i>Pterostichus niger</i>	100
<i>Pterostichus nigrita</i>	33
<i>Pterostichus rhaeticus</i>	78
<i>Pterostichus strenuus</i>	78
<i>Pterostichus vernalis</i>	11

Lowland raised bog n=8 Beetle species	Frequency %
<i>Abax parallelepipedus</i>	50
<i>Agonum muelleri</i>	13
<i>Amara communis</i>	13
<i>Bembidion lampros</i>	25
<i>Carabus arvensis</i>	25
<i>Carabus granulatus</i>	25
<i>Carabus nemoralis</i>	13
<i>Loricera pilicornis</i>	13
<i>Nebria brevicollis</i>	13

Lowland raised bog n=8 Beetle species	Frequency %
<i>Notiophilus germinyi</i>	13
<i>Notiophilus palustris</i>	13
<i>Olisthopus rotundatus</i>	25
<i>Pterostichus diligens</i>	50
<i>Pterostichus madidus</i>	13
<i>Pterostichus melanarius</i>	50
<i>Pterostichus niger</i>	88
<i>Pterostichus nigrita</i>	100

Farm woodland n=11 Beetle species	Frequency %
<i>Abax parallelepipedus</i>	64
<i>Agonum albipes</i>	27
<i>Agonum assimile</i>	27
<i>Agonum dorsale</i>	18
<i>Agonum fuliginosum</i>	36
<i>Agonum moestum</i>	18
<i>Agonum muelleri</i>	45
<i>Agonum obscurum</i>	9
<i>Amara aenea</i>	9
<i>Amara aulica</i>	9
<i>Badister bipustulatus</i>	18
<i>Bembidion aeneum</i>	18
<i>Bembidion lampros</i>	9
<i>Bembidion mannerheimi</i>	18
<i>Bembidion tetracolum</i>	9
<i>Calathus piceus</i>	45
<i>Carabus arvensis</i>	9
<i>Carabus granulatus</i>	55
<i>Carabus nemoralis</i>	27
<i>Carabus problematicus</i>	18
<i>Chlaenius nigricornis</i>	9
<i>Clivina fossor</i>	27
<i>Cychrus caraboides</i>	64

Farm woodland n=11 Beetle species	Frequency %
<i>Elaphrus cupreus</i>	64
<i>Harpalus rufibarbis</i>	9
<i>Harpalus rufipes</i>	9
<i>Leistus fulvibarbis</i>	36
<i>Leistus rufescens</i>	36
<i>Loricera pilicornis</i>	82
<i>Nebria brevicollis</i>	91
<i>Nebria salina</i>	9
<i>Notiophilus biguttatus</i>	36
<i>Olisthopus rotundatus</i>	9
<i>Pterostichus diligens</i>	18
<i>Pterostichus madidus</i>	9
<i>Pterostichus melanarius</i>	100
<i>Pterostichus minor</i>	18
<i>Pterostichus niger</i>	100
<i>Pterostichus nigrita</i>	91
<i>Pterostichus strenuus</i>	91
<i>Pterostichus vernalis</i>	18
<i>Stomis pumicatus</i>	9
<i>Trechus obtusus</i>	9
<i>Trechus quadristriatus</i>	18

Farm scrub n=8	Frequency %
Beetle species	
<i>Abax parallelepipedus</i>	88
<i>Agonum albipes</i>	13
<i>Agonum assimile</i>	25
<i>Agonum dorsale</i>	25
<i>Agonum fuliginosum</i>	63
<i>Agonum muelleri</i>	50
<i>Agonum obscurum</i>	25
<i>Amara aenea</i>	38
<i>Amara communis</i>	25
<i>Amara lunicollis</i>	13
<i>Badister bipustulatus</i>	25
<i>Bembidion guttula</i>	13
<i>Bembidion lampros</i>	38
<i>Bembidion tetracolum</i>	25
<i>Bradycellus sharpi</i>	13
<i>Calathus fuscipes</i>	13
<i>Calathus piceus</i>	38
<i>Carabus granulatus</i>	63
<i>Carabus nemoralis</i>	13
<i>Carabus problematicus</i>	25
<i>Chlaenius nigricornis</i>	13

Farm scrub n=8	Frequency %
Beetle species	
<i>Clivina fossor</i>	38
<i>Cychrus caraboides</i>	50
<i>Elaphrus cupreus</i>	38
<i>Harpalus latus</i>	25
<i>Laemostenus terricola</i>	25
<i>Leistus fulvibarbis</i>	38
<i>Leistus rufescens</i>	50
<i>Loricera pilicornis</i>	63
<i>Nebria brevicollis</i>	88
<i>Notiophilus biguttatus</i>	13
<i>Notiophilus germinyi</i>	13
<i>Olisthopus rotundatus</i>	25
<i>Patrobus assimilis</i>	25
<i>Pterostichus diligens</i>	25
<i>Pterostichus madidus</i>	25
<i>Pterostichus melanarius</i>	88
<i>Pterostichus niger</i>	100
<i>Pterostichus nigrita</i>	75
<i>Pterostichus strenuus</i>	100
<i>Pterostichus vernalis</i>	13

Field boundary restoration n=11	Frequency %
Beetle species	
<i>Abax parallelepipedus</i>	62
<i>Agonum assimile</i>	15
<i>Agonum dorsale</i>	62
<i>Agonum fuliginosum</i>	23
<i>Agonum muelleri</i>	54
<i>Agonum obscurum</i>	23
<i>Amara aenea</i>	31
<i>Amara aulica</i>	23
<i>Amara familiaris</i>	8
<i>Amara lunicollis</i>	15
<i>Amara ovata</i>	8
<i>Asaphidion curtum</i>	8
<i>Badister bipustulatus</i>	23
<i>Bembidion aeneum</i>	15
<i>Bembidion bruxellense</i>	38
<i>Bembidion guttula</i>	8
<i>Bembidion lampros</i>	38
<i>Bembidion mannerheimi</i>	23

