MAGDALEN HILL DOWN EXTENSION

Review of botanical trends (1998 – 2010) and assessment of likely impact on selected butterfly species

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Contents

1. INTRODUCTION

This report assesses the results of botanical monitoring and butterfly trends on the Magdalen Hill Down (MHD) Extension from 1998 to 2010. It seeks to address a number of questions:

- Is overall change in the right direction for an "ancient grassland" community to develop?
- Is current management activity preventing damage from false oat-grass invasion and are there other species that could pose problems?
- Is there any evident correlation between butterfly numbers and their larval foodplants and nectaring plants?
- What management conclusions can be drawn from the findings?

The botanical monitoring of MHD Extension began in 1998, initially with 2 surveys each year and then reducing to one year surveys from 2001 to 2007. Now the surveys are on a 3 year basis with the last one having been done in 2010. 13 surveys have been performed between 1998 and 2010.

Bioscan Environmental Consultancy has previously carried out the analysis and interpretation of the survey data. The last full report was in March 2003, analysing surveys conducted between 1998 and 2002. Some analysis was carried out on subsequent years' data but this was not compiled as a report.

The methodology for the surveys is to record information on the flora in 45 1m x 1m quadrats covering areas A-E (10 quadrats for A-D and 5 for E) (Figure 1). Each quadrat is divided into 25 cells and the presence of all species in each cell is recorded as well as bare earth data.

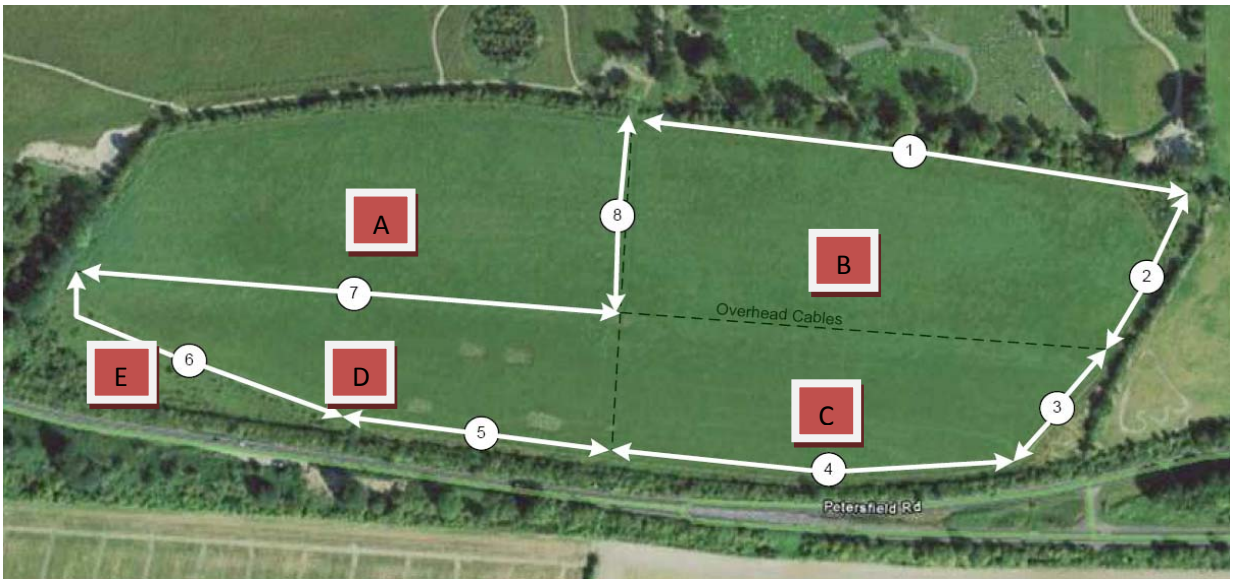


Figure 1: MHD Extension survey areas and butterfly transect sections

2. ANALYSIS

2.1 Originally sown species

The original sowing mixture of 48 species (sown in areas A, B, C and D), reflecting the seed available from harvested chalk grassland, contained many of the species that are constant in species-rich chalk grasslands such as National Vegetation Community CG2. Table 1 shows a summary of abundance of all sown species during the sampling period. The first columns show the number of quadrats a species occurred in, i.e. an estimate of how widespread it was. The second group of columns show the number of cells (out of 25 maximum) that species occurred in when they were present, i.e. an estimate of local cover when they had established. The species in Table 1 are arranged in descending order of spread and local cover attained by 2010.

Species that have become more strongly established over the last three to six years (2010 cover in brackets) are:

- Cowslip *Primula veris* (100%)
- Upright brome *Bromus erectus* (90%)
- Tufted vetch *Vicia cracca* (62.5%)
- Meadow vetchling *Lathyrus pratensis* (57.5%)
- Bulbous buttercup *Ranunculus bulbosus* (52.5%)
- Glaucous sedge *Carex flacca* (45%)
- Burnet saxifrage *Pimpinella saxifraga* (45%)

Species with significantly reduced cover over the last three to six years (2010 cover in brackets) are:

- Yellow oat-grass *Trisetum flavescens* (37.5%) (NB May be falsely low as 2010 survey was done earlier than usual when species was less easy to identify)
- Yorkshire fog *Holcus lanatus* (35%)
- Black medic *Medicago lupulina* (35%)
- Salad burnet *Sanguisorba minor* (22.5%)
- Wild carrot *Daucus carota* (20%)
- Perforate St John's-wort *Hypericum perforatum* (15%)
- Perennial rye-grass *Lolium perenne* (12.5%)
- Oxeye daisy *Leucanthemum vulgare* (10%)
- Kidney vetch *Anthyllis vulneraria* (7.5%)
- Selfheal *Prunella vulgaris* (5%)
- Wild basil *Clinopodium vulgare* (0%)
- Crested dog's-tail *Cynosurus cristatus* (0%)

Absent species (additional to those listed above) are:

- Sweet vernal grass *Anthoxanthum odoratum*
- *C*lustered bellflower *Campanula glomerata*
- Greater knapweed *Centaurea scabiosa*
- Dropwort *Filipendula vulgaris*
- Devil's-bit scabious *Succisa pratensis*
- Sheep's fescue *Festuca ovina*
- Common cat's-ear *Hypochaeris radicata*
- *C*ommon toadflax *Linaria vulgaris*

NB Bulbous oat-grass *Arrenatherum elatius bulbosus* has apparently been absent since 2004 but it has not been recorded separately to False oat-grass *Arrenatherum elatius* in recent surveys.

Table 1 also shows for each year the number of originally sown species that had greater than or equal to 90% cover, greater than or equal to 50% cover and the number of species that were absent. The 2010 survey shows a reduction in the species with greater than or equal to 50% cover and an equally marked increase in the number of absent species.

Table 1: Occurrences of sown species

	Percentage quadrats occupied											Average cells per occupied quadrat										
	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2010	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2010
Lotus corniculatus	47.50	80.00	92.50	95.00	100.00	100.00	100.00	97.50	100.00	100.00	100.00	2.2	6.8	14.2	17.1	20.3	14.7	20.4	22.2	23.4	20.7	23.8
Primula veris	20.00	61.25	42.50	70.00	42.50	80.00	90.00	77.50	95.00	82.50	100.00	1.3	2.2	2.1	3.1	1.6	2.9	3.1	2.2	4.4	4.9	12.3
Plantago lanceolata	97.50	100.00	100.00	100.00	100.00	100.00	97.50	100.00	97.50	97.50	97.50	5.9	11.1	13.3	12.9	16.2	14.2	9.7	13.6	10.8	11.2	12.1
Festuca rubra / ?ovina	97.50	98.75	97.50	100.00	97.50	95.00	100.00	97.50	100.00	100.00	92.50	6.7	13.2	15.0	18.6	16.4	15.3	20.6	22.4	23.5	23.9	23.2
Arrhenatherum elatius	98.75	100.00	95.00	100.00	100.00	100.00	92.50	85.00	97.50	100.00	90.00	11.8	14.2	17.8	16.2	17.2	20.3	10.9	13.7	11.5	15.7	15.3
Bromus erectus	55.00	58.75	37.50	62.50	42.50	77.50	97.50	85.00	75.00	77.50	90.00	1.9	2.9	2.5	2.8	2.4	3.7	7.2	5.2	6.1	11.2	10.1
Leontodon hispidus	72.50	98.75	100.00	100.00	100.00	97.50	95.00	92.50	95.00	90.00	90.00	4.5	8.3	9.3	8.9	8.6	11.0	8.0	11.8	14.9	15.1	17.7
Rumex acetosa	58.75	68.75	72.50	82.50	52.50	72.50	77.50	82.50	70.00	80.00	77.50	1.9	2.1	2.4	2.9	3.2	3.0	3.3	4.2	3.0	3.5	3.9
Trifolium pratense	6.25	18.75	25.00	37.50	60.00	72.50	72.50	95.00	87.50	100.00	72.50	1.2	2.5	4.3	6.3	9.3	5.2	9.0	13.7	9.7	15.9	9.2
Vicia cracca	0.00	6.25	17.50	35.00	37.50	47.50	40.00	37.50	47.50	47.50	62.50	0.0	1.6	4.9	3.5	4.1	3.9	3.7	3.9	2.7	2.9	6.5
Lathyrus pratensis	12.50	13.75	12.50	42.50	27.50	32.50	25.00	35.00	45.00	40.00	57.50	1.6	3.2	5.4	6.0	8.0	6.2	4.9	9.4	5.8	8.1	12.3
Origanum vulgare	22.50	41.25	37.50	50.00	50.00	62.50	65.00	60.00	55.00	67.50	57.50	2.2	4.8	2.1	5.6	4.6	6.6	7.6	9.4	9.1	8.5	11.6
Briza media	17.50	60.00	65.00	37.50	57.50	45.00	42.50	60.00	57.50	45.00	55.00	1.6	2.1	2.4	1.6	3.0	1.6	2.5	2.8	5.4	4.9	3.8
Ranunculus bulbosus	8.75	21.25	20.00	12.50	2.50	12.50	32.50	17.50	17.50	22.50	52.50	1.4	1.5	1.5	2.0	3.0	2.0	3.2	2.0	1.6	3.8	3.3
Plantago media	12.50	63.75	80.00	72.50	80.00	75.00	52.50	67.50	55.00	47.50	47.50	1.5	2.6	2.4	2.1	2.4	2.3	2.3	2.2	2.9	4.1	2.3
Carex flacca	1.25	16.25	10.00	0.00	20.00	20.00	35.00	22.50	27.50	32.50	45.00	1.0	1.5	1.0	0.0	2.1	3.4	3.3	5.9	3.2	9.4	17.3
Pimpinella saxifraga	0.00	12.50	10.00	10.00	12.50	12.50	32.50	20.00	45.00	50.00	45.00	0.0	1.8	2.5	1.5	2.6	2.2	1.9	4.1	4.2	3.6	4.9
Scabiosa columbaria	26.25	61.25	50.00	52.50	55.00	65.00	32.50	40.00	60.00	57.50	45.00	1.5	1.5	1.3	1.4	2.2	2.6	2.2	4.7	6.1	7.1	7.9
Agrostis stolonifera	82.50	78.75	97.50	37.50	60.00	90.00	97.50	90.00	90.00	80.00	42.50	3.6	6.7	10.8	12.0	7.5	10.7	6.9	6.0	7.8	6.7	5.6
Centaurea nigra	21.25	52.50	65.00	62.50	62.50	62.50	50.00	45.00	47.50	50.00	37.50	1.4	2.4	2.7	1.8	2.3	3.4	3.6	2.3	5.1	4.0	4.1
Trisetum flavescens	7.50	25.00	70.00	30.00	97.50	50.00	95.00	97.50	70.00	97.50	37.50	1.2	4.0	9.1	6.3	10.4	7.9	14.0	11.9	9.3	11.5	4.9
Galium verum	2.50	13.75	15.00	20.00	22.50	30.00	27.50	25.00	32.50	45.00	35.00	2.0	1.1	1.0	2.0	3.9	4.1	4.7	5.1	4.7	5.6	7.8
Holcus lanatus	97.50	92.50	100.00	85.00	90.00	100.00	75.00	85.00	70.00	90.00	35.00	7.5	11.6	11.1	8.2	5.9	7.6	3.5	4.8	3.7	5.2	2.6
Medicago lupulina	38.75	87.50	100.00	80.00	100.00	95.00	92.50	95.00	90.00	92.50	35.00	3.3	11.7	18.5	7.6	19.0	19.3	15.9	14.0	9.2	15.7	3.9
Galium mollugo	25.00	40.00	45.00	32.50	32.50	37.50	25.00	40.00	30.00	45.00	27.50	1.4	2.4	2.4	3.7	3.4	6.1	4.3	4.3	2.3	6.6	7.2
Sanguisorba minor	56.25	70.00	82.50	82.50	50.00	67.50	32.50	45.00	45.00	50.00	22.50	1.8	2.4	4.2	3.3	2.8	2.7	2.5	2.5	3.1	3.4	2.7
Daucus carota	45.00	58.75	95.00	82.50	92.50	95.00	87.50	77.50	65.00	60.00	20.00	4.2	6.9	7.5	7.2	8.4	9.3	11.0	7.4	10.6	13.6	2.1
Hypericum perforatum	7.50	40.00	32.50	5.00	25.00	37.50	40.00	32.50	35.00	32.50	15.00	1.5	2.1	1.8	2.0	1.7	2.9	2.6	2.8	1.8	2.4	1.5
Knautia arvensis	6.25	11.25	25.00	10.00	17.50	22.50	5.00	10.00	12.50	10.00	15.00	1.2	1.1	1.2	1.3	1.6	2.0	1.0	2.0	1.8	2.3	1.7
Lolium perenne	63.75	42.50	55.00	30.00	45.00	57.50	12.50	57.50	30.00	22.50	12.50	2.9	2.2	1.5	3.5	1.4	1.6	2.0	2.6	2.3	1.8	5.2
Rhinanthus minor	0.00	0.00	0.00	7.50	2.50	22.50	0.00	0.00	0.00	0.00	12.50	0.0	0.0	0.0	15.0	1.0	13.2	0.0	0.0	0.0	0.0	2.6
Leucanthemum vulgare	42.50	66.25	60.00	57.50	52.50	30.00	35.00	32.50	35.00	15.00	10.00	1.9	2.8	3.0	1.8	2.9	2.3	2.5	2.8	3.0	12.2	4.3
Anthyllis vulneraria	50.00	67.50	77.50	52.50	55.00	37.50	20.00	22.50	20.00	25.00	7.50	2.3	3.0	6.5	4.0	4.9	5.3	5.9	5.1	3.4	7.0	9.3
Campanula rotundifolia	18.75	26.25	7.50	7.50	5.00	7.50	2.50	7.50	7.50	2.50	7.50	1.4	1.2	1.0	1.3	1.0	1.7	2.0	2.3	1.7	3.0	1.7
Agrimonia eupatoria	0.00	3.75	2.50	5.00	0.00	2.50	5.00	2.50	10.00	2.50	5.00	0.0	1.0	1.0	1.0	0.0	1.0	1.5	1.0	1.0	1.0	1.5
Prunella vulgaris	66.25	91.25	92.50	72.50	62.50	55.00	42.50	45.00	42.50	47.50	5.00	2.1	5.0	4.9	2.3	2.7	2.7	2.2	2.7	2.7	3.6	1.5
Linum catharticum	1.25	31.25	2.50	5.00	0.00	0.00	5.00	7.50	10.00	12.50	2.50	1.0	1.4	1.0	1.5	0.0	0.0	2.5	6.0	4.5	1.6	21.0
Anthoxanthum odoratum	0.00	8.75	12.50	7.50	0.00	7.50	0.00	0.00	5.00	0.00	0.00	0.0	1.3	1.2	2.3	0.0	1.3	0.0	0.0	1.0	0.0	0.0
Arrhenatherum elatius bulbosus	11.25	3.75	5.00	0.00	0.00	7.50	0.00	0.00	0.00	0.00	0.00	4.4	1.3	1.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0
Campanula glomerata	2.50	8.75	5.00	10.00	5.00	17.50	7.50	7.50	0.00	7.50	0.00	2.0	1.4	1.0	1.0	1.0	1.6	1.3	2.3	0.0	1.3	0.0
Centaurea scabiosa	1.25	8.75	20.00	25.00	15.00	17.50	10.00	5.00	7.50	12.50	0.00	4.0	1.3	1.3	1.6	2.5	1.4	1.0	2.0	1.3	1.6	0.0
Clinopodium vulgare	36.25	58.75	77.50	77.50	80.00	75.00	72.50	50.00	42.50	27.50	0.00	2.2	5.4	5.0	5.3	7.3	5.4	5.8	2.7	2.4	2.5	0.0
Cynosurus cristatus	82.50	90.00	90.00	97.50	97.50	92.50	75.00	90.00	65.00	55.00	0.00	4.0	5.5	6.4	11.0	8.5	6.5	5.2	6.1	4.2	4.1	0.0
Festuca ovina		18.75				0.00	0.00	0.00	0.00	0.00	0.00		2.1				0.0	0.0	0.0	0.0	0.0	0.0
Filipendula vulgaris	2.50	5.00	15.00	20.00	0.00	12.50	0.00	2.50	7.50	0.00	0.00	3.0	1.0	2.0	3.3	0.0	2.4	0.0	1.0	2.3	0.0	0.0
Hypochaeris radicata	1.25	0.00	2.50	2.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.0	0.0	3.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Linaria vulgaris	5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Succisa pratensis	5.00	6.25	2.50	17.50	15.00	17.50	12.50	10.00	10.00	5.00	0.00	1.3	1.4	1.0	1.0	1.2	1.3	1.2	2.3	3.0	1.5	0.0
Number of species with:																						
90% + presence	4	7	11	6	10	10	10	9	7	9	7											
50% + presence	12	20	22	21	23	23	19	20	19	20	14											
0 presence	6	3	3	4	7	4	7	6	6	7	11											

