



Bilberry bumblebee *Bombus monticola*  
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## Beewalk Report 2018

# Bumblebee monitoring in hay meadows across the Yorkshire Dales and Forest of Bowland AONB

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## 1. INTRODUCTION

The remnant traditional hay meadows of the Yorkshire Dales and Forest of Bowland have had support from the 'Hay Time', 'Meadow Links', 'Networks for Nectar' (N4N) and 'Wild Flowers for the Meadows' projects of Yorkshire Dales Millennium Trust (YDMT) and Forest of Bowland Area of Outstanding Natural Beauty (AONB), for restoration projects to improve their floral diversity. Since 2006 these projects have undertaken restoration works on more than 700 hectares, aiming to increase the area of traditional hay meadow by 70% over the remnant 1,000 hectares in the region. The most common restoration method has been transferring green hay from nearby donor sites, enhanced by locally sourced seed in some meadows (St. Pierre 2016, Robinson 2015).

The Bumblebee Conservation Trust (BBCT) initiated a citizen science scheme 'Beewalk' in 2010 to collect much needed diversity and abundance data of bumblebee populations across the country. YDMT incorporated the 'Beewalk' scheme into these meadow restoration projects through 'A Buzz in the Meadows' in 2015 as a means of monitoring the success of the hay meadow restoration in terms of forage habitat for pollinators. Additional sites were added in the Forest of Bowland AONB in 2016. This has enabled the capture of 5 seasons' bumblebee foraging data to date.

## 2. METHODOLOGY

The study area for the 2018 bumblebee monitoring in these hay meadows included 47 transects over 16 sites across the Yorkshire Dales and Forest of Bowland AONB (fig.1). Sites were surveyed between mid-June and the end of July 2018 to encompass the flowering times for meadow flora, emergence times of bees and the cutting of the hay crop at the end of July.

Training on the methodology of transects and bumblebee identification was given for 'Beewalk' volunteers prior to the start of the data collection period, including a sample transect to monitor the ability of the volunteers at the end of the training. Transects for this study were walked by 45 volunteers.

Hay meadow transects were walked on 4 to 6 occasions from mid-June to the end of July (when the hay is cut). All bumblebee species observed within 2 m either side and up to 4 m ahead of the surveyor were recorded, whilst walking at a slow pace, between 09.45h and 18.00h, on days with no rainfall, wind speed less than 10 ms<sup>-1</sup> and minimum temperature of 13°C; i.e. favourable conditions for bumblebee foraging and following The BBCT Beewalk protocol (BBCT, 2017).

Weather conditions were recorded to ensure data collection fell within the required parameters. Transects passed through different meadow types so each was subdivided into sections accordingly.

The workers of the white-tailed bumblebee *Bombus lucorum* and buff-tailed bumblebee *Bombus terrestris* are notably difficult to separate in the field and therefore, in common with other field-based bumblebee studies (e.g. Goulson *et al.*, 2014), they were recorded as a single taxon. Unidentified bumblebees are included in the data analysis simply as bumblebee *Bombus*, but is excluded from species richness data analysis. A small number of cuckoo bumblebees were recorded but also excluded from the data analysis. Where a bumblebee was recorded on a flower, the plant species was also recorded to provide information on bumblebee foraging habits across the hay meadows. Those seen flying were recorded as "In flight".

Due to sections of transects differing in length, the count on each section was converted to bumblebees per 1,000 metres of transect. This enabled the count data to be comparable across transect sections and habitats.

The meadows were categorised as follows for comparison between habitat types:

*Ancient* ( $n = 25$ ): Traditional hay meadows that have been maintained by a management regime of one hay cut per annum at the end of July or later, low stock grazing in autumn and spring, and no inorganic fertiliser treatment. This category includes some semi-improved grassland.

*Modern* ( $n = 8$ ): Agriculturally improved hay meadows, usually cut once per annum, with organic and/or inorganic fertiliser treatment, and more intensive grazing in autumn through to spring; some may have remnant hay meadow species, often in refuges on the field margins which escape management. Some meadows in this category are permanent pasture. This category is also used to provide a baseline survey for meadows identified for future restoration.

*Restored* ( $n = 14$ ): Previous agriculturally improved hay meadows that have been restored and now managed as per Ancient meadows. Restoration methods varied across the meadows according to what was locally practicable, most commonly using green hay. Following the pre-treatment of restoration sites with crop removal and harrowing, green hay was collected from nearby donor meadows during late July to August (some of which are included in the “Ancient” meadows for this study), then transported and spread within an hour to avoid heating the crop. The transfer rate ranged from 1 ha donor:3 ha restored, to 1 ha donor:5 ha restored. In most sites the flora successfully established but occasionally seed, again harvested from nearby meadows, was added to enhance species richness and abundance in the following year (Robinson 2015, St. Pierre 2016). The year of restoration ranged from 1992 to 2016 but the majority ( $n = 10$ ) were surveyed only one to three years post-treatment.

All records were entered into the BBCT online Beewalk dataset. The data were then collated and analysed in Microsoft Excel, from the raw data provided by Dr. Richard Comont at BBCT.



*View across the transect at Myttons Farm, Slaidburn, June 2018, CE*



### 3. RESULTS

#### 3.1 Abundance

The total number of bumblebees recorded across all the sites surveyed, including two cuckoo species, unidentified “bumblebees” and those in flight, was 2,436. This equated to 47.07 bumblebees per 1000m of transect surveyed. The restored meadows showed a higher mean number of bumblebees recorded per 1000m of transect surveyed (66.48); 56% greater than the mean number recorded in the ancient meadows (41.69) and the modern meadows having the lowest mean abundance at 20.08 (fig.2).

The highest number of bumblebees per 1000m recorded in one section of transect ( $n=229$ ) was at Life4life meadow at Crook O’ Lune, Lancaster; a meadow restored in the previous year. Dent meadows, Dentdale; an ancient meadows site, and Colt Park meadows; first restored in 1992, recorded significantly higher numbers per 1000m at one site ( $n=279$  &  $286$  respectively) than the other sites. The lowest numbers recorded were at Higher High Field Farm, Slaidburn, and Tenant Gill Farm in Malham; both Ancient meadow sites (fig.3).

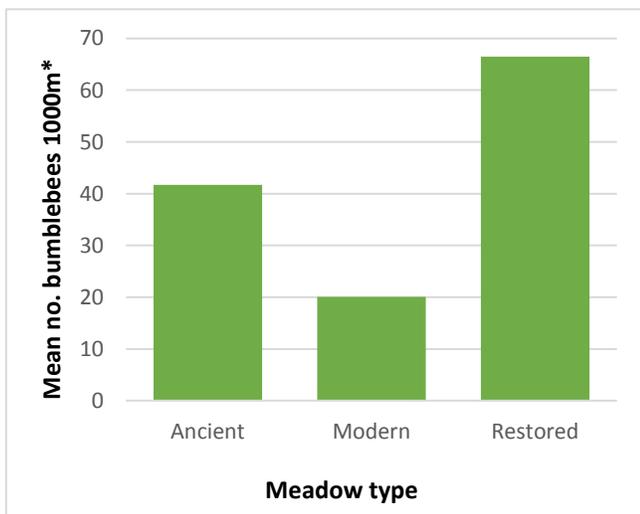


Fig. 2: Abundance of bumblebees per 1000m of transect recorded across three hay meadow habitats: Ancient, Modern and Restored ( $N=48$ ), surveyed June to July 2018 in Forest of Bowland AONB and Yorkshire Dales. Chart shows mean of numbers recorded on each section.