Field boundary restoration n=11	Frequency %
Beetle species	
<i>Calathus fuscipes</i>	8
<i>Calathus melanocephalus</i>	8
<i>Calathus piceus</i>	46
<i>Carabus glabratus</i>	8
<i>Carabus granulatus</i>	85
<i>Carabus nemoralis</i>	23
<i>Carabus problematicus</i>	8
<i>Clivina fossor</i>	23
<i>Cychrus caraboides</i>	15
<i>Elaphrus cupreus</i>	15
<i>Harpalus latus</i>	8
<i>Harpalus rufibarbis</i>	8
<i>Harpalus rufipes</i>	8
<i>Laemostenus terricola</i>	8
<i>Leistus fulvibarbis</i>	23
<i>Leistus rufescens</i>	38
<i>Loricera pilicornis</i>	77
<i>Nebria brevicollis</i>	77

Field boundary restoration n=11	Frequency %
Beetle species	
<i>Nebria salina</i>	8
<i>Notiophilus biguttatus</i>	15
<i>Patrobus assimilis</i>	8
<i>Pterostichus diligens</i>	15
<i>Pterostichus madidus</i>	23
<i>Pterostichus melanarius</i>	92
<i>Pterostichus minor</i>	8
<i>Pterostichus niger</i>	92

Field boundary restoration n=11	Frequency %
Beetle species	
<i>Pterostichus nigrita</i>	77
<i>Pterostichus rhaeticus</i>	15
<i>Pterostichus strenuus</i>	92
<i>Pterostichus vernalis</i>	23
<i>Stomis pumicatus</i>	8
<i>Synuchus nivalis</i>	15
<i>Trechus obtusus</i>	8
<i>Trechus quadristriatus</i>	8

Retained winter stubble n=12	Frequency %
Beetle species	
<i>Abax parallelepipedus</i>	25
<i>Agonum albipes</i>	8
<i>Agonum assimile</i>	33
<i>Agonum dorsale</i>	100
<i>Agonum fuliginosum</i>	25
<i>Agonum marginatum</i>	8
<i>Agonum moestum</i>	50
<i>Agonum muelleri</i>	100
<i>Agonum obscurum</i>	33
<i>Amara aenea</i>	58
<i>Amara aulica</i>	8
<i>Amara lunicollis</i>	8
<i>Amara ovata</i>	17
<i>Amara plebeja</i>	17
<i>Asaphidion curtum</i>	25
<i>Badister bipustulatus</i>	8
<i>Bembidion aeneum</i>	50
<i>Bembidion bruxellense</i>	92
<i>Bembidion guttula</i>	33
<i>Bembidion lampros</i>	75
<i>Bembidion mannerheimi</i>	83
<i>Bembidion obtusum</i>	17
<i>Bradycellus verbasci</i>	8
<i>Calathus fuscipes</i>	25
<i>Calathus melanocephalus</i>	42
<i>Calathus piceus</i>	8

Retained winter stubble n=12	Frequency %
Beetle species	
<i>Carabus granulatus</i>	100
<i>Carabus nemoralis</i>	17
<i>Clivina fossor</i>	58
<i>Elaphrus cupreus</i>	25
<i>Elaphrus riparius</i>	8
<i>Harpalus affinis</i>	8
<i>Leistus fulvibarbis</i>	8
<i>Leistus rufescens</i>	17
<i>Loricera pilicornis</i>	100
<i>Nebria brevicollis</i>	100
<i>Notiophilus biguttatus</i>	33
<i>Pterostichus anthracinus</i>	17
<i>Pterostichus diligens</i>	8
<i>Pterostichus madidus</i>	8
<i>Pterostichus melanarius</i>	100
<i>Pterostichus niger</i>	100
<i>Pterostichus nigrita</i>	92
<i>Pterostichus strenuus</i>	100
<i>Pterostichus vernalis</i>	58
<i>Synuchus nivalis</i>	8
<i>Trechus discus</i>	8
<i>Trechus obtusus</i>	25
<i>Trechus quadristriatus</i>	33

Conversion of grassland to wild bird cover n=12 Beetle species	Frequency %
<i>Abax parallelepipedus</i>	45
<i>Agonum assimile</i>	27
<i>Agonum dorsale</i>	73
<i>Agonum fuliginosum</i>	18
<i>Agonum marginatum</i>	9
<i>Agonum moestum</i>	9
<i>Agonum muelleri</i>	82
<i>Agonum obscurum</i>	9
<i>Amara aenea</i>	18
<i>Amara aulica</i>	9
<i>Amara lunicollis</i>	9
<i>Amara ovata</i>	27
<i>Amara plebeja</i>	18
<i>Amara similata</i>	9
<i>Asaphidion curtum</i>	9
<i>Bembidion aeneum</i>	27
<i>Bembidion bruxellense</i>	45
<i>Bembidion guttula</i>	18
<i>Bembidion lampros</i>	64
<i>Bembidion mannerheimi</i>	45
<i>Calathus fuscipes</i>	18
<i>Calathus piceus</i>	36

Conversion of grassland to wild bird cover n=12 Beetle species	Frequency %
<i>Carabus glabratus</i>	9
<i>Carabus granulatus</i>	55
<i>Clivina fossor</i>	55
<i>Cychrus caraboides</i>	18
<i>Elaphrus cupreus</i>	36
<i>Laemostenus terricola</i>	18
<i>Leistus fulvibarbis</i>	9
<i>Loricera pilicornis</i>	82
<i>Nebria brevicollis</i>	82
<i>Notiophilus biguttatus</i>	18
<i>Patrobus assimilis</i>	18
<i>Pterostichus madidus</i>	27
<i>Pterostichus melanarius</i>	91
<i>Pterostichus niger</i>	91
<i>Pterostichus nigrita</i>	55
<i>Pterostichus strenuus</i>	73
<i>Pterostichus vernalis</i>	64
<i>Trechus obtusus</i>	9
<i>Trechus quadristriatus</i>	27

**Appendix 5.** Percentage frequency of spider species captured in 2002/2003 on sampled habitats from farms participating in the Countryside Management Scheme.