Appendix 1 provides three-yearly trends for all species recorded on areas A to D of the Extension showing the number of cells in which the species were recorded overall and by area from 1998 to 2010. The originally sown speces are highlighted in green.

For the Extension as a whole, in addition to the observations above regarding the originally sown species trends, the species that were not part of the originally sown mix that have become more strongly established over the last three to six years are:

- Yarrow *Achillea millefolium*
- Velvet bent *Agrostis canina*
- Downy oat-grass *Avenula pubescens*
- Cock's-foot *Dactylis glomerata*

The species that were not part of the originally sown mix that show reduced cover over the last three to six years are:

- Soft brome *Bromus hordaceus hordaceus*
- Common mouse-ear *Cerastium fontanum triviale*
- Smooth hawk's-beard *Crepis capillaris*
- Eyebright *Euphrasia officinalis agg*
- Petty spurge *Euphorbia peplus*
- Tall fescue *Festuca arundinacea*
- Timothy-grass *Phleum pratense*
- Common meadow-grass *Poa pratense*
- White clover *Trifolum repens*

The increase and decrease in establishment of a particular species often varies by area.

2.2 Species' richness

In the ex-arable areas A to D there continues to be a steady decline in species richness (Figure 2) on the quadrat scale. The same pattern is reflected on the area scale (apart from Area D which has held its level). This shows that some species have disappeared, not merely become less widespread in the field. In contrast there has been no decline in species density in the remnant grassland E, with only slight fluctuations on a generally steady pattern. Rodwell (2008) gives the average species per 2 metre quadrat sample as 21 (range of 4-35) in CG3a grassland and as 25 (range of 7-45) in CG2a grassland. So although species richness has declined on the Extension it is not dissimilar to that found in typical CG2a and CG3a grassland.

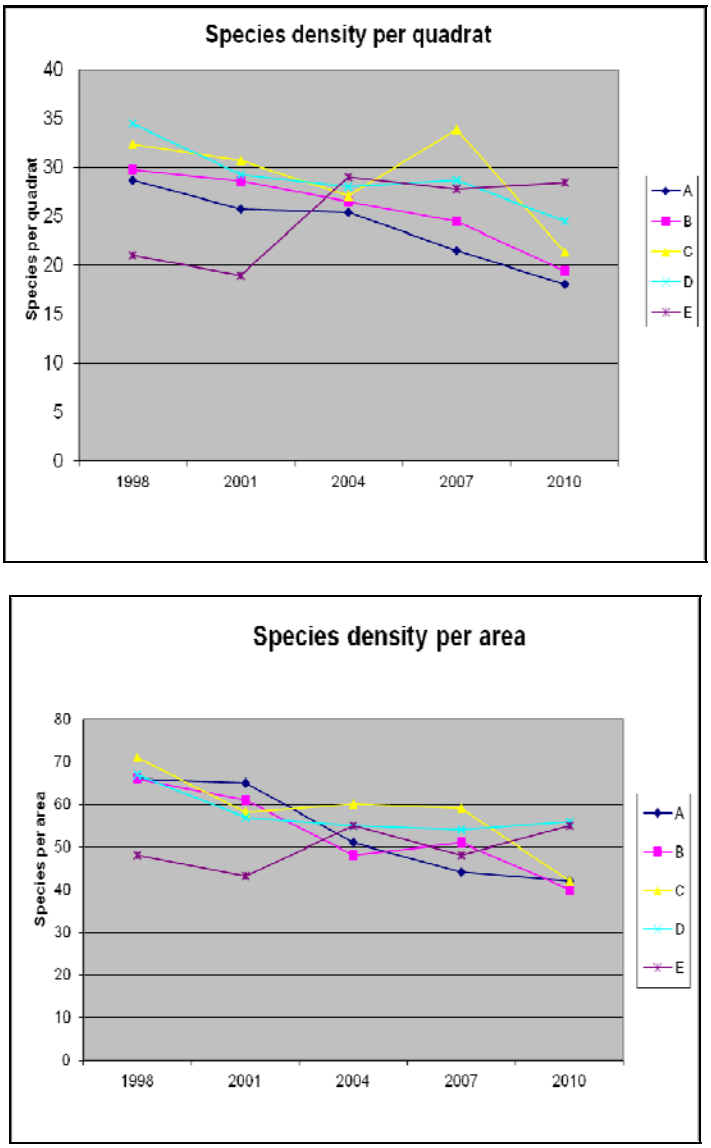


Figure 2: Species density on the quadrat and area scales

2.3 National Vegetation Classification (NVC) analysis

The sown species on the Extension contained many of those found within the NVC CG2 communities. CG2 *Festuca ovina / Avenula pratensis* (sheep's fescue / meadow oat grass) grassland is characterised by a species rich continuous sward with a high density of grass and herb species. It is typically found on free-draining, south-facing, and sometimes thin soils and is maintained by grazing. CG3 *Bromus erectus* (upright brome) grassland is similar to CG2 in terms of structure and floristics but with a greater prominence of upright brome grass, and an overall reduction in botanical diversity.

The method followed for the botanical surveys on the Extension is not the same as that employed to determine the NVC . To determine the NVC the percentage of abundance of all botanical species is estimated, usually in 2m x 2m quadrats (for short sward). However an approximation of the NVC for the Extension has been made using the available data. This gives an indication of the way in which the Extension is developing and whether it is moving from MG1 through to CG3 and / or acquiring CG2 characteristics. The analysis was done for each of the 5 surveyed areas for 1998, 2001, 2004, 2007 and 2010. The results are presented in Table 2. It appears that there over the last 3 years there has been a clear shift from MG1 towards CG3 and there are an increasing number of CG2 constants in areas C, D and E. However, the amount of false oat-grass *Arrenatherum elatius*, most notably in areas B and C, means there is an ever-present risk of reversion to MG1.

Appendix 2 compares the 2010 data for each section with CG3 communities. This data was used to carry out an additional analysis using Tablefit software that automatically classifies vegetation groups according to the National Vegetation Classification (NVC). This gives indications of the most likely community types present but not a definitive conclusion. The results are summarised at Table 3. All the areas A to D are remarkably similar in NVC terms and areas C and D appear to be virtually identical to each other in this respect. A and B appear to be different at sub-community level. All are essentially most like CG3, apparently with components of MG5. It should be noted that the MG5 component may be overstated and the CG3 component understated because the lesser knapweed *Centaurea niger* sub species found on Magdalen Hill Down is probably all sub species *nemoralis* rather than sub species *niger* which is the true dominant of MG5.