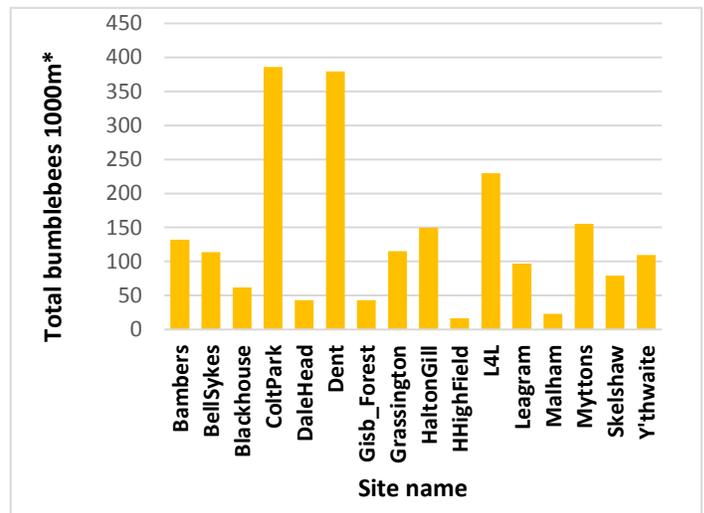


Fig.3: Total bundance of bumblebees. per 1000m of transect recorded across all sites ( $n=16$ ) surveyed June to July 2018 in Forest of Bowland AONB and Yorkshire Dales

### 3.2 Abundance of each species

A total of 11 different species were recorded (white & buff -tailed separated);

All the seven more widespread and common bumblebee species were recorded (Goulson *et al.*, 2005), in addition to heath (a localised heathland specialist), and mountain or bilberry (rare and declining). Two widespread and common cuckoo species were also recorded; The grouped white/buff *B. lucorum/terrestris* being the most abundant (Table 1).

Table1: Bumblebee species recorded across hay meadows (N=48) in the Yorkshire Dales and Forest of Bowland AONB; surveyed June to July 2018.

Common name	Scientific name	Average no. per 1000m of transect	Total no. recorded (Sum of bumblebees per 1000m on each site section rounded to nearest .5)
White-tailed bumblebee	<i>B. lucorum</i>	25.73	1129
Buff-tailed bumblebee	<i>B. terrestris</i>		
Common carder bee	<i>B. pascuorum</i>	8.5	383
Red-tailed bumblebee	<i>B. lapidarius</i>	5.85	238
Tree bumblebee	<i>B. hypnorum</i>	0.82	44
Garden bumblebee	<i>B. hortorum</i>	0.04	2.5
Early bumblebee	<i>B. pratorum</i>	0.08	4.5
Heath bumblebee	<i>B. jonellus</i>	0.02	2.5
Mountain or bilberry bumblebee	<i>B. monticola</i>	0.06	3
Gypsy cuckoo bumblebee	<i>B. bohemicus</i>	0.06	4.5
Field cuckoo bumblebee	<i>B. campestris</i>	0.02	1.5

## Distribution

The majority of species were most abundant in the ancient meadows, with the exception of the common carder bee, which was more abundant in the restored meadows, and the garden bumblebee which was most abundant in the modern meadows. The two species of cuckoo bumblebees were only recorded in the ancient meadows. The early, tree, and bilberry bumblebee were all absent in the modern meadows (figs.4a & 4b).

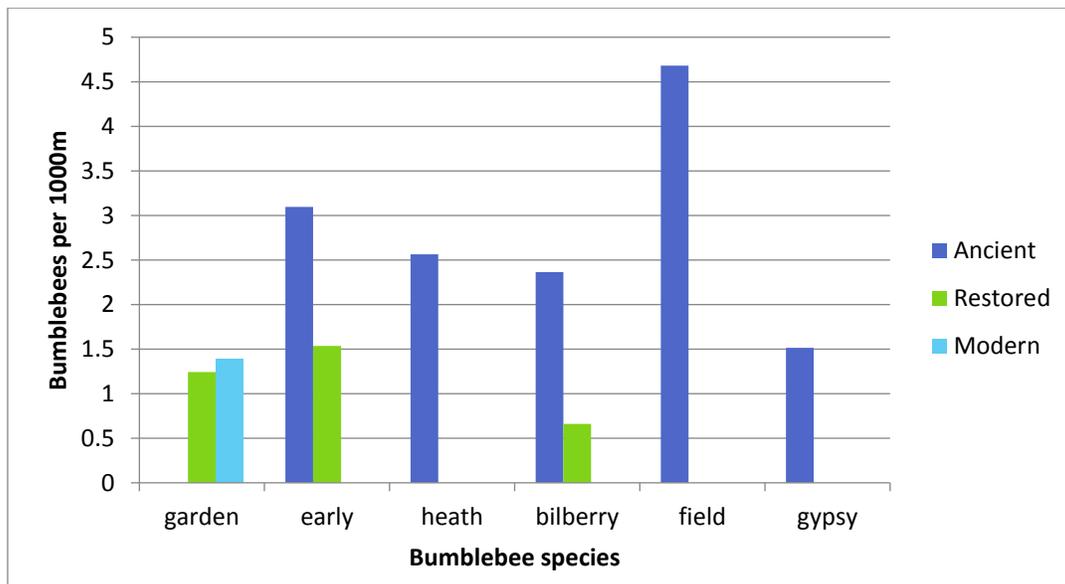
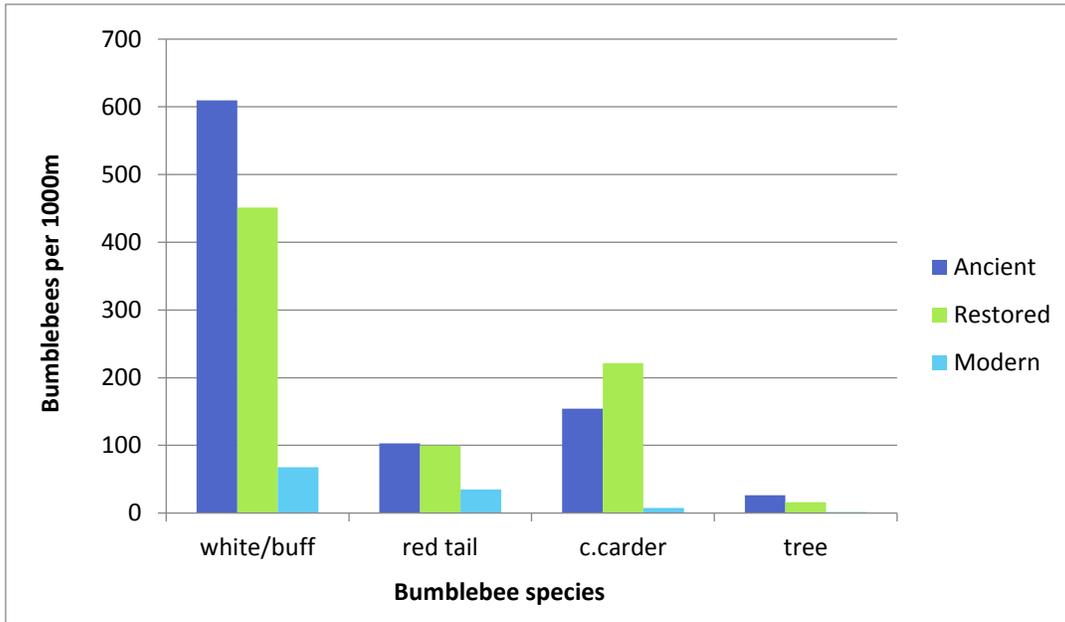


Fig.4a & 4b: Numbers of bumblebee species recorded per 1000m of transect across three types of hay meadow; 'Ancient', 'Modern' and 'Restored' in the Yorkshire Dales and Forest of Bowland AONB; surveyed June to July 2018. Note the differing scale of the two charts. White/buff=combined count of white and buff-tailed bumblebees, c.carder=common carder bee, field=field cuckoo bee, gypsy=gypsy cuckoo bee.

### 3.3 Species richness

The number of individual species recorded varied across the sites, ranging from one to six in total. Yockenthwaite had the highest number of species recorded across all sections this year (white & buff-tailed separated) – 6 across the whole site, whereas Malham had only white/buff-tailed species recorded (fig.5). The individual site reports are included at appendix 1.