Species-rich dry grassland n=8	Frequency %	Species-rich dry grassland n=8	Frequency %
Spider species		Spider species	
<i>Agyneta decora</i>	25	<i>Meioneta saxatilis</i>	13
<i>Agyneta subtilis</i>	13	<i>Monocephalus fuscipes</i>	38
<i>Alopecosa pulverulenta</i>	50	<i>Oedothorax fuscus</i>	75
<i>Antistea elegans</i>	13	<i>Oedothorax gibbosus</i>	25
<i>Bathypantes approximatus</i>	25	<i>Oedothorax retusus</i>	88
<i>Bathypantes gracilis</i>	75	<i>Oxyptila trux</i>	13
<i>Centromerita bicolor</i>	63	<i>Pachygnatha clercki</i>	38
<i>Centromerita concinna</i>	25	<i>Pachygnatha degeeri</i>	100
<i>Clubiona reclusa</i>	13	<i>Pardosa amentata</i>	100
<i>Cnephalocotes obscurus</i>	13	<i>Pardosa palustris</i>	50
<i>Dicymbium nigrum</i>	63	<i>Pardosa pullata</i>	100
<i>Diplocephalus permixtus</i>	13	<i>Pelecopsis mengei</i>	13
<i>Erigone atra</i>	88	<i>Pirata piraticus</i>	13
<i>Erigone dentipalpis</i>	88	<i>Robertus lividus</i>	13
<i>Gonatium rubens</i>	13	<i>Savignia frontata</i>	25
<i>Gongylidiellum vivum</i>	25	<i>Tiso vagans</i>	63
<i>Hypomma bituberculatum</i>	13	<i>Trochosa terricola</i>	100
<i>Lepthyphantes tenebricola</i>	13	<i>Walckenaeria antica</i>	13
<i>Lepthyphantes tenuis</i>	75	<i>Walckenaeria vigilax</i>	25
<i>Leptorhoptrum robustum</i>	25	<i>Xysticus cristatus</i>	38
<i>Lophomma punctatum</i>	13		

Species-rich wet grassland n=10	Frequency %	Species-rich wet grassland n=10	Frequency %
Spider species		Spider species	
<i>Agyneta decora</i>	30	<i>Meioneta saxatilis</i>	10
<i>Allomengea scopigera</i>	20	<i>Meta segmentata</i>	20
<i>Alopecosa pulverulenta</i>	70	<i>Oedothorax fuscus</i>	30
<i>Antistea elegans</i>	80	<i>Oedothorax gibbosus</i>	10
<i>Bathypantes gracilis</i>	60	<i>Oedothorax retusus</i>	30
<i>Centromerita bicolor</i>	10	<i>Pachygnatha clercki</i>	80
<i>Centromerita concinna</i>	20	<i>Pachygnatha degeeri</i>	70
<i>Dicymbium nigrum</i>	10	<i>Pardosa amentata</i>	80
<i>Diplocephalus permixtus</i>	10	<i>Pardosa palustris</i>	10
<i>Erigone atra</i>	30	<i>Pardosa pullata</i>	100
<i>Erigone dentipalpis</i>	10	<i>Pirata piraticus</i>	70
<i>Erigonella ignobilis</i>	20	<i>Robertus lividus</i>	10
<i>Gnathonarium dentatum</i>	40	<i>Tibellus oblongus</i>	10
<i>Gongylidiellum vivum</i>	20	<i>Trochosa spinipalpis</i>	20
<i>Hilaira excisa</i>	20	<i>Trochosa terricola</i>	70
<i>Hypomma bituberculatum</i>	10	<i>Walckenaeria acuminata</i>	20
<i>Lepthyphantes mengei</i>	10	<i>Xysticus cristatus</i>	20
<i>Lepthyphantes tenuis</i>	30		
<i>Lepthyphantes zimmermanni</i>	10		
<i>Linyphia triangularis</i>	20		
<i>Lophomma punctatum</i>	50		

Species-rich hay meadow n=6	Frequency %	Species-rich hay meadow n=6	Frequency %
Spider species		Spider species	
<i>Agyneta decora</i>	17	<i>Oedothorax fuscus</i>	100
<i>Alopecosa pulverulenta</i>	17	<i>Oedothorax retusus</i>	50
<i>Antistea elegans</i>	17	<i>Pachygnatha clercki</i>	50
<i>Bathyphantes approximatus</i>	17	<i>Pachygnatha degeeri</i>	83
<i>Bathyphantes gracilis</i>	83	<i>Pardosa amentata</i>	100
<i>Centromerita concinna</i>	17	<i>Pardosa palustris</i>	17
<i>Dicymbium nigrum</i>	67	<i>Pardosa pullata</i>	67
<i>Diplocephalus permixtus</i>	50	<i>Pirata piraticus</i>	67
<i>Erigone atra</i>	100	<i>Robertus lividus</i>	17
<i>Erigone dentipalpis</i>	100	<i>Savignia frontata</i>	17
<i>Gnathonarium dentatum</i>	17	<i>Taranucnus setosus</i>	17
<i>Gongylidiellum vivum</i>	33	<i>Tiso vagans</i>	17
<i>Hilaira excisa</i>	17	<i>Trochosa spinipalpis</i>	17
<i>Kaestneria pullata</i>	17	<i>Trochosa terricola</i>	50
<i>Lepthyphantes alacris</i>	17	<i>Walckenaeria nudipalpis</i>	17
<i>Lepthyphantes tenuis</i>	50	<i>Walckenaeria vigilax</i>	17
<i>Lophomma punctatum</i>	33	<i>Xysticus cristatus</i>	33
<i>Monocephalus fuscipes</i>	17		