Table 2: NVC community constants by area

	MG1 constants present in each area (max of 2)					***Arrhenatherum elatius, Dactylis glomerata***
YEAR	**A**	**B**	**C**	**D**	**E**	
1998	2	2	2	2	1	
2001	2	2	2	2	1	
2004	2	2	2	2	2	
2007	2	2	2	2	1	
2010	2	2	2	2	1	
						Arrhenatherum elatius always a constant but *Dactylis glomerata* not

	CG3 constants present in each area (max of 6)					***Bromus erectus, Carex flacca, Festuca ovina, Lotus corniculatus, Plantaga lanceolata, Sanguisorba minor***
YEAR	**A**	**B**	**C**	**D**	**E**	
1998	2	2	2	3	2	*Festuca ovina* and *Plantaga lanceolata* constants from the start
2001	4	4	4	5	4	*Sanguisorba minor* and *Lotus corniculatus* become constants
2004	4	4	4	4	4	*Bromus erectus* becomes constant
2007	4	4	6	4	5	
2010	4	4	5	5	4	
						Festuca ovina not present

	CG2 constants present in each area (max of 12)					***Avenula pratensis, Briza media, Carex flacca, Festuca ovina, Hieracium spp, Leontodon hispidus, Linum cartharticum, Lotus corniculatus, Plantago lanceolata, Sanguisorba minor, Scabiosa columbaria, Thymus praecox***
YEAR	**A**	**B**	**C**	**D**	**E**	
1998	1	1	2	3	1	*Plantago lanceolata* constant from start
2001	4	4	5	5	4	*Sanguisorba minor* and *Lotus corniculatus* become constants
2004	3	3	3	3	4	*Leontodon hispidus* becoming constant
2007	4	3	6	5	6	*Carex flacca* constant in C and E
2010	3	3	5	6	5	*Carex flacca* constant in C, D and E, Briza media in C and D
						Avenula pratensis, Festuca ovina, Thymus praecox not present

Table 3: Tablefit analysis on 2010 data

NVC for Magdalen Hill Down Extension (2010) using 'Tablefit' software and data obtained from Frequency Class analysis				
Compartment	**Calcareous Grassland NVC Sub-Community best fit**	**Goodness of fit**	**Mesotrophic Grassland NVC Sub-Community best fit**	**Goodness of fit**
A	CG3a	63 (fair)	MG5b	60 (fair)
B	CG3a	63 (fair)	MG5a	61 (fair)
C	CG3c	62 (fair)	MG5b	61 (fair)
D	CG3c	62 (fair)	MG5b	60 (fair)
E	CG3c & CG6a	54/52 (poor)	All Mesotrophic grassland communities	> 47 (very poor)

NVC Communities & sub-communities identified at Magdalen Hill Down Extension			
NVC Code	**Habitat Type**	**Description (scientific) in Tablefi**	**Description (verbacular taxa)**
MG5a	Mesotrophic Grassland	*Cynosurus cristatus-Centaurea nigra*	Crested Dog's-tail-Lesser Knapweed
	Sub-community	*Lathyrus pratensis*	Meadow Vetchling
MG5b	Mesotrophic Grassland	*Cynosurus cristatus-Centaurea nigra*	Crested Dog's-tail-Lesser Knapweed
	Sub-community	*Galium verum*	Ladies Bedstraw
CG3a	Calcareous Grassland	*Bromus erectus*	Upright Brome
	Sub-community	*(typical sub-community)*	
CG3c	Calcareous Grassland	*Bromus erectus*	Upright Brome
	Sub-community	*Knautia arvensis-Bellis perennis*	Field Scabious-Lawn Daisy
CG6a	Calcareous Grassland	*Avenula pubescens*	Downy Oat-grass
	Sub-community	*Dacylis glomerata-Briza media*	Cock's-foot-Quaking Grass

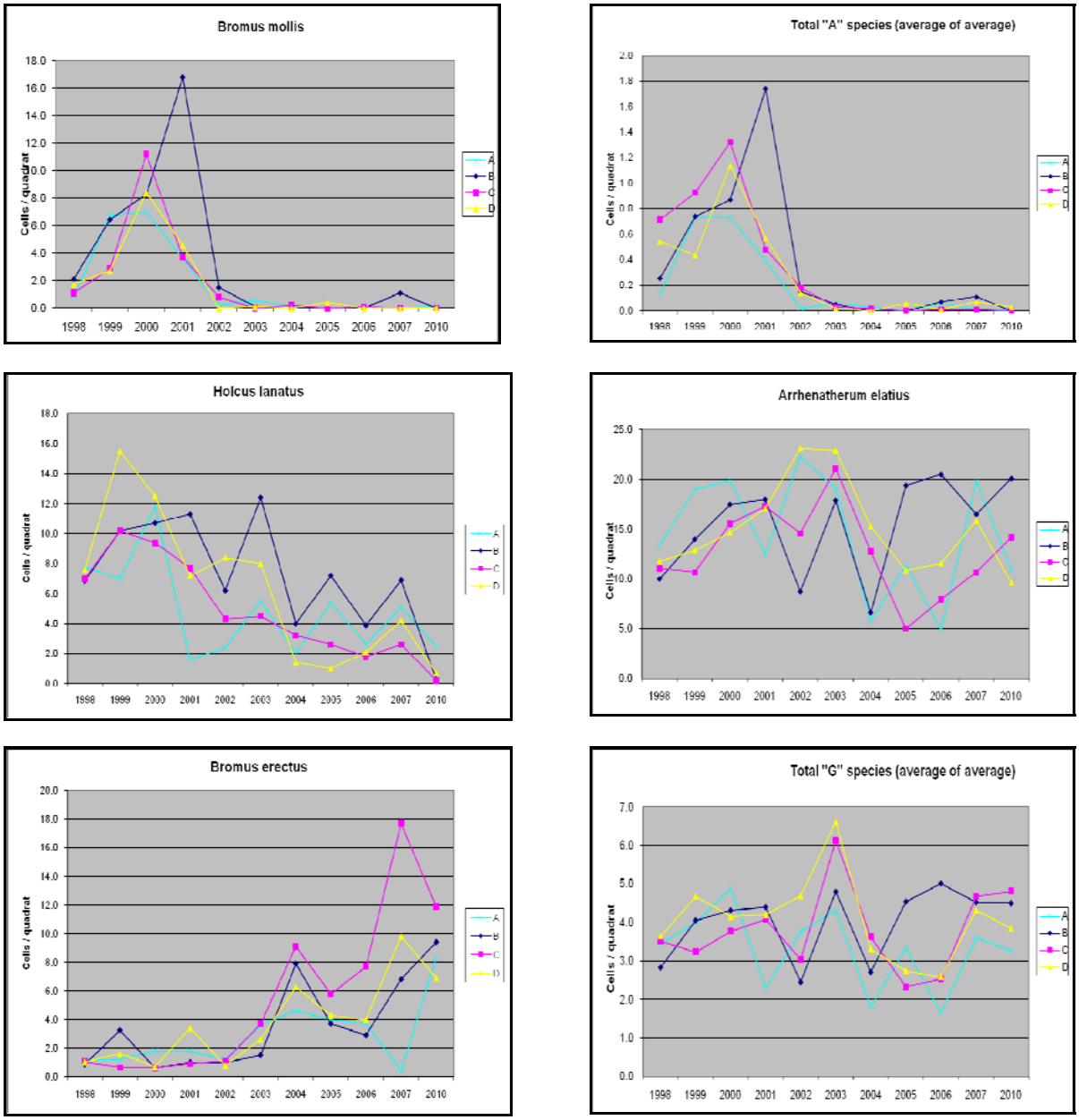
NVC summary for Magdalen Hill Down Extension (2010) using 'Tablefit' software	
Compartment	**Summary description**
A	Typical *Bromus erectus* calcareous grassland with strong features of *Cynosurus- Centaurea* mesotrophic grassland *Galium verum* sub-community
B	Typical *Bromus erectus* calcareous grassland with strong features of *Cynosurus- Centaurea* mesotrophic grassland *Lathyrus pratensis* sub-community
C	*Bromus erectus* calcareous grassland *Knautia* sub-community with strong features of *Cynosurus- Centaurea* mesotrophic grassland *Galium verum* sub-community
D	As above i.e. The same as for Compartment C
E	Mixture of *Bromus erectus* calcareous grassland and *Avenula pubescens* calcareous grassland

2.4 False oat-grass and other problem species

There are a number of species that can monopolise the sward to the detriment of others. Figure 3 shows the course of change in the two groups of such species since 1998. "A" (arable) species are usually short-lived plants that commonly occur as troublesome weeds in arable land. "G" (grassland) species are those that can dominate more established grasslands to the detriment of other species.

Of the "A" species only lop grass *Bromus mollis* was ever common enough to cause concern, but by 2002 it had declined in all areas. Of the "G" species Yorkshire fog *Holcus lanatus* is in decline. Over the last three years false oat grass *Arrenatherum elatius* has declined in areas A and D (where it is now less abundant than it was in 1998) and increased in areas B and C. Upright brome *Bromus erectus* is gradually increasing in abundance but this is also one of the NVC CG3 community constants.

Figure 3: The distribution and abundance of potential "problem" species



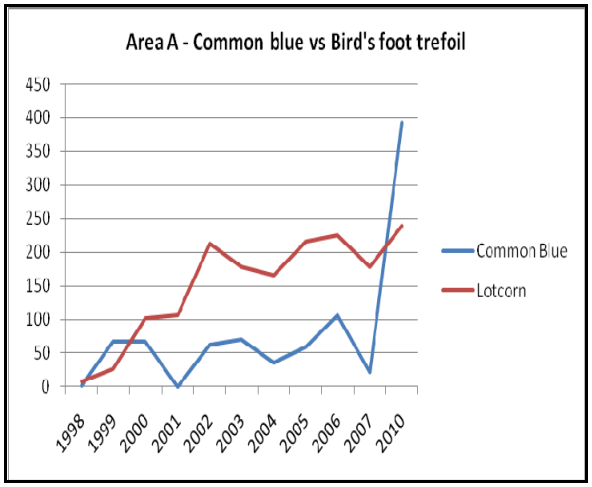
2.5 Butterfly and larval food plant trends

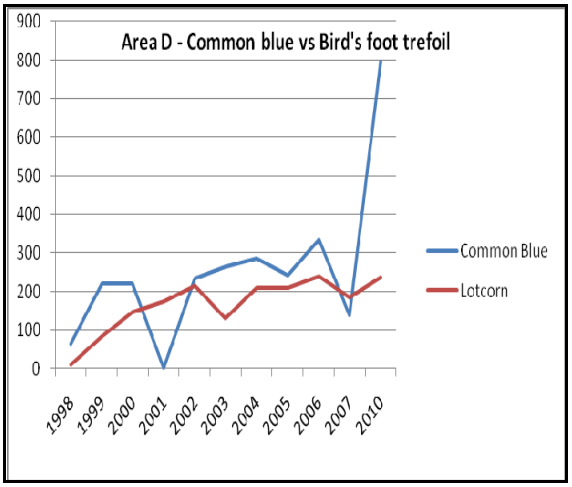
A butterfly transect was established at MHD Extension in 1996 (see Figure 1) to provide base-line data prior to re-seeding of the site, then to monitor changes in subsequent years as the re-seeded grassland sward developed. In 1996 the bulk of the site was bare earth with scattered ruderal species, with just Area E as a small remnant of unimproved chalk grassland. Areas A-D represent the four quarters of the reseeded site. Seeding took place in September 1997, so it is not until the 1998 season that any response to re-seeding would be seen in the butterfly fauna present. Appendix 3 presents a tabulated summary of Annual Indices for all butterfly species recorded at MHD Extension.

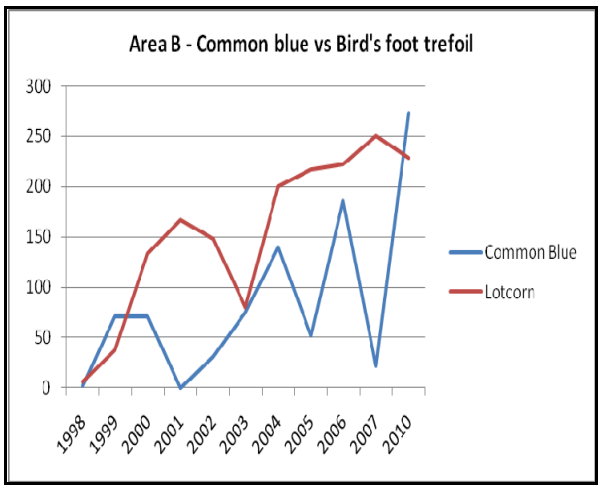
The data for the butterfly transect on the Extension was used to look at the trends in butterfly numbers compared with trends in their larval foodplants. The transect route goes beyond the grazed area so this can only give a broad indication of trends. Each section of the transect was allocated to one or more of the areas A through E: A – sections 7+8, B – sections 1+2+8, C – sections 3+4, D – sections 5+6+7 and E – section 6.

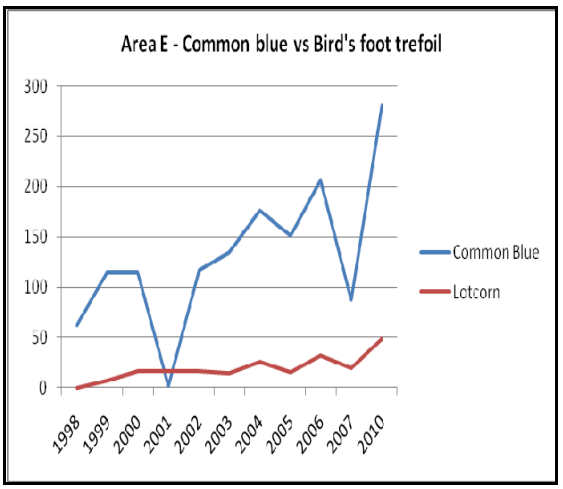
Figure 4 shows by area and for the Extension as a whole the comparison of the Common Blue trends with those of bird's-foot trefoil *Lotus corniculatus* for all survey periods. Figure 5 takes a 3-yearly view of the same data and incorporates the trends for percentage of bare earth. Figure 6 shows for the Extension as a whole the comparison of the Small Blue trends with those of kidney vetch *Anthyllis vulneraria* for all survey periods (the Small Blue numbers are too low to warrant analysis by area).