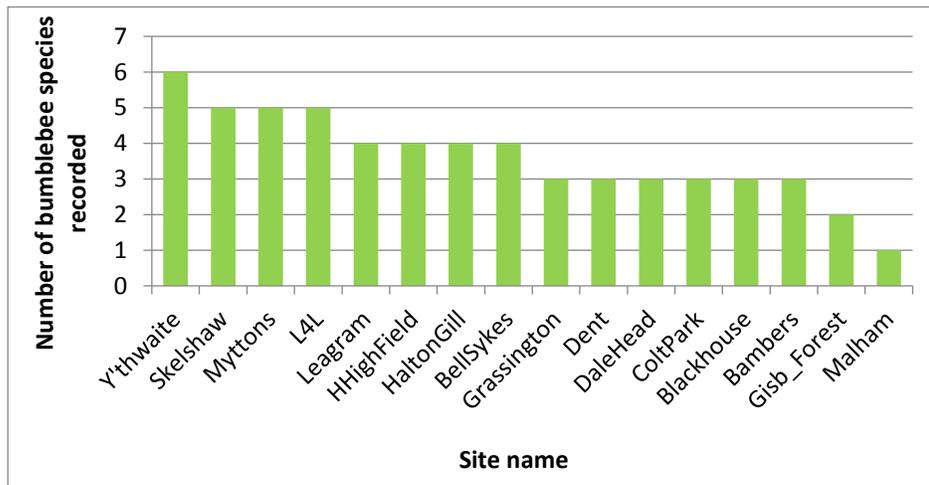


Fig.5: Number of different bumblebee species recorded at each site (N=16) across hay meadows (N=48) in the Yorkshire Dales and Forest of Bowland AONB; surveyed June to July 2018.

Ten different species were recorded across the ancient meadows, 8 species were recorded in the restored meadows. modern meadows recorded fewest species, with some sites having “in flight” bumblebees only, and therefore no actual species recorded. Some of the transects through pasture recorded up to 4 species of bumblebee.

All species are early to mid-season emerging species (Goulson *et al.*, 2008) therefore by mid - June, workers of these species would be actively foraging and therefore it can be concluded that a representative proportion of the population was recorded.

### 3.4 Floral visitation

Yellow rattle *Rhinanthus minor* accounted for 32% of the fifteen most visited flowers, with a similar percentage of visits to Common knapweed *Centaurea nigra* (29%). Clovers *Trifolium spp.* accounted for 22% of the top bumblebee visits to flowers. Together these three species total 75% of *all* visits. The 15 most visited species accounted for almost 95% of all species visited, ( $n=44$ ), as shown in figure 6.

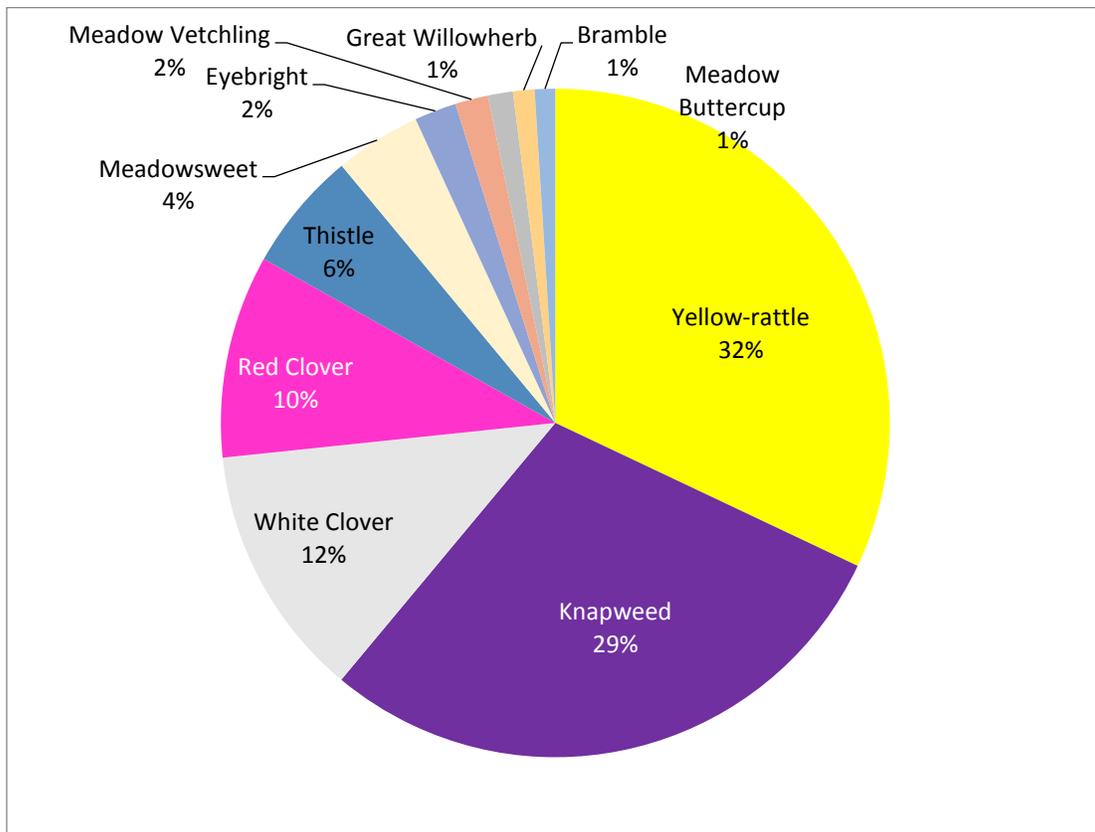
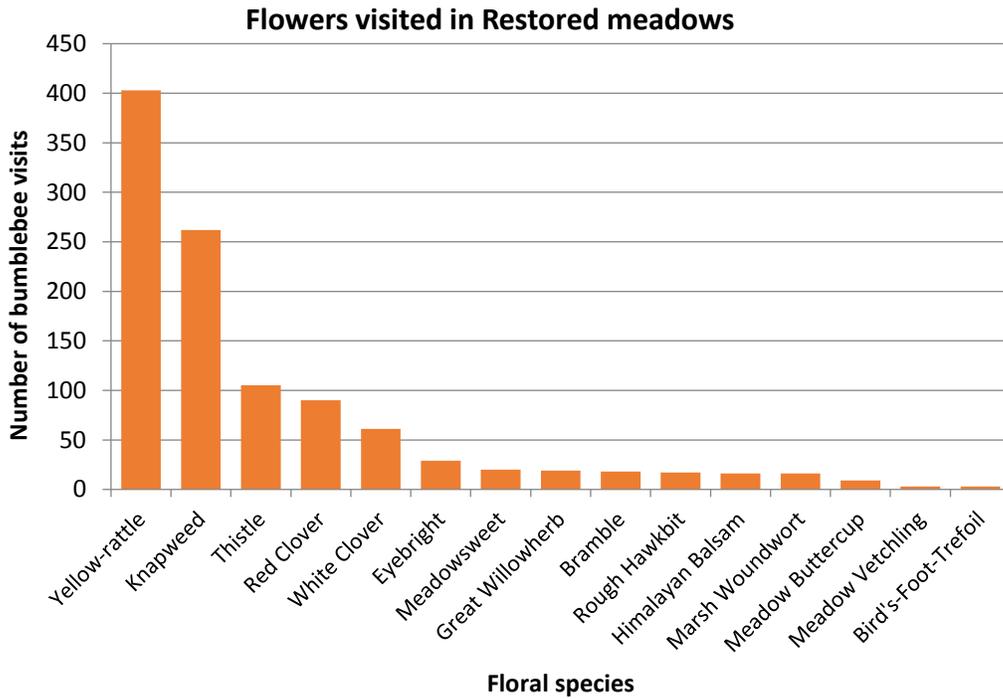
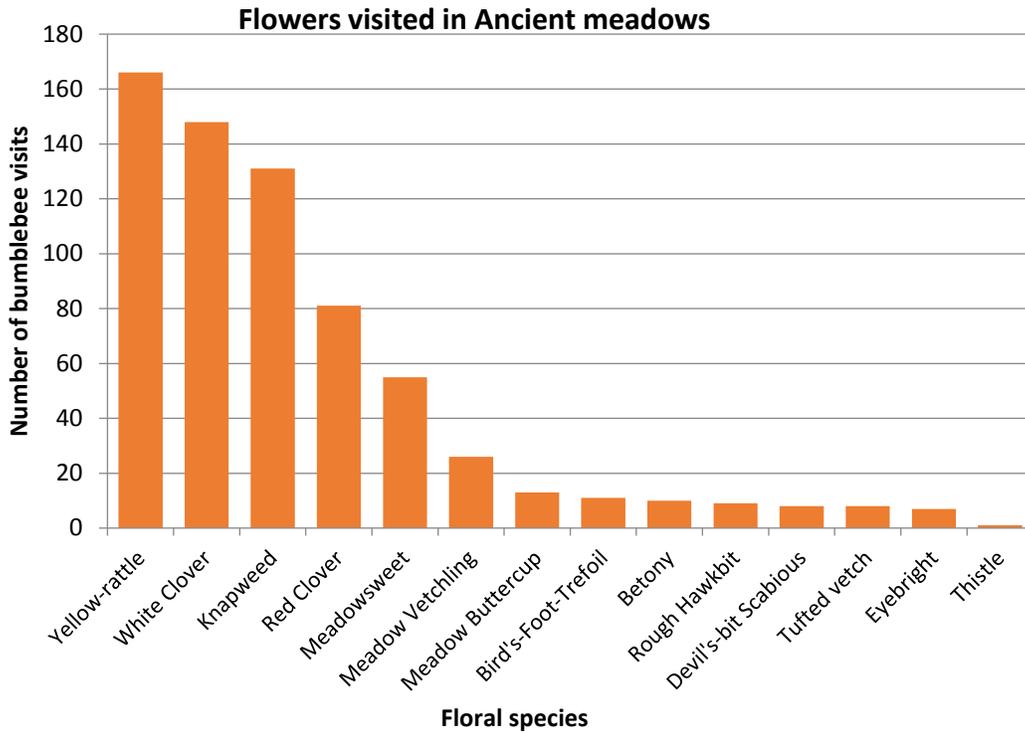