Lowland wet grassland n=12	Frequency %	Lowland wet grassland n=12	Frequency %
Spider species		Spider species	
<i>Agyneta decora</i>	8	<i>Leptorhoptrum robustum</i>	25
<i>Allomengea vidua</i>	8	<i>Lophomma punctatum</i>	67
<i>Alopecosa pulverulenta</i>	25	<i>Microlinyphia pusilla</i>	8
<i>Antistea elegans</i>	42	<i>Monocephalus fuscipes</i>	33
<i>Bathyphantes approximatus</i>	42	<i>Oedothorax fuscus</i>	17
<i>Bathyphantes gracilis</i>	58	<i>Oedothorax gibbosus</i>	8
<i>Clubiona reclusa</i>	8	<i>Oedothorax retusus</i>	50
<i>Clubiona stagnatilis</i>	17	<i>Pachygnatha clercki</i>	58
<i>Cnephalocotes obscurus</i>	8	<i>Pachygnatha degeeri</i>	33
<i>Dicymbium nigrum</i>	25	<i>Pardosa amentata</i>	67
<i>Diplocephalus latifrons</i>	17	<i>Pardosa nigriceps</i>	8
<i>Diplocephalus permixtus</i>	33	<i>Pardosa pullata</i>	75
<i>Diplostyla concolor</i>	8	<i>Pelecopsis mengei</i>	8
<i>Dismodicus bifrons</i>	8	<i>Pirata piraticus</i>	83
<i>Erigone atra</i>	50	<i>Robertus lividus</i>	8
<i>Erigone dentipalpis</i>	17	<i>Tallusia experta</i>	17
<i>Erigonella hiemalis</i>	8	<i>Taranucnus setosus</i>	8
<i>Erigonella ignobilis</i>	8	<i>Tiso vagans</i>	17
<i>Gnathonarium dentatum</i>	17	<i>Trochosa spinipalpis</i>	8
<i>Gongylidiellum vivum</i>	8	<i>Trochosa terricola</i>	50
<i>Hilaira excisa</i>	8	<i>Walckenaeria acuminata</i>	25
<i>Hypomma bituberculatum</i>	17	<i>Xysticus cristatus</i>	25
<i>Kaestneria pullata</i>	8		
<i>Lepthyphantes flavipes</i>	8		
<i>Lepthyphantes tenuis</i>	33		
<i>Lepthyphantes zimmemanni</i>	8		

Dry heath n=6	Frequency %
Spider species	
<i>Agyneta decora</i>	17
<i>Agyneta olivacea</i>	17
<i>Agyneta subtilis</i>	50
<i>Alopecosa pulverulenta</i>	67
<i>Antistea elegans</i>	17
<i>Araeoncus crassiceps</i>	17
<i>Bathyphantes gracilis</i>	33
<i>Bolyphantes luteolus</i>	17
<i>Centromerita concinna</i>	17
<i>Ceratinella brevipes</i>	17
<i>Dicymbium nigrum</i>	33
<i>Diplocephalus permixtus</i>	33
<i>Dismodicus bifrons</i>	17
<i>Erigone atra</i>	50
<i>Erigone dentipalpis</i>	17
<i>Gonatium rubens</i>	17
<i>Lepthyphantes alacris</i>	17
<i>Lepthyphantes alcaris</i>	17
<i>Lepthyphantes mengei</i>	17
<i>Lepthyphantes tenebricola</i>	17
<i>Lepthyphantes tenuis</i>	33
<i>Lepthyphantes zimmermanni</i>	17
<i>Micrargus herbigradus</i>	17

Dry heath n=6	Frequency %
Spider species	
<i>Monocephalus fuscipes</i>	17
<i>Oedothorax gibbosus</i>	50
<i>Oedothorax retusus</i>	50
<i>Oxyptila trux</i>	50
<i>Pachygnatha clercki</i>	33
<i>Pachygnatha degeeri</i>	67
<i>Pardosa amentata</i>	17
<i>Pardosa nigriceps</i>	83
<i>Pardosa palustris</i>	17
<i>Pardosa pullata</i>	100
<i>Pirata piraticus</i>	67
<i>Pocadicnemis pumilla</i>	17
<i>Robertus lividus</i>	67
<i>Saaristoa abnormis</i>	33
<i>Silometopus elegans</i>	17
<i>Tiso vagans</i>	50
<i>Trochosa terricola</i>	100
<i>Walckenaeria acuminata</i>	33
<i>Walckenaeria antica</i>	17
<i>Walckenaeria vigilax</i>	17
<i>Xysticus cristatus</i>	67

Wet heath n=12	Frequency %
Spider species	
<i>Agroeca proxima</i>	17
<i>Agyneta olivacea</i>	25
<i>Agyneta subtilis</i>	8
<i>Alopecosa pulverulenta</i>	25
<i>Antistea elegans</i>	67
<i>Araeoncus crassiceps</i>	8
<i>Araneus quadratus</i>	8
<i>Bathyphantes gracilis</i>	33
<i>Centromerita bicolor</i>	17
<i>Centromerita concinna</i>	8
<i>Centromerus prudens</i>	8
<i>Clubiona diversa</i>	8
<i>Clubiona lutescens</i>	8
<i>Clubiona trivialis</i>	8
<i>Cnephalocotes obscurus</i>	8
<i>Dicymbium nigrum</i>	25
<i>Diplocephalus permixtus</i>	8
<i>Dismodicus bifrons</i>	25
<i>Drepanotylus uncatus</i>	8
<i>Erigone atra</i>	17
<i>Erigone dentipalpis</i>	8
<i>Ero furcata</i>	8