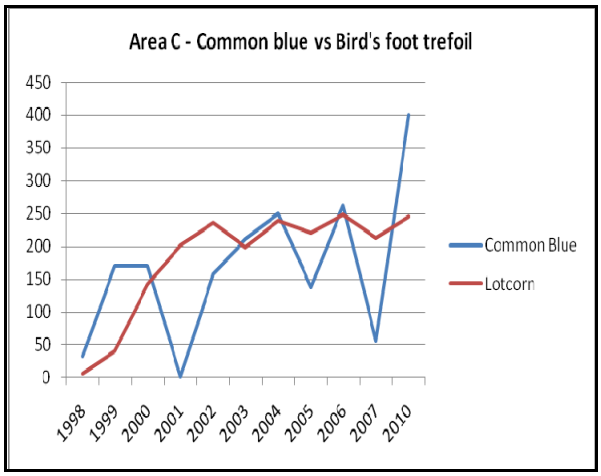
There is an evident positive correlation between the numbers of a butterfly species recorded and the presence of its larval foodplant.











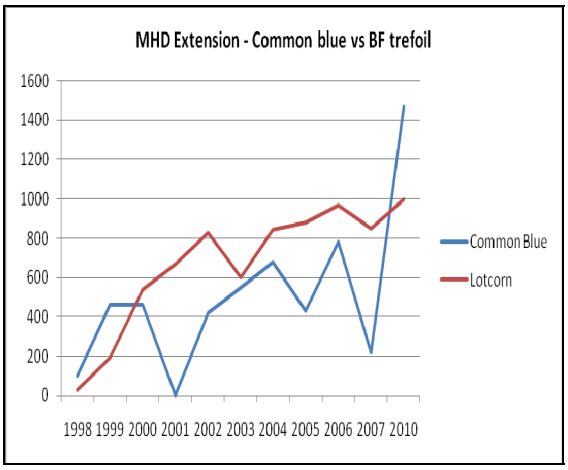


Figure 4: Comparison of Common Blue and bird's-foot trefoil trends

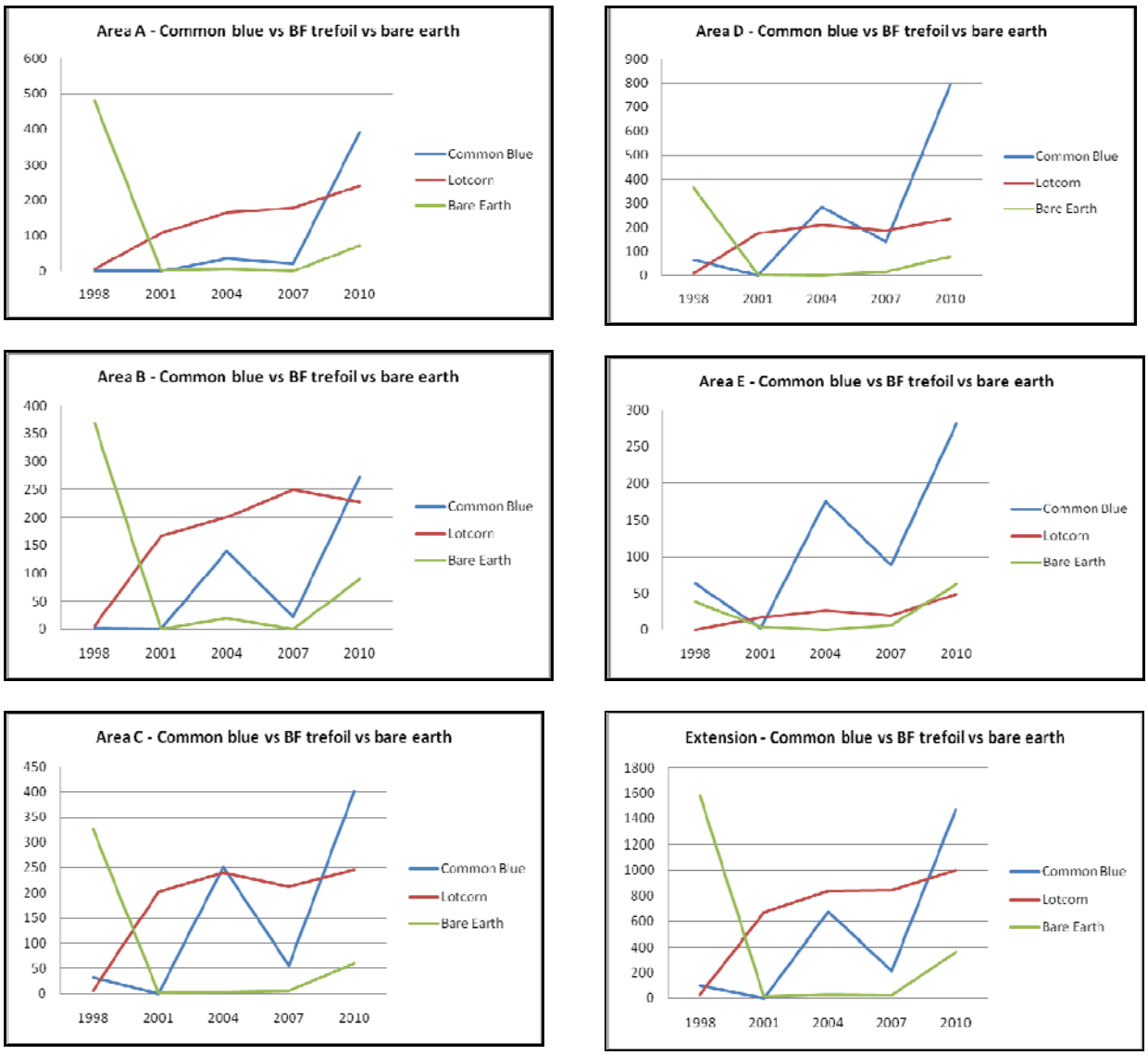


Figure 5: Comparison of Common Blue, bird's-foot trefoil and bare earth trends

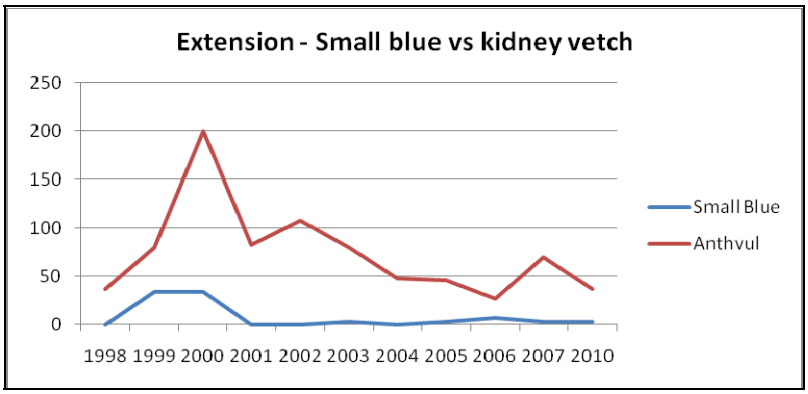


Figure 6: Comparison of Small Blue and kidney vetch

2.6 Relationships between grasses and butterflies with grass-feeding larvae.

Dominant grass species in the sward

The dominant grasses at MHD Extension are *Arrhenatherum elatius*, *Bromus erectus*, *Festuca rubra* and *Dactylis glomerata*. All bar *Dactylis glomerata* are recorded as being part of the original seed mix, but given the even distribution and frequency of occurrence of *Dactylis glomerata* it is assumed it was probably in the original mix but not listed. Other grass species well distributed across the site, but less frequent, and in generally lower abundance are *Holcus lanatus*, *Agrostis stolonifera*, *Poa pratensis*, *Avenula pubescens*, *Trisetum flavescens* and *Briza media*. Of these, *Avenula pubescens* and *Poa pratensis* are not listed as part of the original seed mix. A further four species (*Phleum pratense ssp. pratense*, *Agrostis canina*, *Lolium perenne*, *Bromus mollis*) are recorded as present, but are very local in occurrence and make up an insignificant amount of the sward. Two species, *Anthoxanthum odoratum* and *Cynosurus cristatus*, were part of the original seed mix, but are presently absent from the sward. The former was only ever present in small quantities, but had largely disappeared by 2003. For *Cynosurus cristatus*, there is a rather dramatic change in fortunes. From 1998-2005 it was widespread, occupying 90%+ of quadrats surveyed, and present in c.5-8 out of 25 cells per quadrat, so was a siginificant, although not a dominant species. However, after 2005, things changed dramatically, with a drop to occupancy of just 65% of quadrats in 2006, 55% by 2007, and complete absence (0%) in 2010. The reason for this dramatic change is unknown.

Important larval foodplants in the sward

From Table 4 it can be seen that of the dominant grass species in the sward, *Dactylis glomerata* and *Festuca rubra* are important larval foodplants, whereas *Arrhenatherum elatius* and *Bromus erectus* are not specifically listed as larval foodplants for any of Hampshire's butterfly species.

Of the other grasses that are well distributed within the sward but in lower quantities, the most significant larval foodplants are *Holcus lanatus*, *Agrostis stolonifera* and *Poa pratensis*. The most important larval foodplant grass species absent from the sward is *Festuca ovina*, which is the sole foodplant for Silver-spotted Skipper, and principal foodplant for Small Heath.

Trends for Hesperidae and Satyridae with grass-feeding larvae.

Small Skipper & Essex Skipper

Small Skipper and Essex Skipper are not consistently distinguished from each other during transect recording, so the data are presented as a combined figure. Independent observation shows that Small Skipper accounts for the vast majority of individuals recorded at MHD. Apart from a massive increase in 2010, the figures for Small/Essex Skipper have changed little since re-seeding of the site in 1997. This is not unexpected, despite *Holcus lanatus*, the main foodplant for Small Skipper, being well distributed across the site and locally dominant. The hard winter and spring grazing by cattle and sheep would not suit the species, since larvae overwinter in the grass sheath/stem and would be consumed. The same would also be true for Essex Skipper, which overwinters as ova in the tight sheath or hard dead stems of *Dactylis glomerata* or *Holcus mollis*. The former is a dominant grass at the site but gets grazed down each winter/spring.

Table 4: Grass species in relation to butterfly larval foodplant. Solid dot (●) is main larval foodplant, open dot (○) for other cited larval foodplants, and (-) for possible foodplants. Data is based on Maitland Emmet & Heath(1989), Thomas & Lewington (1991), Asher et al. (2001) and Thomas & Lewington (2010), and personal observations in Hampshire by Andy Barker. Shaded rows are those grass species that form a significant part of the grass sward at 'MHD Extension', darkest shading for those with highest frequency of occurrence. Those species with tick (✓) are those listed as being in the original seed mix. A-E are 2010 frequency and abundance values by compartment for each grass species, following NVC floristic table standard notation.

	Small Skipper	Essex Skipper	Large Skipper	Silver-spotted Skipper	Speckled Wood	Marbled White		Gatekeeper	Meadow Brown	Ringlet	Small Heath	A	B	C	D	E
						young larvae	later instars									
Holcus lanatus ✓	●				●		○					IV (3-8)	II (3)	I (4)	II (3-5)	II (3-5)
Holcus mollis	○	●														
Dactylis glomerata		●	●		●		○		○	●		V (5-9)	V (6-8)	V (4-8)	V (4-9)	I (3)
Phleum pratense	-	○					○					I (3)				
Brachypodium sylvaticum	-	○	○		●				○	●						
Brachypodium pinnatum		○	○				○									
Molinia caerulea			○													
Festuca rubra ✓						●	●	●	○		○	V (7-10)	V (9-10)	V (8-10)	IV (7-10)	V (9-10)
Festuca ovina				●			○	●			●					
Elymus (Agropyron) repens					○			○		●						
Agrostis capillaries								●	●		○					
Agrostis stolonifera ✓								●	●		○	IV (3-9)	I (3)	II (3-7)	III (3-5)	II (4-5)
Agrostis canina								●	●		○	I (5)			I (5)	I (3)
Poa trivialis								●	●	●	○					
Poa pratensis								●	●	●	○	II (3-5)	II (3-4)	I (3)	I (3)	I (5)
Lolium perenne ✓									●			I (0-6)	II (0-7)			I (0-3)
Avenula (Helictotrichon) pubescens									○			I (3)		II (5-10)	IV (2-9)	IV (5-10)
Deschampsia cespitosa										○						
Arrhenatherum elatius ✓												IV (3-9)	V (7-10)	V (5-9)	V (5-9)	V (3-6)
Bromus erectus ✓												V (4-8)	V (4-10)	V (4-9)	IV (2-9)	III (3-7)
Cynosurus cristatus ✓																
Trisetum flavescens ✓												II (3-9)		II (5-7)	IV (3-6)	I (4)
Briza media ✓												I (5)	II (4-6)	IV (3-6)	V (2-5)	I (3)
Bromus mollis												I (4)				
Anthoxanthum odoratum ✓																

Large Skipper

As with Small/Essex Skipper, the populations of Large Skipper at MHD Extension have changed little since the site was re-seeded in 1997. The principal foodplant for this species is *Dactylis glomerata*, one of the commonest grasses at the site, but given the winter/spring grazing, the larvae which live in a winter leaf-blade tube hibernaculum would not fare well, and would be grazed off. One might expect that in the ungrazed perimeter of the site between the fence and the hedge the species might be able to breed successfully, but the data show little evidence of this.