Fig.6: Flora visited by *Bombus spp.* as percent of top 15 floral species visited, recorded in hay meadows in the Yorkshire Dales and Forest of Bowland AONB, June to July 2018.

Yellow rattle, common knapweed and clovers were, as in previous years, the most visited species in both the ancient and restored meadows. However, visits to yellow rattle and common knapweed were far more dominant in the restored meadows compared to those in the ancient meadows, where the visits to clovers were equally dominant (figs. 7a & b).



Figures.7a & b: The fifteen most common floral sp. as visited by bumblebees in hay meadow types; ancient, and restored; surveyed June to July, in the Yorkshire Dales and Forest of Bowland AONB, 2018. Note the difference in scale between the two charts.

The proportion of bumblebee visitations to the two species of clover; red *Trifolium pratense* and white *Trifolium repens*; differed across the three habitats. In the ancient meadows the proportion of white clover visited was significantly greater than red clover (the opposite to the previous year); in the restored meadows a greater number of visits to red clover were recorded (again the opposite to the previous year), and in the modern, agriculturally improved meadows, the number of visits recorded were similar for both clover species (fig 8).

The numbers of floral visits are taken from the raw data i.e. actual numbers of flower visits recorded, as opposed to the bumblebee numbers which are recorded per 1000m of transect surveyed.

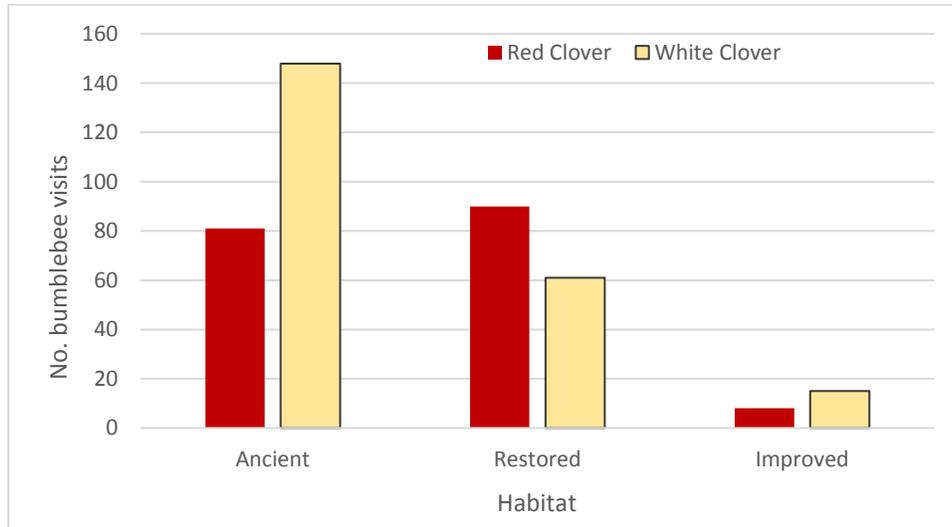


Fig.8: Comparison of bumblebee visits to red and white clover in three hay meadow types; Ancient, Modern and Restored; surveyed June to July, in Yorkshire Dales and Forest of Bowland AONB, north England, 2018.

## 4. DISCUSSION

### 4.1 Comparing data from 2016-2018

#### 4.1.1 Bumblebee abundance

The data are comparable with the findings from 2016 (Edmondson *et al*, 2017), and 2017 (Edmondson *et al*, 2018), with the difference in bumblebee abundance and number of species being much lower in the modern versus both the restored and ancient meadows.

Comparing the abundance of bumblebees recorded per 1000m transect over three years of surveys, the overall abundance has shown a minor increase – (2016=43.95; 2017=46.8; 2018=47.7).

Focusing on the abundance of each species, they varied considerably between the species, but the numbers for each species are reasonably consistent across the three years of surveying (fig.9); e.g. white/buff tailed bumblebees have been recorded in the greatest number every year, and most other species were recorded in similar numbers, despite the radical changes in seasons we have experienced over the last three years. Common carder bees have fluctuated greatly, but numbers were up on 2016 in 2018. One species showing a decrease in numbers recorded is the early bumblebee, possibly due – as the name suggests – to its early emergence: 2017 saw a very wet and cold early summer; 2018 was a late hard freeze, followed by the long hot spell, meaning the nests may have been through their life cycle before the survey season started this year.

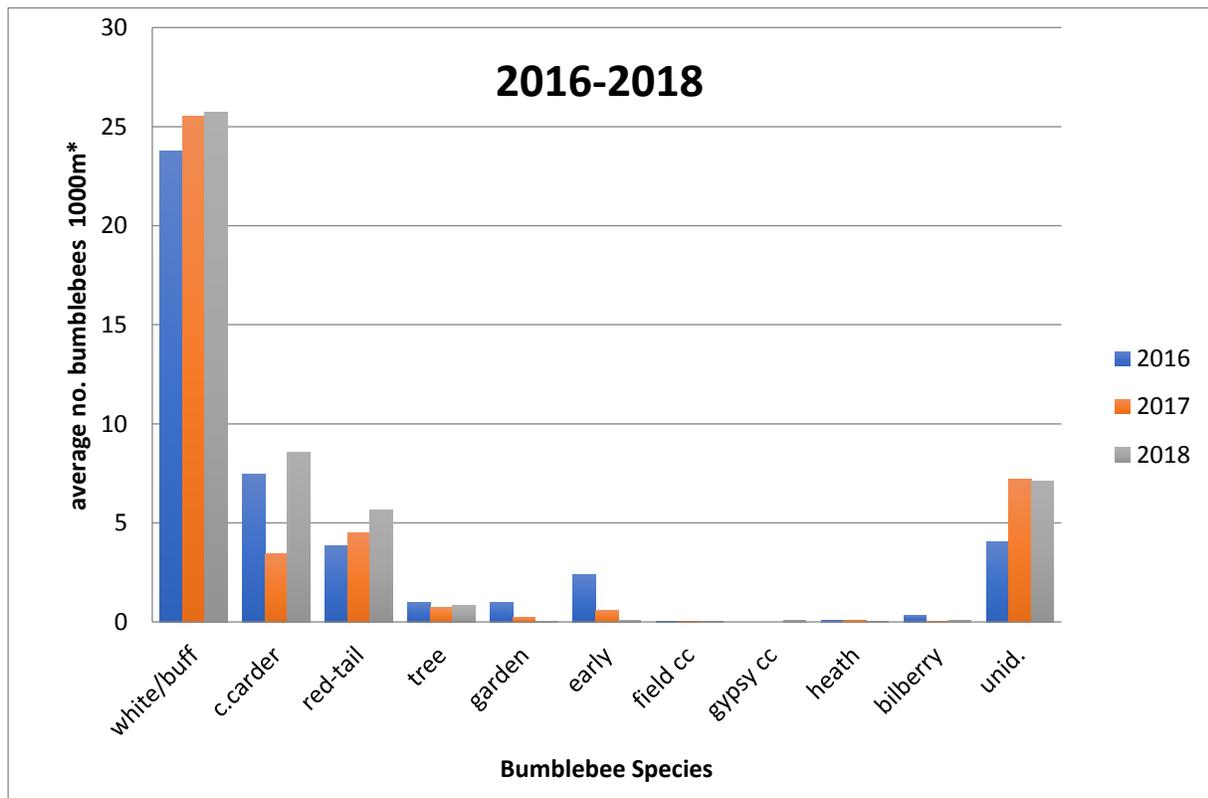


Fig.9: Comparison of mean abundance of each bumblebee species recorded across hay meadows in the Yorkshire Dales and Forest of Bowland AONB; surveyed June to July 2016-2018.