Wet heath n=12	Frequency %
Spider species	
<i>Gonatium rubens</i>	25
<i>Gongylidiellum vivum</i>	17
<i>Haplodrassus signifer</i>	8
<i>Hypomma bituberculatum</i>	25
<i>Hypselistes jacksoni</i>	17
<i>Lepthyphantes angulatus</i>	8
<i>Lepthyphantes mengei</i>	58
<i>Lepthyphantes tenuis</i>	8
<i>Lepthyphantes zimmermanni</i>	42
<i>Lophomma punctatum</i>	42
<i>Meioneta beata</i>	8
<i>Oedothorax fuscus</i>	8
<i>Oedothorax gibbosus</i>	17
<i>Oedothorax retusus</i>	25
<i>Oxyptila trux</i>	25
<i>Pachygnatha clercki</i>	75
<i>Pachygnatha degeeri</i>	58
<i>Pardosa amentata</i>	17
<i>Pardosa nigriceps</i>	67
<i>Pardosa pullata</i>	100
<i>Pirata piraticus</i>	75
<i>Pirata uliginosus</i>	25

Wet heath n=12	Frequency %
Spider species	
<i>Robertus arundineti</i>	8
<i>Robertus lividus</i>	42
<i>Scotina gracilipes</i>	8
<i>Tapinopa longidens</i>	17
<i>Trochosa terricola</i>	83
<i>Walckenaeria acuminata</i>	8

Wet heath n=12	Frequency %
Spider species	
<i>Walckenaeria antica</i>	8
<i>Walckenaeria unicornis</i>	17
<i>Walckenaeria vigilax</i>	25
<i>Xysticus cristatus</i>	25

Blanket bog n=2	Frequency %
Spider species	
<i>Agroeca proxima</i>	100
<i>Agyneta subtilis</i>	50
<i>Antistea elegans</i>	50
<i>Ceratinella brevipes</i>	50
<i>Dicymbium nigrum</i>	50
<i>Lepthyphantes tenuis</i>	100
<i>Lepthyphantes zimmemanni</i>	50
<i>Oedothorax gibbosus</i>	50
<i>Oedothorax retusus</i>	50

Blanket bog n=2	Frequency %
Spider species	
<i>Pachygnatha clercki</i>	50
<i>Pachygnatha degeeri</i>	50
<i>Pardosa nigriceps</i>	50
<i>Pardosa pullata</i>	100
<i>Pirata piraticus</i>	50
<i>Pirata uliginosus</i>	50
<i>Scotina gracilipes</i>	50
<i>Trochosa terricola</i>	100

Degraded heath n=10	Frequency %
Spider species	
<i>Agyneta subtilis</i>	20
<i>Alopecosa pulverulenta</i>	90
<i>Antistea elegans</i>	60
<i>Araeoncus crassiceps</i>	20
<i>Bathyphantes gracilis</i>	30
<i>Bolyphantes luteolus</i>	10
<i>Centromerita bicolor</i>	10
<i>Centromerita concinna</i>	30
<i>Ceratinella brevis</i>	10
<i>Clubiona reclusa</i>	20
<i>Clubiona trivialis</i>	10
<i>Dicymbium nigrum</i>	40
<i>Diplocephalus permixtus</i>	10
<i>Drassodes cupreus</i>	10
<i>Erigone atra</i>	40
<i>Erigone dentipalpis</i>	20
<i>Gonatium rubens</i>	10
<i>Hahnna montana</i>	10
<i>Haplodrassus signifer</i>	20
<i>Hypselistes jacksoni</i>	10
<i>Kaestneria pullata</i>	20
<i>Lepthyphantes alacris</i>	10
<i>Lepthyphantes mengei</i>	40
<i>Lepthyphantes zimmemanni</i>	10
<i>Leptorhoptrum robustum</i>	10
<i>Lophomma punctatum</i>	40

Degraded heath n=10	Frequency %
Spider species	
<i>Meioneta saxatilis</i>	10
<i>Oedothorax fuscus</i>	20
<i>Oedothorax gibbosus</i>	40
<i>Oedothorax retusus</i>	40
<i>Oxyptila trux</i>	10
<i>Pachygnatha clercki</i>	60
<i>Pachygnatha degeeri</i>	80
<i>Pardosa amentata</i>	30
<i>Pardosa nigriceps</i>	30
<i>Pardosa palustris</i>	10
<i>Pardosa pullata</i>	100
<i>Pirata piraticus</i>	80
<i>Robertus lividus</i>	50
<i>Saaristoa abnormis</i>	20
<i>Sintula cornigera</i>	10
<i>Tibellus maritimus</i>	20
<i>Tibellus oblongus</i>	10
<i>Tiso vagans</i>	30
<i>Trichopterna thorelli</i>	10
<i>Trochosa spinipalpis</i>	30
<i>Trochosa terricola</i>	90
<i>Walckenaeria acuminata</i>	20
<i>Walckenaeria antica</i>	10
<i>Walckenaeria vigilax</i>	20
<i>Xysticus cristatus</i>	20
<i>Xysticus erraticus</i>	10