Speckled Wood

Occasional individuals are recorded on transect, but this is primarily a woodland species where it uses *Brachypodium sylvaticum* as a favoured larval foodplant. This grass does not occur in the re-seeded area.

Marbled White

In 1998 this species was almost entirely confined to that part of the transect (Section 6) that traverses the small remnant of unimproved downland (Area E). Whilst the species now occurs in reasonable numbers across the whole site, the transect data shows no real change since re-seeding in 1997. It is assumed, that whilst the principal larval foodplant, *Festuca rubra*, is one of the dominant grasses at the site, conditions are not right in terms of breeding requirements. The well-established, complicated, and seemingly important relationship with a fungus (*Acremonium*) that commonly infests *Festuca rubra* may be significant (see Thomas & Lewington, 2010).

Gatekeeper

This species was at a low ebb in 1998, but there was a steady rise in numbers up to 2004, before dropping back to low numbers again in the wet summer of 2008. Since then there has been a recovery. Whether the rise from 1998-2004 was due to breeding in the newly seeded site is difficult to judge, but several important larval foodplants, namely *Festuca rubra, Agrostis stolonifera* and *Poa pratensis* are key components of the re-seeded sward, and quite probably present additional breeding opportunities.

Meadow Brown

This species showed a spectacular rise in numbers over the period 1997-2004, going from an Annual Index of 152 to one of 2615. Although numbers have since dropped back and levelled off at around the 1000-1400 mark, there seems little doubt that the Meadow Brown is fully utilising the re-seeded sward as additional breeding habitat. Of the dominant grass species at the site, only *Festuca rubra* is likely to be used as a larval foodplant by the Meadow Brown (see Table 4). Of those other grasses present at the site it would seem that *Poa pratensis* and *Agrostis stolonifera* are the most likely foodplants being used. Thomas & Lewington (2010) describe Meadow Browns as using a wide range of grasses, but favouring medium and fine-leaved species. Thomas & Lewington (1991) had previously stated that Meadow Brown larvae can be found by day deep in tussocks of favoured grasses such as *Poa*

pratensis. It may, therefore, be that although this species is not the commonest grass in the sward at MHD Extension, it may perhaps be one of the most important for Meadow Brown.

Ringlet

Up until 2005, this species was only seen in very low numbers at MHD Extension (Annual Index generally <20 and never exceeding 34). Since 2005, however, numbers have shown a significant increase, and in both 2009 and 2010 the Annual Index topped the 200 mark. Whether this is due to the condition of the sward as suitable breeding habitat, or due to the weather, or other factors, is unknown. *Dactylis glomerata* and *Poa pratensis* are the key larval foodplants within the sward, although neither of these was listed as present in the original seed mix.

Small Heath

This species is only recorded in low numbers, and has shown no change since re-seeding in 1997. This is not surprising as the re-seeded sward lacks *Festuca ovina*, the principal larval foodplant. Furthermore, the sward height is generally rather longer than that preferred by the Small Heath.

3. CONCLUSIONS AND RECOMMENDATIONS

The conclusions and recommendations have been developed through on site discussions at the August 2011 MHD Site Management Meeting and through a subsequent site visit with Colin Matthews and Phil Budd.

The questions this report aimed to address and the conclusions drawn are as follows:

Is overall change in the right direction for an "ancient grassland" community to develop?

It appears that the Extension now has many of the characteristic species of an ancient grassland community, most closely resembling NVC CG3a. Species richness is on a gentle downward trend but is still well within the expected range for CG3a, or, indeed, for CG2a. However, nearly a quarter of the originally sown species are now no longer present and there are some CG3a and CG2a community constant species that are absent.

Is current management activity preventing damage from false oat-grass invasion and are there other species that could pose problems?

Arrenatherum elatius is generally under control, although it needs to be monitored closely in sections B and C. There do not apear to be any other problem species at present.

Is there any evident correlation between butterfly numbers and their larval foodplants and nectaring plants?

There is an evident positive correlation between the numbers of Common Blue and Small Blue species recorded and their respective larval foodplants. The strength of this correlation is affected by other factors such as presence of bare earth, sward height and, importantly, the prevailing weather conditions impacting the species throughout its lifecycle.

Of those butterflies whose larvae feed on grasses, only the Meadow Brown and possibly Gatekeeper, seem to be utilising the re-seeded sward to any great extent as breeding habitat. Of those grass species present, it is probably *Poa pratensis* and *Festuca rubra* that are the most important larval foodplants, with *Dactylis glomerata* and *Agrostis stolonifera* having a lesser role for some species.

What management conclusions can be drawn from the findings?

The findings suggest that the management of MHD Extension has been highly effective in establishing a close approximation to an ancient grassland community in just twelve years since re-seeding.

However, there is visually a big difference between sections A, B, C and D. Some of the difference may be down to the previous presence of the nearby arable field above section A or the different soil depths or the behaviour of grazing animals (it has been suggested that the cattle / sheep spend more time grazing areas A and D because they hunker down for the night under the trees at the east end of the site).

Large areas of section B in particular would benefit from more intensive cattle grazing (ie more beasts but for the same duration and timing in order to minimise impact on butterfly numbers). Cattle are preferred to sheep because they produce a more varied sward with some areas of bare ground. It would be costly to limit the beasts to specific areas but increasing the intensity of grazing across the Extension would help improve the sward in all areas. It would also be advisable to spread yellow rattle *Rhinanthus minor* seeds to help reduce the density of grasses in area B.

It is recommended that seeds or plant plugs for selected species are provided in the scrapes on the Extension with the aim of increasing the number of CG3a and CG2a community constants and to provide additional larval foodplants (eg *Anthyllis vulneraria* for the Small Blue, *Hippocrepis comosa* for the Chalkhill Blue and *Helianthemum chamaesistus* for the Brown Argus) and nectaring plants (eg *Thymus praecox*). Sections A and B would also benefit from some scrapes because the sward density makes it difficult for some species to establish.

The Extension should be resurveyed, using the same methodology, on a 3 year basis. It may also be appropriate to commence surveys of MHD North using the same method in order to get a baseline of data against which trends can be assessed for that part of the site. Additionally an NVC survey should be conducted on the Original and the Extension in 2012 to compare the 2 parts of the site and to provide valid NVC classifications.

4. ACKNOWLEDGEMENTS

We are grateful to Colin Matthews and Phil Budd for their assistance in interpreting the results of the analysis.

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Appendix 1: Botanical species 3-yearly trends overall (areas A-D) and by area 1998-2010

- Figures shown are the number of cells in which a species was recorded
- The 1998 figures are for the first set of measurements in that year (for comparative purposes with future years)
- The green highlighted columns show those species that were in the original sown mix

Year	Area	Acer campestre	Acer pseudoplatanus	Achillea millefolium	Aethusa cynapium	Agrimonia eupatoria	Agrostis canina	Agrostis stolonifera	Alopecurus myosuroides	Alopecurus pratensis	Anacamptis pyramidalis	Anagallis arvensis	Anthoxanthum odoratum	Anthriscus sylvestris	Anthyllis vulneraria	Aphanes arvensis	Arenaria serpyllifolia	Arrhenatherum elatius bulbosum	Arrhenatherum elatius	Asperula cynanchica	Avenula pratensis	Avenula pubescens	Bellis perennis	Fallopia convolvulus	Blackstonia perfoliata	Brachypodium pinnatum	Brachypodium sylvaticum	Briza media	Bromus commutatus	Bromopsis erectus	Bromus hordeaceus hordeaceus	B.moll/ A.ster sdl	Anisantha sterilis	Buddleja davidii	Campanula glomerata	Campanula rotundifolia	Carduus acanthoides	Carduus nutans	Carex flacca	Centaurea scabiosa	Centaurium erythraea	Centaurea nigra	Cerastium fontanum triviale	Cerastium glomeratum	Chaenorhinum minus	Chamerion angustifolium	Chenopodium album	Cirsium acaule	Cirsium arvense	Cirsium sp.	Cirsium vulgare	Clematis vitalba	Clinopodium vulgare	Convolvulus arvensis
1998	**ALL**	0	0	6	1	0	0	155	55	0	0	143	0	0	37	9	159	33	427	0	0	72	2	49	0	3	0	19	0	34	50	0	70	0	1	7	0	9	0	0	0	6	130	0	1	0	43	0	2	0	1	16	18	0
2001	**ALL**	0	0	31	0	2	0	180	1	0	0	2	7	0	83	0	0	0	649	0	0	7	0	0	0	2	0	24	0	71	287	0	16	0	4	4	0	0	0	16	0	46	125	0	0	0	0	0	12	0	0	15	164	4
2004	**ALL**	0	0	73	1	3	0	268	2	0	0	1	0	0	47	0	0	0	405	1	0	3	0	0	0	0	0	42	0	279	3	0	0	0	4	2	0	0	46	4	3	71	10	0	0	0	0	0	0	0	0	30	168	1
2007	**ALL**	0	0	65	0	1	0	213	0	0	0	2	0	0	70	0	0	0	629	0	0	20	1	0	4	0	0	89	0	347	11	0	0	0	4	3	0	0	122	8	1	80	22	0	0	0	0	0	8	0	0	33	27	0
2010	**ALL**	0	2	45	0	3	18	96	0	0	0	0	0	0	28	0	0	0	549	0	0	172	0	1	2	0	0	84	0	365	1	0	0	0	0	5	0	0	312	0	1	61	13	0	0	0	0	0	3	0	0	19	0	0
1998	**A**	0	0	1	0	0	0	77	0	0	0	63	0	0	8	2	9	0	109	0	0	2	0	36	0	0	0	12	0	9	11	0	4	0	0	3	0	0	0	0	0	0	26	0	0	0	36	0	0	0	0	0	2	0
2001	**A**	0	0	3	0	0	0	0	1	0	0	1	5	0	7	0	0	0	125	0	0	1	0	0	0	0	0	5	0	18	36	0	0	0	2	1	0	0	0	5	0	6	27	0	0	0	0	0	0	0	0	1	66	0
2004	**A**	0	0	18	0	0	0	92	2	0	0	0	0	0	0	0	0	0	58	0	0	0	0	0	0	0	0	2	0	46	1	0	0	0	0	0	0	0	2	2	0	9	3	0	0	0	0	0	0	0	0	0	62	0
2007	**A**	0	0	15	0	1	0	25	0	0	0	0	0	0	1	0	0	0	198	0	0	0	0	0	0	0	0	6	0	4	0	0	0	0	0	0	0	0	0	5	0	6	1	0	0	0	0	0	1	0	0	0	1	0
2010	**A**	0	0	13	0	0	9	69	0	0	0	0	0	0	0	0	0	0	110	0	0	1	0	0	0	0	0	10	0	83	1	0	0	0	0	5	0	0	9	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0
1998	**B**	0	0	3	1	0	0	40	0	0	0	5	0	0	6	2	24	0	105	0	0	14	1	1	0	0	0	4	0	10	14	0	0	0	0	2	0	0	0	0	0	1	20	0	0	0	5	0	0	0	0	0	0	0
2001	**B**	0	0	11	0	0	0	60	0	0	0	0	0	0	22	0	0	0	180	0	0	1	0	0	0	2	0	3	0	10	168	0	5	0	0	2	0	0	0	3	0	11	48	0	0	0	0	0	1	0	0	0	59	0
2004	**B**	0	0	9	1	0	0	76	0	0	0	0	0	0	8	0	0	0	66	0	0	0	0	0	0	0	0	10	0	79	0	0	0	0	0	0	0	0	10	0	0	8	3	0	0	0	0	0	0	0	0	0	42	1
2007	**B**	0	0	12	0	0	0	63	0	0	0	0	0	0	9	0	0	0	165	0	0	8	0	0	0	0	0	18	0	68	11	0	0	0	2	0	0	0	2	0	0	1	10	0	0	0	0	0	0	0	0	0	2	0
2010	**B**	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	201	0	0	0	0	1	0	0	0	26	0	94	0	0	0	0	0	0	0	0	4	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0
1998	**C**	0	0	1	0	0	0	27	2	0	0	28	0	0	7	5	33	26	99	0	0	34	1	1	0	2	0	3	0	6	4	0	65	0	0	1	0	0	0	0	0	4	30	0	1	0	0	0	2	0	1	14	8	0
2001	**C**	0	0	6	0	0	0	119	0	0	0	1	0	0	32	0	0	0	173	0	0	0	0	0	0	0	0	11	0	9	37	0	11	0	2	0	0	0	0	6	0	10	29	0	0	0	0	0	0	0	0	8	15	0
2004	**C**	0	0	19	0	1	0	61	0	0	0	1	0	0	18	0	0	0	128	1	0	1	0	0	0	0	0	13	0	91	2	0	0	0	2	0	0	0	22	0	0	15	2	0	0	0	0	0	0	0	0	21	23	0
2007	**C**	0	0	21	0	0	0	23	0	0	0	2	0	0	37	0	0	0	107	0	0	12	0	0	0	0	0	22	0	177	0	0	0	0	2	3	0	0	113	2	0	47	5	0	0	0	0	0	0	0	0	8	19	0
2010	**C**	0	0	17	0	0	0	13	0	0	0	0	0	0	21	0	0	0	142	0	0	74	0	0	0	0	0	23	0	119	0	0	0	0	0	0	0	0	174	0	0	36	0	0	0	0	0	0	0	0	0	11	0	0
1998	**D**	0	0	1	0	0	0	11	53	0	0	47	0	0	16	0	93	7	114	0	0	22	0	11	0	1	0	0	0	9	21	0	1	0	1	1	0	9	0	0	0	1	54	0	0	0	2	0	0	0	0	2	8	0
2001	**D**	0	0	11	0	2	0	1	0	0	0	0	2	0	22	0	0	0	171	0	0	5	0	0	0	0	0	5	0	34	46	0	0	0	0	1	0	0	0	2	0	19	21	0	0	0	0	0	11	0	0	6	24	4
2004	**D**	0	0	27	0	2	0	39	0	0	0	0	0	0	21	0	0	0	153	0	0	2	0	0	0	0	0	17	0	63	0	0	0	0	2	2	0	0	12	2	3	39	2	0	0	0	0	0	0	0	0	9	41	0
2007	**D**	0	0	17	0	0	0	102	0	0	0	0	0	0	23	0	0	0	159	0	0	0	1	0	4	0	0	43	0	98	0	0	0	0	0	0	0	0	7	1	1	26	6	0	0	0	0	0	7	0	0	25	5	0
2010	**D**	0	2	14	0	3	9	13	0	0	0	0	0	0	7	0	0	0	96	0	0	97	0	0	2	0	0	25	0	69	0	0	0	0	0	0	0	0	125	0	1	23	1	0	0	0	0	0	3	0	0	8	0	0