A limiting factor to the data collection compared to 2016 & 2017 was the earlier cutting dates at some sites. This may also have an effect on abundance in 2019, as the food source for some species may have been removed (as shown in the photographs below) before males or queens have been produced to perpetuate their population.



*Myttons section 1 looking south, taken early July 2016.  
Photo by C. Edmondson*



*Myttons section 1 looking south, taken early July 2018.  
Photo by C. Edmondson*

#### *4.1.2 Comparing meadow types*

The restored meadows show a different story when comparing the data from the last three years. There is no determinable pattern when looking at each year since restoration, other than the consistently higher numbers of foraging bumblebees in all the restored meadows over the modern, agriculturally improved meadows, with most being comparable or greater than those in the ancient, traditionally managed meadows in each year surveyed (fig.10). However, to truly analyse the data for any population trends, more years of data collection are required.

The meadows at Colt Park, (the subject of a restoration study from 1990 – 1998 *Smith & Corkhill, 2000*), had few bumblebees recorded in 2017, whereas in 2018 had the highest overall abundance of bumblebees per 1000m. Another complete change from the previous year was at the Dent meadows, where fewer species were recorded in 2018, but in higher numbers than in 2016 and 2017.

Yockenthwaite as in previous years, was an anomaly; as here the highest diversity of species was recorded, but at lower numbers than other sites. The meadows here are a mixture of traditional wildflower hay meadows, pasture and agriculturally- improved meadows. Whether the anomaly is due to remnant wildflower species in the margins between the meadows or the natural spread of yellow rattle into the modern field margins, would be worth further investigation.

The high temperatures at the peak recording time of day in 2018 was expected to have an adverse effect on numbers recorded, but this only seems to have been the case at a small number of sites. Bell Sykes Coronation Meadows, for example, had a reduction in both abundance and species numbers compared to the two previous years. However, the farmer reported high numbers of bumblebees in the meadows early in the mornings (7am), long before the “optimal” survey time, and before the temperatures

increased beyond 30°C, as it did some days. Grassington and Malham also had a reduction in both abundance and species diversity on previous years.

Restoration success stories are clearly demonstrated at three sites; Bambers, Leagram Mill and Life4life meadows, all having had restoration work in 2016-17, and showing a significant increase in bumblebee abundance in 2018 (Table 2) (All individual site reports are included at Appendix 1).

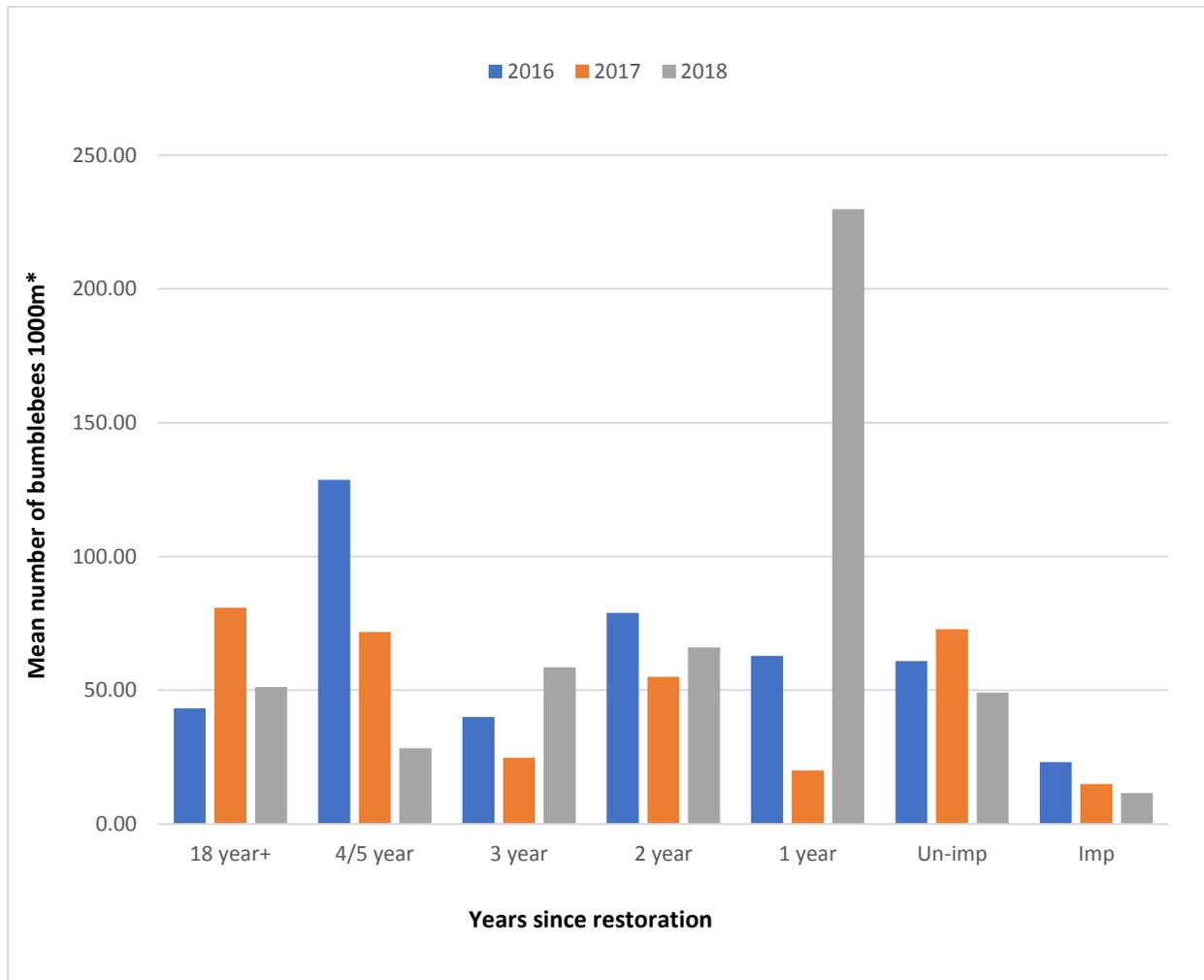


Fig.10: Comparison of mean number of bumblebees by year since meadow restoration work, recorded across restored hay meadows in the Yorkshire Dales and Forest of Bowland AONB; surveyed June to July 2016-2018.

Table 2: Comparison of bumblebee abundance by year in all sites surveyed in 2018, recorded across restored hay meadows in the Yorkshire Dales and Forest of Bowland AONB; surveyed June to July 2016-2018. Sites undergone restoration from 2016-2017 are highlighted. Sites with a # were not surveyed in 2016.

Site	Total number of bumblebees recorded per 1000m transect		
	2016	2017	2018
Bambers	28.50	40.30	132.01
Bell Sykes	514.24	466.66	113.49
Blackhouse	84.24	147.81	61.88
Colt Park	0.00	51.10	386.00
Dale Head	56.89	33.53	42.91
Dent	227.88	234.58	379.51
Gisburn Forest	66.09	71.69	43.25
Grassington	201.44	266.46	115.00
Halton Gill	145.49	111.62	149.68
Higher High Field	#	11.67	16.30
L4L	#	18.63	229.81
Leagram	0	95.62	96.77
Malham	#	149.47	23.00
Myttons	462.86	248.79	155.52
Skelshaw	149.58	91.21	79.09
Yockenthwaite	281.22	240.83	109.49

## 4.2 Floral visitation

The data on bumblebee visits to flowers has its limitations as there is no reference to the abundance i.e. percentage cover, species diversity or phenology of flowers across the habitats. In addition, due to the varying levels of plant identification skills of the volunteers, some species were aggregated as, for example, 'thistle' or 'clover'. However, it does show which species are of greatest importance to the foraging bumblebees.