Rough moorland grazing n=9	Frequency %	Rough moorland grazing n=9	Frequency %
<b>Spider species</b>		<b>Spider species</b>	
<i>Agroeca proxima</i>	11	<i>Lophomma punctatum</i>	22
<i>Agyneta decora</i>	33	<i>Micrargus herbigradus</i>	11
<i>Allomengea scopigera</i>	22	<i>Microlinyphia pusilla</i>	11
<i>Alopecosa pulverulenta</i>	22	<i>Oedothorax fuscus</i>	22
<i>Antistea elegans</i>	44	<i>Oedothorax gibbosus</i>	22
<i>Araneus quadratus</i>	11	<i>Oedothorax retusus</i>	44
<i>Baryphyma trifons</i>	11	<i>Oxyptila trux</i>	11
<i>Bathyphantes gracilis</i>	33	<i>Pachygnatha clercki</i>	67
<i>Bathyphantes nigrinus</i>	11	<i>Pachygnatha degeeri</i>	56
<i>Bolyphantes luteolus</i>	11	<i>Pardosa amentata</i>	33
<i>Centromerita bicolor</i>	33	<i>Pardosa nigriceps</i>	44
<i>Centromerus prudens</i>	11	<i>Pardosa pullata</i>	100
<i>Ceratinella brevipes</i>	22	<i>Peponocranium ludicrum</i>	11
<i>Dicymbium nigrum</i>	44	<i>Pirata piraticus</i>	100
<i>Diplocephalus permixtus</i>	11	<i>Pirata uliginosus</i>	22
<i>Drepanotylus uncatus</i>	11	<i>Robertus lividus</i>	33
<i>Erigone atra</i>	22	<i>Saaristoa abnormis</i>	11
<i>Erigone dentipalpis</i>	22	<i>Silometopus elegans</i>	11
<i>Gnathonarium dentatum</i>	11	<i>Trochosa terricola</i>	89
<i>Gonatium rubens</i>	33	<i>Walckenaeria acuminata</i>	22
<i>Gongylidiellum vivum</i>	11	<i>Walckenaeria antica</i>	11
<i>Hypomma bituberculatum</i>	44	<i>Walckenaeria nodosa</i>	11
<i>Lepthyphantes mengei</i>	11	<i>Walckenaeria vigilax</i>	22
<i>Lepthyphantes tenuis</i>	11	<i>Xysticus cristatus</i>	56
<i>Lepthyphantes zimmemanni</i>	22		
<i>Leptorhoptrum robustum</i>	11		
<i>Leptothrix hardyi</i>	11		

Lowland raised bog n=8	Frequency %	Lowland raised bog n=8	Frequency %
<b>Spider species</b>		<b>Spider species</b>	
<i>Agyneta olivacea</i>	25	<i>Peponocranium ludicrum</i>	13
<i>Alopecosa pulverulenta</i>	25	<i>Pirata piraticus</i>	50
<i>Antistea elegans</i>	50	<i>Pirata uliginosus</i>	63
<i>Bathyphantes gracilis</i>	13	<i>Pocadicnemis pumilla</i>	13
<i>Dictyna arundinacea</i>	13	<i>Robertus lividus</i>	13
<i>Erigone atra</i>	13	<i>Saaristoa abnormis</i>	25
<i>Gongylidiellum latebricola</i>	13	<i>Scotina gracilipes</i>	25
<i>Gongylidiellum vivum</i>	13	<i>Theridion bimaculatum</i>	13
<i>Lepthyphantes mengei</i>	25	<i>Trochosa terricola</i>	100
<i>Lepthyphantes tenuis</i>	38	<i>Walckenaeria acuminata</i>	13
<i>Lepthyphantes zimmemanni</i>	13	<i>Walckenaeria antica</i>	25
<i>Lophomma punctatum</i>	13	<i>Walckenaeria vigilax</i>	25
<i>Monocephalus fuscipes</i>	38	<i>Xysticus cristatus</i>	13
<i>Pachygnatha clercki</i>	63		
<i>Pardosa amentata</i>	25		
<i>Pardosa nigriceps</i>	63		
<i>Pardosa pullata</i>	100		

Farm woodland n=11	Frequency %
Spider species	
<i>Allomengea vidua</i>	9
<i>Antistea elegans</i>	18
<i>Bathypantes approximatus</i>	9
<i>Bathypantes gracilis</i>	36
<i>Ceratinella brevipes</i>	9
<i>Clubiona compta</i>	9
<i>Dicymbium nigrum</i>	27
<i>Diplocephalus latifrons</i>	55
<i>Diplocephalus permixtus</i>	18
<i>Diplocephalus picinus</i>	9
<i>Erigone atra</i>	27
<i>Erigone dentipalpis</i>	18
<i>Gongylidiellum vivum</i>	9
<i>Gongylidium rufipes</i>	9
<i>Hilaira excisa</i>	27
<i>Hypomma bituberculatum</i>	9
<i>Lepthyphantes cristatus</i>	9
<i>Lepthyphantes flavipes</i>	9
<i>Lepthyphantes mengei</i>	9
<i>Lepthyphantes tenebricola</i>	55
<i>Lepthyphantes tenuis</i>	36
<i>Lepthyphantes zimmemanni</i>	64
<i>Leptorhoptrum robustum</i>	9
<i>Lophomma punctatum</i>	36

Farm woodland n=11	Frequency %
Spider species	
<i>Meioneta saxatilis</i>	9
<i>Meta merianae</i>	9
<i>Meta segmentata</i>	9
<i>Microneta viaria</i>	27
<i>Monocephalus fuscipes</i>	45
<i>Neriene clathrata</i>	9
<i>Neriene peltata</i>	9
<i>Oedothorax fuscus</i>	9
<i>Oedothorax gibbosus</i>	9
<i>Oxyptila trux</i>	9
<i>Pachygnatha clercki</i>	64
<i>Pachygnatha degeeri</i>	27
<i>Pardosa amentata</i>	64
<i>Pardosa pullata</i>	36
<i>Pirata hygophilus</i>	9
<i>Porhomma campbelli</i>	9
<i>Saaristoa abnormis</i>	9
<i>Segestria senoculata</i>	9
<i>Tapinocyba insecta</i>	9
<i>Trochosa terricola</i>	64
<i>Walckenaeria acuminata</i>	27
<i>Walckenaeria nudipalpis</i>	9