Year	Area	Cornus sanguinea	Crataegus monogyna	Crepis capillaris	Crepis vesicaria	Cynosurus cristatus	Dactylis glomerata	Daucus carota	Echium vulgare	Elytrigia repens	Epilobium hirsutum	Epilobium angustifolium	Epilobium adenocaulon	Epilobium montanum	Epilobium montanum	Eupatorium cannabinum	Euphorbia exigua	Euphorbia helioscopia	Euphrasia officinalis agg	Euphorbia peplus	Festuca arundinacea	Festuca ovina	Festuca pratensis	Festuca rubra / ?ovina	Filipendula vulgaris	Fraxinus excelsior	Fumaria officinalis	Galium aparine	Galium mollugo	Galium sp.	Galium verum	Gentianella amarella	Geranium columbinum	Geranium dissectum	Geranium molle	Geranium sp. annual	Geum urbanum	Hedera helix	Hellanthemum chamaecistus	Heraclium sphondylium	Pilosella officinarum	Hieracium 'indeterminate'	Holcus lanatus	Holcus mollis	Hypochaeris maculata	Hypochaeris radicata	Hypericum perforatum	Inula conyza	Kickxia elatine	Kickxia spuria	Knautia arvensis	Koeleria macrantha	Lactuca serriola	Lamium amplexicaule	Lathyrus pratensis	Legousia hybrida
1998	ALL	0	5	178	1	168	179	31	0	0	0	0	533	655	1	0	1	0	0	2	0	0	0	217	4	1	43	30	11	0	0	0	0	0	7	0	2	0	0	0	4	21	299	0	0	0	0	0	7	0	0	2	8	5	15
2001	ALL	0	2	47	14	430	136	236	0	0	0	0	4	0	0	0	0	0	0	0	0	0	1	743	26	1	0	1	48	0	16	0	1	0	12	0	0	0	0	0	0	1	278	0	19	5	4	0	0	0	5	0	0	0	102	0
2004	ALL	0	2	20	0	157	344	384	0	0	0	0	0	0	0	0	0	0	17	12	29	0	0	825	0	2	0	0	43	0	52	0	0	0	0	0	0	0	0	0	0	0	106	0	0	0	41	0	0	0	2	0	0	0	49	0
2007	ALL	0	4	3	0	91	360	326	0	0	0	0	0	0	0	0	0	0	69	0	0	0	1	956	0	1	0	0	118	0	100	0	0	0	0	0	0	0	0	0	0	0	188	0	0	0	31	0	0	0	9	0	0	0	130	0
2010	ALL	0	4	0	0	0	440	17	0	0	0	0	0	0	0	0	0	0	17	0	0	0	0	860	0	0	0	0	79	0	109	1	0	0	1	0	0	0	2	3	0	0	37	0	0	0	9	0	0	0	10	0	0	0	284	0
1998	A	0	1	51	0	31	62	1	0	0	0	0	46	60	1	0	0	0	0	0	0	0	0	74	0	0	30	0	2	0	0	0	0	0	0	0	0	0	0	0	4	0	85	0	0	0	0	0	7	0	0	0	1	2	3
2001	A	0	1	13	1	34	39	41	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	127	4	0	0	1	13	0	2	0	0	0	1	0	0	0	0	0	0	0	16	0	6	5	2	0	0	0	2	0	0	0	9	0
2004	A	0	0	6	0	25	93	81	0	0	0	0	0	0	0	0	0	0	1	12	11	0	0	203	0	0	0	0	19	0	8	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	12	0	0	0	0	0	0	0	12	0
2007	A	0	0	0	0	2	76	13	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	240	0	0	0	0	64	0	34	0	0	0	0	0	0	0	0	0	0	0	51	0	0	0	1	0	0	0	3	0	0	0	42	0
2010	A	0	1	0	0	0	127	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	195	0	0	0	0	12	0	48	0	0	0	0	0	0	0	0	0	0	0	25	0	0	0	0	0	0	0	3	0	0	0	142	0
1998	B	0	0	34	1	59	40	14	0	0	0	0	225	225	0	0	0	0	0	2	0	0	0	61	4	1	7	2	0	0	0	0	0	0	0	0	0	0	0	0	0	10	74	0	0	0	0	0	0	0	0	0	2	5	2	9
2001	B	0	1	14	8	108	22	50	0	0	0	0	2	0	0	0	0	0	0	0	0	0	1	211	2	1	0	0	14	0	2	0	0	0	0	0	0	0	0	0	0	0	113	0	5	0	0	0	0	0	1	0	0	0	8	0
2004	B	0	0	9	0	37	76	82	0	0	0	0	0	0	0	0	0	0	13	0	0	0	0	211	0	0	0	0	4	0	23	0	0	0	0	0	0	0	0	0	0	0	40	0	0	0	20	0	0	0	2	0	0	0	5	0
2007	B	0	0	1	0	24	97	9	0	0	0	0	0	0	0	0	0	0	25	0	0	0	1	250	0	0	0	0	7	0	30	0	0	0	0	0	0	0	0	0	0	0	69	0	0	0	20	0	0	0	1	0	0	0	28	0
2010	B	0	0	0	0	0	126	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	250	0	0	0	0	30	0	11	0	0	0	0	0	0	0	0	2	0	0	3	0	0	0	3	0	0	0	3	0	0	0	76	0
1998	C	0	2	31	0	23	21	7	0	0	0	0	203	236	0	0	1	0	0	0	0	0	0	24	0	0	0	20	7	0	0	0	0	0	4	0	2	0	0	0	0	6	63	0	0	0	0	0	0	0	0	0	0	0	1	0
2001	C	0	0	13	4	218	29	96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	212	4	0	0	0	19	0	11	0	1	0	0	0	0	0	0	0	0	1	77	0	8	0	0	0	0	0	2	0	0	0	5	0
2004	C	0	2	5	0	67	79	104	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	205	0	1	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	32	0	0	0	2	0	0	0	0	0	0	0	6	0
2007	C	0	2	0	0	35	90	157	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	248	0	1	0	0	21	0	13	0	0	0	0	0	0	0	0	0	0	0	26	0	0	0	8	0	0	0	5	0	0	0	10	0
2010	C	0	1	0	0	0	78	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	232	0	0	0	0	5	0	32	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	6	0	0	0	1	0	0	0	25	0
1998	D	0	2	62	0	55	56	9	0	0	0	0	59	134	0	0	0	0	0	0	0	0	0	58	0	0	6	8	2	0	0	0	0	0	3	0	0	0	0	0	0	5	77	0	0	0	0	0	0	0	0	0	2	0	3
2001	D	0	0	7	1	70	46	49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	193	16	0	0	0	2	0	1	0	0	0	11	0	0	0	0	0	0	0	72	0	0	0	2	0	0	0	0	0	0	0	80	0
2004	D	0	0	0	0	28	96	117	0	0	0	0	0	0	0	0	0	0	3	0	15	0	0	206	0	1	0	0	20	0	13	0	0	0	0	0	0	0	0	0	0	0	14	0	0	0	7	0	0	0	0	0	0	0	26	0
2007	D	0	2	2	0	30	97	147	0	0	0	0	0	0	0	0	0	0	27	0	0	0	0	218	0	0	0	0	26	0	23	0	0	0	0	0	0	0	0	0	0	0	42	0	0	0	2	0	0	0	0	0	0	0	50	0
2010	D	0	2	0	0	0	109	7	0	0	0	0	0	0	0	0	0	0	17	0	0	0	0	183	0	0	0	0	32	0	18	1	0	0	1	0	0	0	2	1	0	0	7	0	0	0	0	0	0	0	3	0	0	0	41	0