As in the previous years' data there are three species visited in a much greater proportion than all other recorded flowers visited. The dominance of clover *Trifolium* spp. was equivalent to that in the 2016 data, as was the seasonal dominance of yellow-rattle and common knapweed *Centaurea nigra*, but with the difference in 2018 of yellow-rattle being the most common across all meadow types.

These favoured flowers are likely to be the species providing the best nectar and pollen, in terms of quantity and quality (Baude *et al.* 2016), but they might also be visited often because they are most abundant in the meadows. Clovers are recognised as a significant source of nectar in grasslands (Baude *et al.* 2016) and were found to be a dominant source of pollen collected by bees in the study by Wood *et al.* (2015).

## 5. CONCLUSIONS AND NEXT STEPS

The greater abundance and diversity of the bumblebees in the restored meadows, compared to the modern meadows, demonstrates the increase in foraging habitat in the meadows where restoration work has been carried out. In addition, the presence of the majority of floral species in the restored meadows most commonly visited by bumblebees is equivalent, if not greater numbers to that of the ancient meadows, suggests that the restoration has effectively transferred the bumblebees favoured flora.

The comparable bumblebee abundance and species numbers with the ancient meadows also shows that overall, the restored meadows are supporting the foraging bumblebee numbers that would be expected in a florally diverse, traditionally managed meadow – in other words the restoration work has been successful in terms of effectively expanding the available food resource for this valuable and vulnerable pollinator.

The unidentified bumblebees in the Modern meadows are recorded mainly “in flight” and of greater proportion than in the more florally diverse meadows – possibly passing from nesting sites in the landscape, over this grass dominated habitat, to the more floral rich habitat of the species rich hay meadows.



*Typical nesting site in grassland for the white & buff tailed bumblebee. Photo courtesy of BBCT.*



*A common carder bee visiting yellow rattle. Photo C. Edmondson 2018.*

It is difficult to draw any solid conclusions from the clover visitation data without floral coverage data to reference, but the contrasting dominance of white and red clover in the restored and ancient meadows, and the contrast to the previous years’ data would suggest that the coverage of the two clover species had changed in the two meadow types. Alternatively, the extreme hot weather could have played a part in the phenology or nectar production of the plants themselves meaning bumblebee foraging availability had changed.

For future projects, recording the percentage cover of the flora present along each transect would give more meaning to the ‘flowers visited’ data, enabling a comparison between those visited, and their

abundance in the meadow; thereby offering an insight as to whether they are the most preferred species or merely the most abundant – or both.

Longer term study linked to floral species will provide more insight into the bumblebee foraging preference of floral species, in addition to which species is actually more abundant.

As a minimum, more in-depth data on the relative abundance of clover species would be informative for future restoration projects.

The fluctuations each year in the abundance of each species could also be related to changes in the surrounding landscape in addition to the changes in individual meadow management regimes such as cutting dates etc. The availability of nesting sites in the surrounding landscape will have an impact on the numbers of bees foraging in the area.

Further research into nest abundance, or suitable nesting habitat, in association with the meadow types would assist in explaining the difference in bumblebee numbers across the florally diverse meadows, such as Svenson *et al.*, 2000. An assessment of the wider surrounding landscape of each site, in conjunction with nesting preference of each species would also add further understanding of the use of the meadows in relation to the landscape, and possibly contribute to location choice for future restoration projects.

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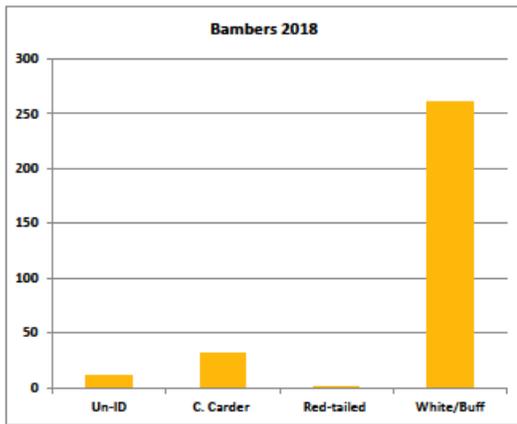
# Appendix 1. Individual site reports and maps

## Bambers 2018

Flower	No. of BB visits
Yellow-rattle	161
Thistle	102
Buttercup	9
Clover	3
Eyebright	1
<b>Grand Total</b>	<b>276</b>

	2016	2017	2018
Total bumblebees	55	72	305
Total species	6	5	4
Average temp	18	n/a	17.2
No. visits	4	4	5
Total m transect	905	905	905
<b>Bumblebees per 1000m</b>	<b>15.2</b>	<b>19.9</b>	<b>67.40</b>

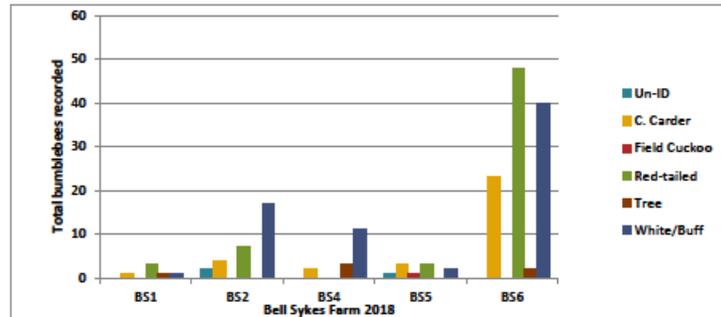
Section	Un-ID	C. Carder	Red-tailed	White/Buff	Grand Total
BB1	5	19		82	106
BB2	6	13	1	179	199
	<b>11</b>	<b>32</b>	<b>1</b>	<b>261</b>	<b>305</b>



**Bell Sykes 2018**

Flower	No. of BB visits
Yellow-rattle	42
Knapweed	41
Red Clover	16
Meadow Vetchling	15
Rough Hawkbit	11
Marsh Thistle	8
Common Catsear	7
Meadow Crane's-bill	7
Meadow Buttercup	6
Red Bartsia	5
Meadowsweet	4
Hawkbit	3
Unidentified flower	2
Bugle	1
Common Vetch	1
Eyebright	1
<b>Grand Total</b>	<b>170</b>

	2016	2017	2018
Total bumblebees	547	635	175
Total species	8	7	6
Average temp	16.2	17.6	20
No. visits	5	5	6
Total m transect	1383	1222	1222
<b>Bumblebees per 1000m</b>	<b>79.1</b>	<b>104</b>	<b>23.86</b>



Section	Un-ID	C. Carder	Field Cuckoo	Red-tailed	Tree	White/Buff	Total
BS1		1		3	1	1	6
BS2	2	4		7			30
BS4		2			3	11	16
BS5	1	3	1	3		2	10
BS6		23		48	2	40	113
	3	33	1	61	6	69	175