Farm scrub n=8	Frequency %
Spider species	
<i>Agroeca proxima</i>	13
<i>Agyneta olivacea</i>	13
<i>Alopecosa pulverulenta</i>	38
<i>Bathypantes gracilis</i>	38
<i>Bathypantes nigrinus</i>	13
<i>Centromerita bicolor</i>	13
<i>Clubiona diversa</i>	13
<i>Dicymbium nigrum</i>	50
<i>Diplostyla concolor</i>	25
<i>Erigone dentipalpis</i>	13
<i>Ero cambridgei</i>	13
<i>Ero furcata</i>	13
<i>Gonatium rubens</i>	13
<i>Gongylidiellum vivum</i>	13
<i>Lepthyphantes alacris</i>	13
<i>Lepthyphantes mengei</i>	25
<i>Lepthyphantes tenuis</i>	25
<i>Lepthyphantes zimmemanni</i>	38
<i>Lophomma punctatum</i>	25
<i>Meioneta saxatilis</i>	13
<i>Meta mengei</i>	13

Farm scrub n=8	Frequency %
Spider species	
<i>Micrargus herbigradus</i>	13
<i>Monocephalus fuscipes</i>	38
<i>Neriene montana</i>	13
<i>Neriene peltata</i>	13
<i>Oedothorax retusus</i>	13
<i>Oxyptila trux</i>	13
<i>Pachygnatha clercki</i>	63
<i>Pachygnatha degeeri</i>	63
<i>Pardosa amentata</i>	63
<i>Pardosa nigriceps</i>	13
<i>Pardosa pullata</i>	63
<i>Pirata piraticus</i>	13
<i>Robertus lividus</i>	38
<i>Saaristoa abnormis</i>	13
<i>Tiso vagans</i>	13
<i>Trochosa terricola</i>	50
<i>Walckenaeria acuminata</i>	50
<i>Xysticus cristatus</i>	13

Retained winter stubble n=12	Frequency %	Retained winter stubble n=12	Frequency %
Spider species		Spider species	
<i>Agyneta cauta</i>	8	<i>Meta segmentata</i>	8
<i>Alopecosa pulverulenta</i>	8	<i>Micrargus herbigradus</i>	8
<i>Araeoncus crassiceps</i>	8	<i>Milleriana inerrans</i>	50
<i>Bathyphantes gracilis</i>	92	<i>Monocephalus fuscipes</i>	8
<i>Bathyphantes nigrinus</i>	8	<i>Oedothorax fuscus</i>	50
<i>Clubiona diversa</i>	8	<i>Oedothorax retusus</i>	17
<i>Clubiona stagnatilis</i>	17	<i>Pachygnatha degeeri</i>	92
<i>Dicymbium nigrum</i>	8	<i>Pardosa amentata</i>	67
<i>Diplocephalus latifrons</i>	17	<i>Pardosa palustris</i>	8
<i>Erigone arctica</i>	8	<i>Pardosa pullata</i>	33
<i>Erigone atra</i>	108	<i>Pirata piraticus</i>	8
<i>Erigone dentipalpis</i>	108	<i>Porrhomma pygmaeum</i>	67
<i>Erigone longipalpis</i>	8	<i>Robertus lividus</i>	8
<i>Gongylidiellum vivum</i>	42	<i>Saaristoia abnormis</i>	8
<i>Lepthyphantes pallidus</i>	8	<i>Savignia frontata</i>	8
<i>Lepthyphantes tenuis</i>	100	<i>Segestria senoculata</i>	8
<i>Lepthyphantes zimmermanni</i>	8	<i>Silometopus elegans</i>	8
<i>Leptorhoptrum robustum</i>	25	<i>Trochosa terricola</i>	17
<i>Meioneta rurestris</i>	8		

Wild bird cover n=12	Frequency %	Wild bird cover n=12	Frequency %
Spider species		Spider species	
<i>Alopecosa pulverulenta</i>	8	<i>Monocephalus fuscipes</i>	8
<i>Bathyphantes gracilis</i>	92	<i>Oedothorax fuscus</i>	92
<i>Bathyphantes nigrinus</i>	8	<i>Oedothorax retusus</i>	25
<i>Dicymbium nigrum</i>	33	<i>Oxyptila trux</i>	8
<i>Diplostyla concolor</i>	8	<i>Pachygnatha degeeri</i>	50
<i>Dismodicus bifrons</i>	8	<i>Pardosa amentata</i>	67
<i>Drassodes cupreus</i>	8	<i>Pardosa palustris</i>	8
<i>Erigone atra</i>	100	<i>Pardosa pullata</i>	42
<i>Erigone dentipalpis</i>	100	<i>Savignia frontata</i>	17
<i>Gongylidiellum vivum</i>	25	<i>Trochosa terricola</i>	33
<i>Hypomma bituberculatum</i>	8	<i>Walckenaeria acuminata</i>	8
<i>Labulla thoracica</i>	8	<i>Walckenaeria vigilax</i>	17
<i>Lepthyphantes tenuis</i>	67		
<i>Leptorhoptrum robustum</i>	42		
<i>Micrargus subaequalis</i>	17		
<i>Milleriana inerrans</i>	42		