Year	Area	Leontodon autumnalis	Leontodon hispidus	Leontodon sp.	Leontodon saxatilis	Leucanthemum vulgare	Ligustrum vulgare	Linum catharticum	Linaria vulgaris	Lolium multiflorum	Lolium perenne	Lotus corniculatus	Luzula campestris	Luzula pilosa	Malva moschata	Malva sylvestris	Medicago lupulina	Melilotus altissimus	Melilotus officianalis	Misopates orontium	Myosotis arvensis	Myosotis discolor	Odontites vema	Origanum vulgare	Orobanche elatior	Orobanche minor	Papaver argemone	Papaver dubium	Papaver rhoeas	Papaver sp.	Pastinaca sativa	Phleum pratense	Pimpinella saxifraga	Plantago lanceolata	Plantago major	Plantago media	Poa annua	Poa compressa	Poa pratensis	Polygonum aviculare	Potentilla reptans	Potentilla sterilis	Primula veris	Prunus avium	Prunus spinosa	Prunella vulgaris	Pulicaria dysenterica	Ranunculus acris	Ranunculus bulbosus	Ranunculus repens	Ranunculus sp.	Reseda luteola	Reseda lutea	Rhamnus catharticus	Rhinanthus minor
1998	ALL	0	37	0	0	21	0	0	4	0	78	30	0	0	0	0	20	0	0	0	200	0	0	11	0	0	21	0	90	0	0	19	0	189	0	4	52	0	208	35	0	0	7	0	0	28	0	0	1	2	0	0	17	3	0
2001	ALL	0	355	0	0	42	0	3	0	0	42	650	0	0	0	0	243	0	0	0	0	0	12	111	0	0	0	0	0	0	0	21	6	517	0	60	2	0	722	0	1	0	88	0	0	67	0	26	10	0	0	0	2	1	45
2004	ALL	0	304	0	0	35	0	5	0	0	10	815	0	0	0	2	589	0	0	0	0	0	481	198	0	0	0	0	0	0	5	1	25	379	0	49	0	0	114	0	4	0	110	0	0	37	4	4	42	0	0	0	0	1	0
2007	ALL	0	543	0	0	73	0	8	0	4	16	826	0	0	0	0	580	0	0	0	0	0	333	230	0	0	0	0	0	0	11	0	72	436	1	78	0	1	70	0	0	0	163	0	0	69	0	1	34	0	0	0	0	1	0
2010	ALL	0	636	0	0	17	0	21	0	0	26	950	0	0	0	0	55	0	0	0	0	0	10	267	0	0	0	0	0	0	51	1	89	473	0	43	0	0	19	0	0	0	493	0	0	3	0	1	69	0	0	0	0	0	13
1998	A	0	2	0	0	4	0	0	0	0	9	7	0	0	0	0	6	0	0	0	5	0	0	5	0	0	0	0	9	0	0	4	0	51	0	3	20	0	88	21	0	0	5	0	0	7	0	0	1	2	0	0	14	0	0
2001	A	0	103	0	0	9	0	0	0	0	1	107	0	0	0	0	83	0	0	0	0	0	4	26	0	0	0	0	0	0	0	6	2	128	0	8	2	0	243	0	0	0	20	0	0	22	0	1	1	0	0	0	2	0	0
2004	A	0	78	0	0	5	0	4	0	0	3	166	0	0	0	2	174	0	0	0	0	0	151	21	0	0	0	0	0	0	0	1	2	144	0	19	0	0	70	0	0	0	29	0	0	9	0	3	13	0	0	0	0	0	0
2007	A	0	72	0	0	0	0	0	0	0	0	178	0	0	0	0	69	0	0	0	0	0	65	68	0	0	0	0	0	0	0	0	4	116	0	1	0	0	32	0	0	0	36	0	0	2	0	1	0	0	0	0	0	0	0
2010	A	0	106	0	0	0	0	0	0	0	9	240	0	0	0	0	11	0	0	0	0	0	5	33	0	0	0	0	0	0	0	1	5	115	0	5	0	0	10	0	0	0	74	0	0	0	0	0	7	0	0	0	0	0	0
1998	B	0	1	0	0	2	0	0	4	0	18	6	0	0	0	0	5	0	0	0	10	0	0	0	0	0	0	0	1	0	0	6	0	28	0	0	25	0	60	0	0	0	1	0	0	4	0	0	0	0	0	1	2	0
2001	B	0	84	0	0	12	0	2	0	0	2	167	0	0	0	0	33	0	0	0	0	0	1	12	0	0	0	0	0	0	0	1	3	98	0	19	0	0	173	0	0	0	22	0	0	14	0	3	4	0	0	0	0	0	0
2004	B	0	71	0	0	4	0	0	0	0	5	200	0	0	0	0	191	0	0	0	0	0	99	73	0	0	0	0	0	0	1	0	8	152	0	20	0	0	19	0	0	0	27	0	0	9	0	0	8	0	0	0	0	0	0
2007	B	0	104	0	0	0	0	0	0	4	7	250	0	0	0	0	105	0	0	0	0	0	90	29	0	0	0	0	0	0	0	0	4	156	0	4	0	1	21	0	0	0	34	0	0	11	0	0	1	0	0	0	0	0	0
2010	B	0	122	0	0	0	0	0	0	0	17	228	0	0	0	0	6	0	0	0	0	0	4	100	0	0	0	0	0	0	0	0	22	129	0	3	0	0	6	0	0	0	104	0	0	0	0	1	11	0	0	0	0	0	12
1998	C	0	14	0	0	8	0	0	0	0	16	6	0	0	0	0	6	0	0	0	60	0	0	1	0	0	13	0	2	0	0	4	0	35	0	0	2	0	25	0	0	0	0	0	0	3	0	0	0	0	0	2	1	0
2001	C	0	60	0	0	8	0	1	0	0	27	202	0	0	0	0	81	0	0	0	0	0	7	61	0	0	0	0	0	0	0	5	0	148	0	12	0	0	95	0	1	0	9	0	0	13	0	6	0	0	0	0	1	45
2004	C	0	72	0	0	4	0	1	0	0	2	240	0	0	0	0	79	0	0	0	0	0	107	15	0	0	0	0	0	0	0	0	10	47	0	4	0	0	13	0	4	0	26	0	0	11	4	0	12	0	0	0	0	1	0
2007	C	0	221	0	0	42	0	8	0	0	6	212	0	0	0	0	215	0	0	0	0	0	67	56	0	0	0	0	0	0	0	0	36	75	0	49	0	0	4	0	0	0	45	0	0	19	0	0	19	0	0	0	0	1	0
2010	C	0	226	0	0	2	0	0	0	0	0	246	0	0	0	0	9	0	0	0	0	0	0	39	0	0	0	0	0	0	0	0	45	113	0	22	0	0	1	0	0	0	200	0	0	0	0	0	11	0	0	0	0	0	0
1998	D	0	20	0	0	7	0	0	0	0	35	11	0	0	0	0	3	0	0	0	125	0	0	5	0	0	8	0	78	0	0	5	0	75	0	1	5	0	35	14	0	0	1	0	0	14	0	0	0	0	0	0	0	0	0
2001	D	0	108	0	0	13	0	0	0	0	12	174	0	0	0	0	46	0	0	0	0	0	0	12	0	0	0	0	0	0	0	9	1	143	0	21	0	0	211	0	0	0	37	0	0	18	0	16	5	0	0	0	0	0	0
2004	D	0	83	0	0	22	0	0	0	0	0	209	0	0	0	0	145	0	0	0	0	0	124	89	0	0	0	0	0	0	4	0	5	36	0	6	0	0	12	0	0	0	28	0	0	8	0	1	9	0	0	0	0	0	0
2007	D	0	146	0	0	31	0	0	0	0	3	186	0	0	0	0	191	0	0	0	0	0	111	77	0	0	0	0	0	0	11	0	28	89	1	24	0	0	13	0	0	0	48	0	0	37	0	0	14	0	0	0	0	0	0
2010	D	0	182	0	0	15	0	21	0	0	0	236	0	0	0	0	29	0	0	0	0	0	1	95	0	0	0	0	0	0	51	0	17	116	0	13	0	0	2	0	0	0	115	0	0	3	0	0	40	0	0	0	0	0	1

Year	Area	Rosa canina	Rubus caesius	Rubus fruticosus agg.	Rumex acetosa	Rumex crispus	Rumex obtusifolius	Sambucus nigra	Sanguisorba minor	Scabiosa columbaria	Senecio erucifolius	Senecio jacobaea	Senecio vulgaris	Sherardia arvensis	Silene alba	Silene vulgaris	Sinapis arvensis	Sisymbrium officinale	Solidago canadensis	Sonchus asper	Sonchus oleraceus	Sonchus sp.	Stellaria media	Succisa pratensis	Taraxacum seedling/sp	Torilis japonica	Tragopogon pratensis	Trifolium campestre	Trifolium dubium	Trifolium hybridum	Trifolium pratense	Trifolium repens	Trisetum flavescens	Unidentified grass	Unid herbaceous dicot	Urtica dioica	Urtica urens	Veronica arvensis	Verbascum thapsus	Veronica chamaedrys	Veronica persica	Veronica serpyllifolia	Viburnum lantana	Viburnum opulus	Vicia cracca	Vicia hirsuta	Vicia sp.	Vicia sativa nigra	Vicia sepium	Vicia tetrasperma	Viola arvensis	Viola hirta
1998	ALL	4	0	0	44	1	0	1	34	2	0	0	875	6	0	0	19	3	0	7	0	279	196	0	15	0	0	0	0	0	0	7	5	0	0	0	0	454	0	0	71	0	0	0	0	0	0	0	0	463	0
2001	ALL	1	0	0	96	0	0	0	108	29	2	1	0	0	0	0	0	0	0	0	0	0	0	7	29	0	0	0	22	2	94	200	75	0	0	0	0	4	0	0	0	0	0	0	49	0	0	0	0	0	0	0
2004	ALL	1	0	2	102	0	0	0	32	28	2	0	0	0	0	0	0	0	0	0	0	0	0	6	20	0	1	0	2	0	262	265	531	0	0	0	0	0	0	2	0	0	0	0	59	0	0	0	0	0	0	1
2007	ALL	6	1	0	111	0	0	1	68	163	0	1	0	0	0	0	0	0	0	0	0	0	0	3	17	0	8	0	0	0	634	437	450	0	0	0	0	0	0	3	0	0	0	0	56	0	0	0	0	0	0	0
2010	ALL	1	0	0	122	0	0	0	24	142	1	0	0	0	0	0	0	0	0	0	0	0	0	0	36	0	2	0	0	0	266	130	74	0	0	0	0	0	0	1	0	0	0	1	162	0	0	2	0	0	0	0
1998	A	0	0	0	13	0	0	0	9	0	0	0	205	2	0	0	0	1	0	7	0	21	62	0	9	0	0	0	0	0	0	3	0	0	0	0	0	109	0	0	31	0	0	0	0	0	0	0	0	39	0
2001	A	0	0	0	14	0	0	0	26	9	0	1	0	0	0	0	0	0	0	0	0	0	0	3	10	0	0	0	0	2	8	38	13	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0
2004	A	0	0	0	20	0	0	0	3	5	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	52	100	132	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0
2007	A	0	0	0	20	0	0	0	21	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	119	171	94	0	0	0	0	0	0	1	0	0	0	0	4	0	0	0	0	0	0	0
2010	A	0	0	0	40	0	0	0	0	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	47	42	25	0	0	0	0	0	0	0	0	0	0	0	10	0	0	2	0	0	0	0
1998	B	1	0	0	6	0	0	0	8	1	0	0	236	0	0	0	0	0	0	0	0	49	51	0	4	0	0	0	0	0	0	3	5	0	0	0	0	214	0	0	5	0	0	0	0	0	0	88	0
2001	B	0	0	0	16	0	0	0	19	6	2	0	0	0	0	0	0	0	0	0	0	0	0	2	11	0	0	0	16	0	37	110	43	0	0	0	0	0	0	0	0	0	0	0	18	0	0	0	0	0	0	0
2004	B	0	0	0	29	0	0	0	13	10	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	1	0	100	99	146	0	0	0	0	0	0	0	0	0	0	0	11	0	0	0	0	0	0	0
2007	B	0	0	0	30	0	0	1	6	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	158	198	158	0	0	0	0	0	0	1	0	0	0	0	28	0	0	0	0	0	0	0
2010	B	0	0	0	38	0	0	0	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	0	0	0	0	0	90	50	0	0	0	0	0	0	0	1	0	0	0	0	66	0	0	0	0	0	0	0
1998	C	3	0	0	12	0	0	1	3	1	0	0	208	4	0	0	6	0	0	0	0	144	30	0	2	0	0	0	0	0	0	0	0	0	0	0	0	37	0	0	11	0	0	0	0	0	0	0	0	179	0
2001	C	0	0	0	23	0	0	0	30	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	6	0	39	15	18	0	0	0	0	3	0	0	0	0	0	0	23	0	0	0	0	0	0	0
2004	C	1	0	2	23	0	0	0	4	10	2	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	1	0	95	47	150	0	0	0	0	0	0	2	0	0	0	0	33	0	0	0	0	0	0	0
2007	C	5	1	0	27	0	0	0	33	73	0	1	0	0	0	0	0	0	0	0	0	0	0	2	15	0	2	0	0	0	197	31	103	0	0	0	0	0	0	1	0	0	0	0	16	0	0	0	0	0	0	0
2010	C	1	0	0	13	0	0	0	13	42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	2	0	0	0	65	9	18	0	0	0	0	0	0	0	0	0	0	1	69	0	0	0	0	0	0	0
1998	D	0	0	0	13	1	0	0	14	0	0	0	226	0	0	0	13	2	0	0	0	65	53	0	0	0	0	0	0	0	0	1	0	0	0	0	0	94	0	0	24	0	0	0	0	0	0	157	0
2001	D	1	0	0	43	0	0	0	33	11	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	10	37	1	0	0	0	0	1	0	0	0	0	0	0	4	0	0	0	0	0	0	0
2004	D	0	0	0	30	0	0	0	12	3	0	0	0	0	0	0	0	0	0	0	0	0	0	3	10	0	1	0	0	0	15	19	103	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	1
2007	D	1	0	0	34	0	0	0	8	45	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	160	37	95	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0
2010	D	0	0	0	31	0	0	0	9	84	1	0	0	0	0	0	0	0	0	0	0	0	0	0	14	0	0	0	0	0	64	29	31	0	0	0	0	0	0	0	0	0	0	0	17	0	0	0	0	0	0	0