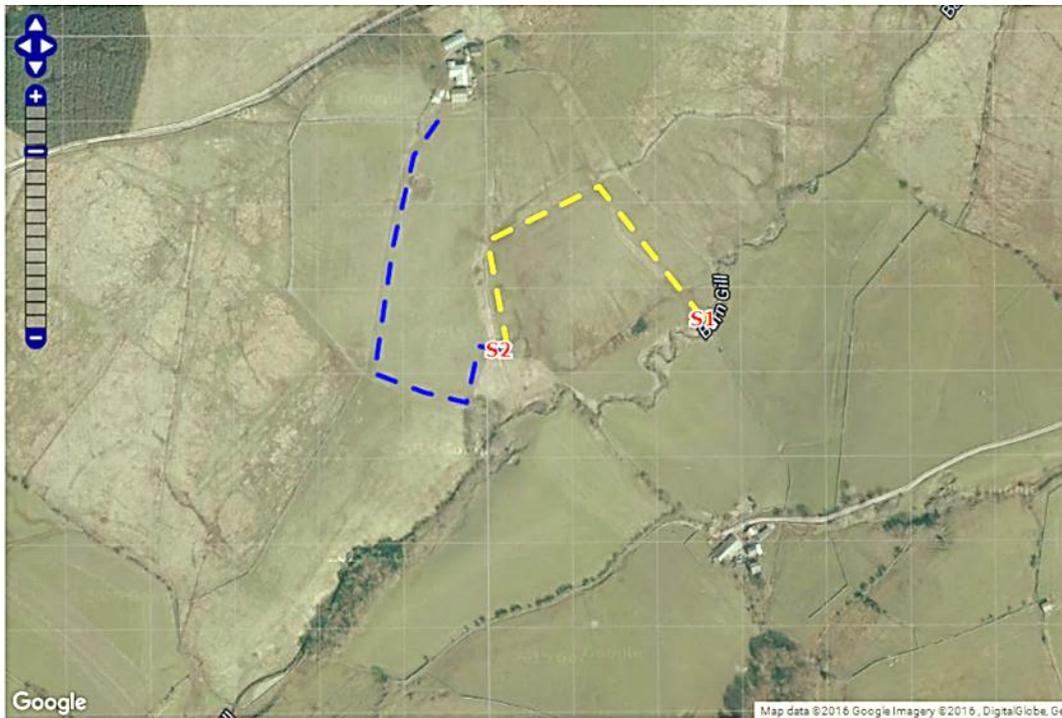
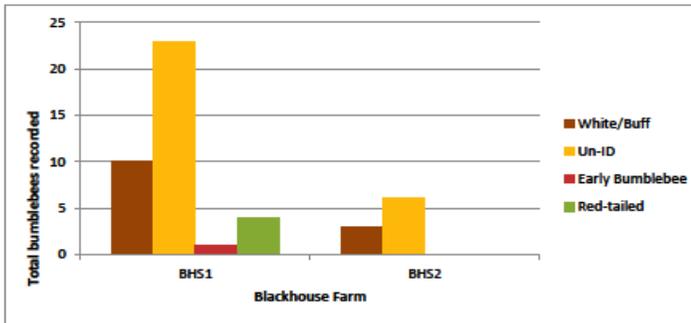


**Blackhouse 2018**

Flower	No. of BB visits
Meadowsweet	8
Yellow-rattle	6
Knapweed	5
White Clover	3
Eyebright	1
Meadow Vetchling	1
Grand Total	24

	2016	2017	2018
Total bumblebees	211	215	47
Total species	6	4	4
Average temp	19.3	19.75	24
No. visits	6	4	2
Total m transect	885	885	885
<b>Bumblebees per 1000m</b>	<b>39.7</b>	<b>60.7</b>	<b>26.55</b>

Section	Un-ID	Early Bumblebee	Red-tailed	White/Buff	Total
BHS1	23	1	4	10	38
BHS2	6			3	9
<b>Total</b>	<b>29</b>	<b>1</b>	<b>4</b>	<b>13</b>	<b>47</b>

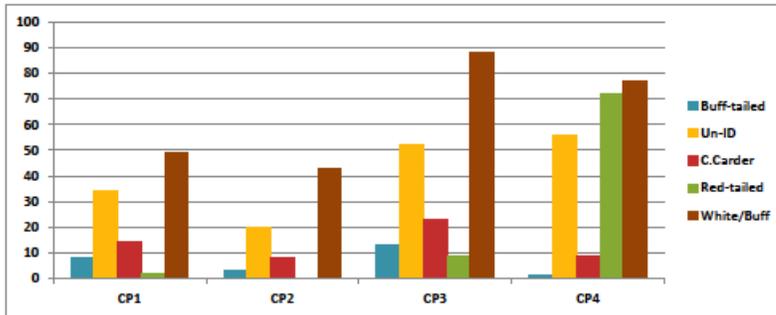


**Colt Park 2018**

Flower	No. of BB visits
Knapweed	150
Yellow-rattle	126
Red Clover	72
White Clover	25
Eyebright	17
Meadowsweet	13
Rough Hawkbit	3
Giant Bellflower	2
Selfheal	2
Meadow Buttercup	2
Betony	1
Bird's-Foot-Trefoil	1
<b>Grand Total</b>	<b>414</b>

Colt Park	2017	2018
Total bumblebees	51	581
Total species	7	6
Average temp	-	18
No. visits	6	7
Total m transect	848	848
<b>Bumblebees per 1000m</b>	<b>10</b>	<b>97.88</b>

Colt Park	Buff-tailed	Un-ID	C.Carder	Red-tailed	White/Buff	Total
CP1	8	34	14	2	49	107
CP2	3	20	8		43	74
CP3	13	52	23	9	88	185
CP4	1	56	9	72	77	215
<b>Total</b>	<b>25</b>	<b>162</b>	<b>54</b>	<b>83</b>	<b>257</b>	<b>581</b>

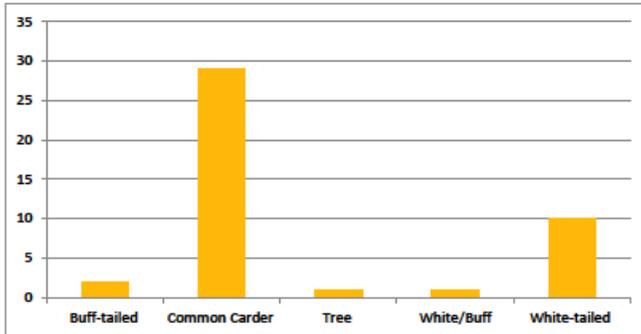


**Dalehead 2018**

Flower	No. of BB visits
Bird's-Foot-Trefoil	11
Red Clover	9
Meadowsweet	4
Meadow Vetchling	3
Lousewort	2
Yellow Vetchling	2
Cinquefoil	2
Yellow-rattle	2
White Clover	1
Selfheal	1
Mouse-Ear-Hawkweed	1
Common Knapweed	1
<b>Grand Total</b>	<b>39</b>

	2016	2017	2018
Total bumblebees	57	28	43
Total species	6	5	4
Average temp	15.3	16.8	20
No. visits	6	5	6
Total m transect	167	167	167
<b>Bumblebees per 1000m</b>	<b>56.9</b>	<b>33.5</b>	<b>42.9</b>

Buff-tailed	Common Carder	Tree	White/Buf	White-tailed	Total
2	29	1	1	10	43

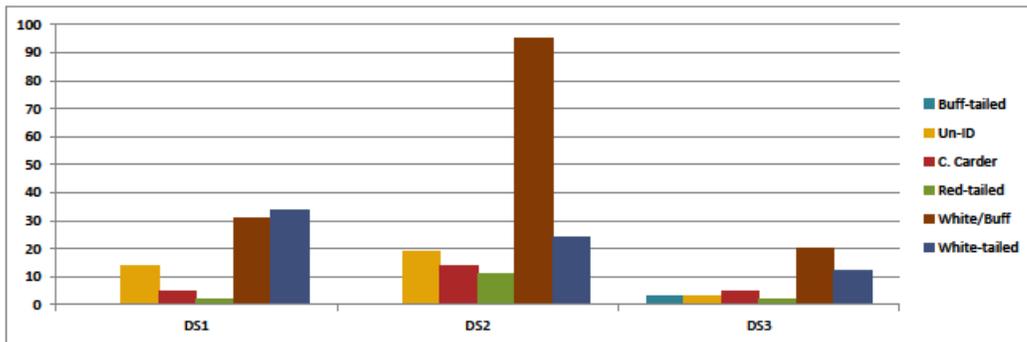


**Dent 2018**

Flower	No. of BB visits
White Clover	105
Yellow-rattle	62
Knapweed	42
Red Clover	16
Meadow Buttercup	9
Meadowsweet	3
Meadow Vetchling	2
Woundwort	1
Rough Hawkbit	1
Eyebright	1
<b>Grand Total</b>	<b>242</b>

	2016	2017	2018
Total bumblebees	133	141	294
Total species	6	5	4
Average temp	16.5	16.2	20
No. visits	6	6	4
Total m transect	446	376	376
<b>Bumblebees per 1000m</b>	<b>49.7</b>	<b>62.5</b>	<b>195.48</b>