Field boundary restoration n=11	Frequency %	Field boundary restoration n=11	Frequency %
<hr/>		<hr/>	
Spider species		Spider species	
<i>Allomengea scopigera</i>	9	<i>Meta segmentata</i>	9
<i>Alopecosa pulverulenta</i>	9	<i>Micaria pulicaria</i>	9
<i>Antistea elegans</i>	9	<i>Micrargus subaequalis</i>	45
<i>Bathyphantes gracilis</i>	73	<i>Milleriana inerrans</i>	9
<i>Bathyphantes nigrinus</i>	27	<i>Monocephalus fuscipes</i>	73
<i>Bathyphantes parvulus</i>	9	<i>Neriene montana</i>	45
<i>Ceratinella scabrosa</i>	18	<i>Oedothorax fuscus</i>	27
<i>Clubiona lutescens</i>	9	<i>Oedothorax gibbosus</i>	9
<i>Dicymbium nigrum</i>	18	<i>Oedothorax retusus</i>	36
<i>Diplocephalus latifrons</i>	9	<i>Oxyptila trux</i>	36
<i>Diplocephalus permixtus</i>	9	<i>Pachygnatha degeeri</i>	73
<i>Diplostyla concolor</i>	9	<i>Pardosa amentata</i>	73
<i>Erigone atra</i>	100	<i>Pardosa pullata</i>	64
<i>Erigone dentipalpis</i>	64	<i>Pirata piraticus</i>	9
<i>Gongylidiellum vivum</i>	18	<i>Pocadicnemis pumilla</i>	36
<i>Gongylidium rufipes</i>	9	<i>Tapinopa longidens</i>	18
<i>Lepthyphantes alacris</i>	9	<i>Tiso vagans</i>	18
<i>Lepthyphantes alcaris</i>	9	<i>Trochosa terricola</i>	27
<i>Lepthyphantes cristatus</i>	9	<i>Walckenaeria acuminata</i>	9
<i>Lepthyphantes obscurus</i>	9	<i>Walckenaeria vigilax</i>	9
<i>Lepthyphantes tenuis</i>	91	<i>Xysticus cristatus</i>	9
<i>Lepthyphantes zimmemanni</i>	27	<i>Xysticus erraticus</i>	9
<i>Leptorhoptrum robustum</i>	36		
<i>Meioneta saxatilis</i>	18		

## Appendix 6. New county records of spiders.

\* New Irish Record.

### Co. Antrim Records

*Ceratinella brevipes*  
*Micrargus subaequalis*  
*Pirata uliginosus*  
*Theridion bimaculatum*

### Co. Armagh Records

*Allomengea scopigera*  
*Antistea elegans*  
*Bathyphantes approximatus*  
*Clubiona stagnatilis*  
*Cnephalocotes obscurus*  
*Diplocephalus latifrons*  
*Hilaira excisa*  
*Lepthyphantes flavipes*  
*Lepthyphantes mengei*  
*Lepthyphantes tenebricola*  
*Lophomma punctatum*  
*Meioneta saxatilis*  
*Micrargus herbigradus*  
*Micrargus subaequalis*  
*Monocephalus fuscipes*  
*Pocadicnemis pumilla*  
*Taranucnus setosus*  
*Xysticus erraticus*

### Co. Down Records

*Allomengea vidua*  
*Antistea elegans*  
*Clubiona stagnatilis*  
*Lophomma punctatum*  
*Meta segmentata*  
*Micrargus subaequalis*  
*Milleriana inerrans* \*  
*Tallusia experta*

### Co. Fermanagh Records

*Allomengea scopigera*  
*Centromerita concinna*  
*Clubiona trivialis*  
*Cnephalocotes obscurus*  
*Ero cambridgei*  
*Hypselistes jacksoni*  
*Meioneta saxatilis*  
*Micrargus herbigradus*  
*Oedothorax retusus*  
*Pirata uliginosus*  
*Porhomma campbelli*  
*Robertus arundineti*  
*Tapinocyba insecta*  
*Taranucnus setosus*  
*Walckenaeria antica*  
*Walckenaeria nodosa*  
*Walckenaeria nudipalpis*  
*Walckenaeria unicornis*

### Co. Londonderry Records

*Alopecosa pulverulenta*  
*Araeoncus crassiceps*  
*Bathyphantes approximatus*  
*Centromerita bicolor*  
*Centromerita concinna*  
*Ceratinella scabrosa*  
*Clubiona diversa*  
*Cnephalocotes obscurus*  
*Dicymbium nigrum*  
*Kaestneria pullata*  
*Lepthyphantes mengei*  
*Lepthyphantes tenebricola*  
*Leptothrix hardyi*  
*Lophomma punctatum*  
*Meta segmentata*  
*Micrargus herbigradus*  
*Micrargus subaequalis*  
*Oedothorax fuscus*  
*Oedothorax retusus*  
*Silometopus elegans*  
*Trochosa spinipalpis*  
*Walckenaeria antica*  
*Walckenaeria vigilax*  
*Xysticus cristatus*

### Co. Tyrone Records

*Agyneta olivacea*  
*Alopecosa pulverulenta*  
*Baryphyma trifons*  
*Bathyphantes approximatus*  
*Bathyphantes gracilis*  
*Bolyphantes luteolus*  
*Centromerita bicolor*  
*Centromerita concinna*  
*Ceratinella brevis*  
*Clubiona compta*  
*Dictyna arundinacea*  
*Dicymbium nigrum*  
*Diplocephalus latifrons*  
*Diplocephalus permixtus*  
*Drassodes cupreus*  
*Gnathonarium dentatum*  
*Hahnia montana*  
*Hilaira excisa*  
*Kaestneria pullata*  
*Lepthyphantes alacris*  
*Lepthyphantes tenebricola*  
*Meta segmentata*  
*Neriere clathrata*  
*Oedothorax fuscus*  
*Oedothorax retusus*  
*Pachygnatha clercki*  
*Pachygnatha degeeri*  
*Pardosa palustris*  
*Pirata uliginosus*  
*Saaristoa abnormis*  
*Segestria senoculata*  
*Trochosa spinipalpis*  
*Walckenaeria acuminata*  
*Walckenaeria antica*  
*Walckenaeria vigilax*  
*Xysticus erraticus*