Appendix 2: Comparison of 2010 survey results by area with NVC CG3

	CG3a	CG3b	CG3c	A (2010)	B (2010)	C (2010)	D (2010)	E (2010)
Bromus erectus	V (5-9)	V (5-9)	V (5-9)	V (4-8)	V (4-10)	V (4-9)	IV (2-9)	III (3-7)
Sanguisorba minor	IV (1-6)	V (2-6)	IV (1-5)		I (4)	III (4-5)	II (3-5)	III (6-8)
Carex flacca	IV (1-6)	IV (1-5)	IV (1-5)	I (6)	I (5)	V (4-10)	IV (5-10)	V (9-10)
Plantago lanceolata	IV (1-7)	III (1-5)	IV (1-5)	V (5-8)	V (5-8)	V (4-8)	V (4-10)	V (5-10)
Lotus corniculatus	IV (1-5)	IV (2-6)	V (2-5)	V (8-10)	V (4-10)	V (8-10)	V (8-10)	IV (6-9)
Festuca ovina	IV (2-8)	V (2-8)	III (2-7)					
Leontodon hispidus	IV (1-8)	III (2-5)	III (1-4)	IV (3-10)	V (4-10)	V (6-10)	IV (8-10)	V (6-10)
Campanula rotundifolia	III (1-2)	II (1-3)	I (1-2)	II (3-4)				
Pseudoscleropodium purum	III (1-8)	II (2-9)	II (1-4)					
Homalothecium lutescens	II (1-4)	I (1-3)	I (1)					
Asperula cynanchica	II (1-2)	I (2-4)	I (1)					
Fissidens cristatus	II (1-3)	I (2)	I (1-2)					
Centaurea nigra	I (1-4)	IV (1-4)	I (2-4)	I (3-4)		IV (3-7)	III (3-7)	II (6-8)
Thymus praecox	II (1-6)	III (2-5)	II (1-5)					
Polygala vulgaris	I (1-3)	II (1-5)	I (1)					
Senecio jacobaea	I (1-2)	II (1-3)	I (2-3)					
Rhinanthus minor	I (1-4)	II (2-3)	I (5)		II (3-5)		I (3)	I (3)
Galium mollugo	I (1-3)	II (2-5)	I (1-3)	I (5-6)	II (5-8)	I (3-5)	II (3-9)	IV (3-7)
Achillea millefolium	I (2-4)	II (1-4)	I (2-3)	I (4-7)	I (3)	III (3-7)	II (3-6)	II (4-7)
Daucus carota	I (1-3)	II (1-4)		I (4)	I (4-5)	II (3-4)	I (3-5)	V (3-5)
Hypocharis radicata		II (1-4)						
Prunella vulgaris	III (1-4)	II (1-4)	IV (1-4)				I (3-4)	II (3-5)
Taraxacum officinale agg.	I (2-3)	I (2)	IV (1-3)	I (5)	II (3-5)	I (4-5)	III (3-5)	III (3)
Bellis perennis	I (1-3)	I (2-4)	IV (1-3)					
Trifolium pratense	II (1-8)	II (1-5)	V (1-6)	III (3-9)	IV (5-10)	IV (3-8)	IV (4-7)	IV (4-5)
Medicago lupulina	II (1-4)	I (2-4)	V (1-5)	II (3-6)	II (3-4)	II (3-5)	II (2-8)	III (4-8)
Knautia arvensis	I (1-3)	I (2-3)	IV (1-3)	I (3-4)	I (3-4)	I (3)	I (5)	
Dactylis glomerata	II (1-5)	II (1-5)	III (1-4)	V (5-9)	V (6-8)	V (4-8)	V (4-9)	I (3)
Viola hirta	II (1-5)	I (2-4)	III (1-5)					I (5)
Vicia cracca	I (1-3)	I (3)	III (1-4)	II (4-5)	IV (3-8)	V (4-7)	III (3-6)	
Blackstonia perfoliata	I (1-4)	I (2-3)	III (1-3)				I (4)	
Trifolium repens	I (1-3)	I (1-3)	III (1-5)	IV (3-8)		II (3-5)	III (3-8)	II (3-5)
Cynosurus cristatus	I (1-5)	I (1-6)	III (2-5)					
Centaurium erythraea	I (1-3)	I (3)	III (1-3)				I (2)	
Phleum pratense bertolinii	I (1-2)	I (2-4)	III (1-4)	I (3)				
Holcus lanatus	I (1-5)	I (2-5)	II (1-4)	IV (3-8)	II (3)	I (4)	II (3-5)	II (3-5)
Lolium perenne	I (1)	I (2-6)	II (1-4)	I (6)	II (3-7)			I (3)
Ranunculus bulbosus	I (1-4)	I (2)	II (1-3)	II (3-5)	III (3-5)	II (3-5)	IV (3-7)	
Cerastium fontanum	I (1-3)	I (2-3)	II (1-3)	I (3-4)	II (3-5)		I (3)	II (3-4)
Trisetum flavescens	I (1-6)	I (2-5)	II (1-4)	II (3-9)		II (5-7)	IV (3-6)	I (4)
Lathyrus pratensis	I (1)	I (3)	II (1-3)	IV (4-10)	IV (3-10)	II (4-8)	II (5-10)	I (4)
Primula veris	I (1-2)	I (1-6)	II (1-3)	V (3-7)	V (4-8)	V (7-10)	V (2-9)	IV (3-7)
Anthyllis vulneraria	I (1-3)	I (1-4)	II (1-3)			I (9)	I (2-5)	I (6)
Leucanthemum vulgare	I (1-4)	I (1-6)	II (1-3)			I (4)	II (4-6)	
Agrostis stolonifera	I (1-3)	I (2-5)	II (1-6)	IV (3-9)	I (3)	II (3-7)	III (3-5)	II (4-5)
Ononis spinosa	I (1-3)		II (1-3)					
Cersium eriophorum			II (1-3)					
Festuca rubra	II (2-9)	I (2-8)	II (4-6)	V (7-10)	V (9-10)	V (8-10)	IV (7-10)	V (9-10)
Festuca arundinacea	I (1-6)		I (1)					
Centaurea scabiosa	I (1-4)	II (2-4)	I (1-4)					I (4)

	CG3a	CG3b	CG3c	A (2010)	B (2010)	C (2010)	D (2010)	E (2010)
Cirsium acaule	IV (1-8)	III (1-7)	IV (1-6)					
Briza media	III (1-7)	IV (1-6)	IV (1-6)	I (5)	II (4-6)	IV (3-6)	V (2-5)	I (3)
Koeleria macrantha	III (1-5)	III (1-5)	II (1-4)					
Pimpinella saxifraga	III (1-4)	III (1-4)	II (1-3)	I (4-5)	III (3-6)	IV (3-9)	II (3-7)	
Avenula pratensis	III (1-6)	II (1-4)	II (2-3)					
Linum catharticum	III (1-4)	II (1-3)	III (1-4)				I (8)	IV (3-7)
Helianthemum nummularium	II (1-6)	II (1-6)	II (1-6)				I (4)	
Plantago media	III (1-5)	I (1-4)	III (1-4)	II (3-5)	I (3-4)	IV (3-6)	III (3-5)	I (8)
Scabiosa columbaria	III (1-4)	III (1-4)	I (1-2)	I (5-6)	I (3-4)	III (3-8)	IV (4-9)	
Galium verum	II (1-4)	II (1-4)	II (1-4)	III (5-8)	II (4-6)	II (6-7)	II (5)	
Hieracium pilosella	II (1-4)	I (2-4)	II (1-6)					I (4)
Carex caryophyllea	II (1-4)	I (1-2)	II (1-5)					
Hippocrepis comosa	II (1-5)	II (1-4)	I (3)					
Euphrasia officinalis agg.	II (1-4)	I (2-3)	II (1-4)				II (4-7)	
Avenula pubescens	II (1-7)	I (1-5)		I (3)		III (5-10)	IV (2-9)	IV (5-10)
Succisa pratensis	II (1-5)	I (1-4)	I (3)					
Rumex acetosa		I (3)	I (1)	V (3-6)	V (3-7)	II (3-5)	IV (3-7)	
Arrhenatherum elatius		I (3-8)	I (2)	IV (3-9)	V (7-10)	V (5-9)	V (5-9)	V (3-6)
Origanum vulgare	I (4-5)	I (2-5)	I (1)	II (4-8)		II (4-8)	IV (4-9)	V (8-10)
Poa pratensis				II (3-5)	II (3-4)	I (3)	I (3)	I (5)
Odontites vernus				II (4)	I (5)		I (3)	
Agrostis canina				I (5)			I (5)	I (3)
Bromus mollis				I (4)				
Crataegus monogyna	I (1-2)	I (1-3)	I (1)	I (3)		I (3)	I (3-4)	IV (3-7)
Heracleum sphondylium					I (4)		I (3)	
Hypericum perforatum					I (3-4)	II (3-5)		II (3-5)
Fallopia convolvulus (BILDCON)					I (3)			
Ranunculus acris					I (3)			
Veronica chamaedrys	I (1)	I (1-3)	I (1)		I (3)			V (5-9)
Clematis vitalba						II (3-5)	II (3-5)	I (4)
Rosa canina agg.	I (1)	I (1-3)				I (3)		IV (3-4)
Tragopogon pratensis	I (1-3)	I (3)	I (1)			I (3)		
Viburnum opulus						I (3)		
Pastinaca sativa	I (1-2)	I (2-4)	I (1)				II (7-10)	III (3-5)
Cirsium arvensis	I (1-3)	I (2-3)	I (4)				I (5)	I (3)
Agrimonia eupatoria	I (1)	I (3)	I (1-2)				I (3-4)	IV (3-5)
Acer pseudoplatanus							I (2-3)	II (3)
Geranium molle							I (3)	
Senecio erucifolius							I (3)	I (3)
Gentianella amarella							I (2)	
Potentilla reptans	I (1-3)	I (3)	I (1)					V (5-8)
Ligustrum vulgare								IV (3-6)
Rhamnus catharticus								III (3-5)
Clinopodium vulgare		I (2-4)	I (2-3)					I (5)
Melilotus altissima								I (4)
Cornus sanguinea								I (3)
Luzula pilosa								I (3)
Prunus spinosa								I (3)

Appendix 3: MHD Extension Butterfly transect counts: 1996 – 2010

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Small Skipper	53	28	19	46	82	72	48	88	52	104	0	0	0	0	0
Essex Skipper	2	1	3	0	0	2	0	0	0	0	0	0	0	0	0
Small/Essex Skipper	0	0	0	0	0	0	0	0	0	0	53	28	38	46	146
Small/Essex Skipper (tot)	55	29	22	46	82	74	48	88	52	104	53	28	38	46	146
Large Skipper	10	6	3	8	28	13	5	4	6	6	8	12	2	15	25
Silver-spotted Skipper	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dingy Skipper	0	0	0	1	0	0	0	0	0	4	1	0	0	0	0
Grizzled Skipper	0	0	1	2	0	0	0	0	0	1	1	3	0	0	2
Clouded Yellow	5	0	4	0	69	0	32	18	11	2	26	4	0	4	2
Brimstone	102	97	68	54	163	131	170	88	145	113	110	89	57	108	60
Large White	24	93	100	78	33	25	24	33	39	42	25	12	22	159	53
Small White	167	173	146	183	156	189	94	345	334	63	143	138	91	295	168
Green-veined White	46	71	99	20	31	19	70	26	100	36	40	14	14	68	36
Orange Tip	22	18	25	22	23	14	34	10	12	27	18	6	3	16	35
Green Hairstreak	5	8	3	4	10	9	9	8	3	13	20	8	4	6	20
Brown Hairstreak	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
White-letter Hairstreak	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Purple Hairstreak	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Small Copper	1	5	23	17	4	1	5	11	83	8	57	36	2	8	2
Small Blue	0	0	0	0	37	0	0	3	1	3	8	3	0	0	3
Silver-studded Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brown Argus	105	57	50	70	123	51	46	71	129	101	48	22	13	65	109
Common Blue	50	77	100	575	490	186	422	550	676	431	873	217	198	456	1507
Chalkhill Blue	227	157	219	369	152	57	63	77	40	81	68	11	7	33	84
Adonis Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Holly Blue	72	114	54	10	4	15	27	9	18	35	4	14	2	0	16
Duke of Burgundy	0	0	0	0	r	r	0	0	r	0	0	0	0	0	0
Purple Emperor	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
White Admiral	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Red Admiral	83	71	25	85	40	67	20	42	10	69	51	45	37	12	6
Painted Lady	517	2	4	3	16	2	28	48	8	3	134	6	2	1940	1
Small Tortoiseshell	95	286	43	27	38	59	153	359	73	13	8	10	6	29	10
Peacock	101	37	46	29	29	105	72	7	7	19	60	270	49	279	35
Comma	4	11	3	1	13	8	1	9	2	8	6	2	9	10	2
Pearl-bordered Fritillary	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Small P-b Fritillary	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dark Green Fritillary	0	4	0	0	1	0	1	0	0	1	0	0	0	0	1
Silver-washed fritillary	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Marsh Fritillary	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Glanville Fritillary	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Speckled Wood	1	1	1	2	2	1	1	0	2	4	8	1	0	7	4
Wall Brown	0	0	0	0	0	0	r	0	0	0	0	0	0	0	0
Marbled White	175	272	430	289	274	138	141	116	132	145	252	121	66	237	295
Grayling	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gatekeeper	148	51	38	71	133	182	195	224	311	228	233	183	80	140	200
Meadow Brown	189	152	371	462	628	1083	1032	1556	2615	1401	930	1077	1078	1240	1112
Small Heath	6	12	18	68	10	12	2	33	18	8	14	20	13	16	17
Ringlet	7	19	9	10	33	7	34	21	14	16	59	63	73	202	233
TOTAL	2217	1823	1906	2506	2622	2448	2730	3756	4841	2985	3258	2415	1866	5391	4187