Section	Buff-tailed	Un-ID	C. Carder	Red-tailed	White/Buff	White-tailed	Total
DS1		14	5	2	31	34	86
DS2		19	14	11	95	24	163
DS3	3	3	5	2	20	12	45
<b>Total</b>	<b>3</b>	<b>36</b>	<b>24</b>	<b>15</b>	<b>146</b>	<b>70</b>	<b>294</b>

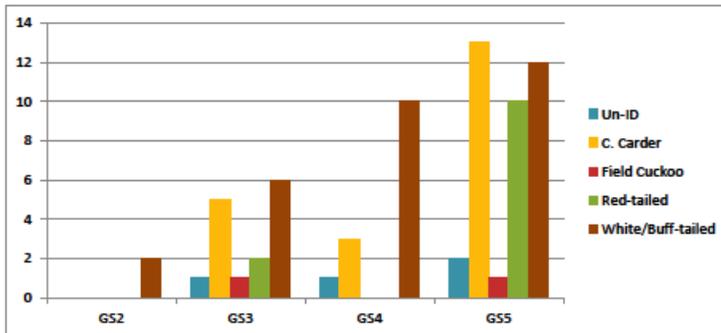


**Grassington 2018**

Flower	No. of BB visits
Knapweed	25
Betony	9
Devil's-bit Scabious	8
Red Clover	5
White Clover	4
Meadow Vetchling	4
Yellow-rattle	3
Selfheal	2
Lady's-slipper	2
Unidentified flower	1
Rough Hawkbit	1
Oxeye Daisy	1
<b>Grand Total</b>	<b>65</b>

	2016	2017	2018
Total bumblebees	127	174	69
Total species	7	10	5
Average temp	16.6	18	21.5
No. visits	6	6	6
Total m transect	636	636	636
<b>Bumblebees per 1000m</b>	<b>33.3</b>	<b>45.6</b>	<b>18.08</b>

Section	Un-ID	C. Carder	Field Cuckoo	Red-tailed White/Buff-tailed	
GS2					2
GS3		1	5	1	2
GS4		1	3		10
GS5		2	13	1	10
<b>Total</b>	<b>4</b>	<b>4</b>	<b>21</b>	<b>2</b>	<b>30</b>

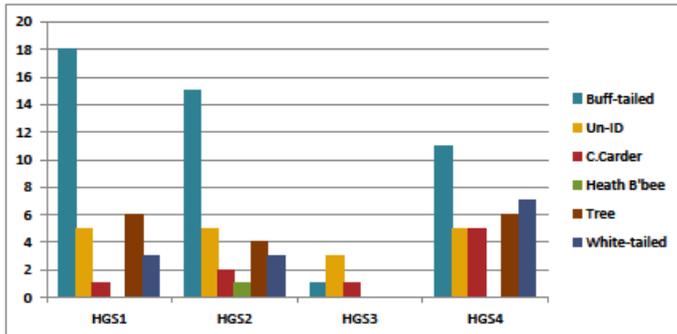


**Halton Gill 2018**

Flower	No. of BB visits
White Clover	38
Yellow-rattle	28
Red Clover	13
Eyebright	3
Grand Total	82

	2016	2017	2018
Total bumblebees	118	83	102
Total species	7	6	6
Average temp	15	16	18.5
No. visits	5	6	6
Total m transect	917	917	917
Bumblebees per 1000m	25.7	18.1	18.54

Section	Buff-tailed	Un-ID	C.Carder	Heath B'bee	Tree	White-tail	Total
HGS1	18	5	1			3	33
HGS2	15	5	2		1	4	30
HGS3	1	3	1				5
HGS4	11	5	5		6	7	34
<b>Total</b>	<b>45</b>	<b>18</b>	<b>9</b>		<b>1</b>	<b>13</b>	<b>102</b>

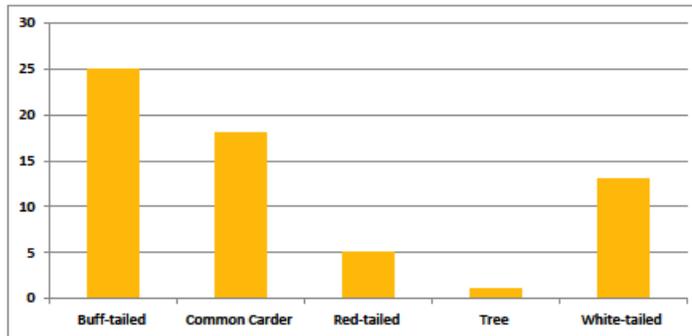


**Higher High Field 2018**

Flower	No. of BB visits
Yellow-rattle	41
Hawkbit	6
Knapweed	4
White Clover	3
Great Burnet	2
Red Clover	2
Meadow Vetchling	1
Hawkweed	1
Eyebright	1
Hogweed	1
Grand Total	62

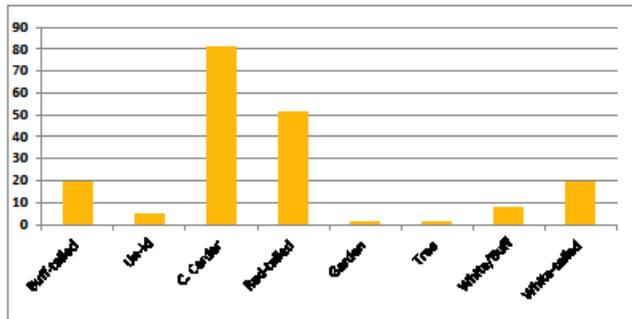
	2017	2018
Total bumblebees	37	62
Total species	5	5
Average temp	15	17.25
No. visits	6	5
Total m transect	634	634
<b>Bumblebees per 1000m</b>	<b>9.7</b>	<b>19.55</b>

Buff-tailed	Common Carder	Red-tailed	Tree	White-tailed	Total
25	18	5	1	13	62



**Life4life meadow 2018**

Flower	No. of BB visits
Knapweed	104
Great Willowherb	19
Marsh Woundwort	16
Himalayan Balsam	16
Rosebay Willowherb	6
Greater Knapweed	6
Balsam	4
Greater Willowherb	3
Bird's-Foot-Trefoil	3
Thistle	2
Spear Thistle	1
Yellow-rattle	1
Meadowsweet	1
Creeping Thistle	1
Hogweed	1
<b>Grand Total</b>	<b>184</b>



Buff-tailed	Un-id	C. Carder	Red-tailed	Garden	Tree	White/Buf	White-tailed	Total
19	5	81	51	1	1	8	19	185

	2017	2018
Total bumblebees	18	185
Total species	3	6
Average temp	19	20.4
No. visits	4	5
Total m transect	161	161
<b>Bumblebees per 1000m</b>	<b>28</b>	<b>216.4</b>



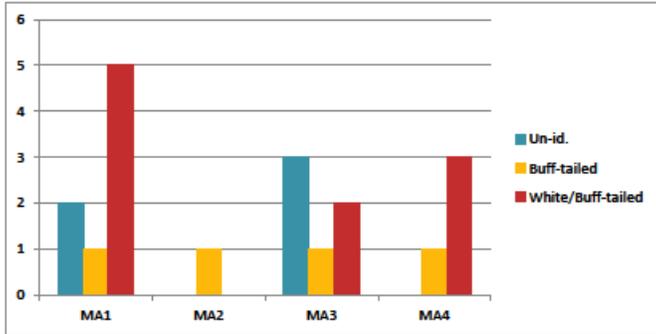


**Malham 2018**

Flower	No. of BB visits
Yellow-rattle	4
White Clover	3
Red Clover	3
Unidentified flower	1
<b>Grand Total</b>	<b>11</b>

	2016	2017	2018
Total bumblebees	23	117	19
Total species	3	3	2
Average temp	17	19	19
No. visits	2	5	6
Total m transect	612	612	612
<b>Bumblebees per 1000m</b>	<b>18.8</b>	<b>38.23</b>	<b>5.17</b>

Section	Un-id.	Buff-tailed	White/Buff-tailed	Total
MA1	2	1	5	8
MA2		1		1
MA3	3	1	2	6
MA4		1	3	4
<b>Total</b>	<b>5</b>	<b>4</b>	<b>10</b>	<b>19</b>

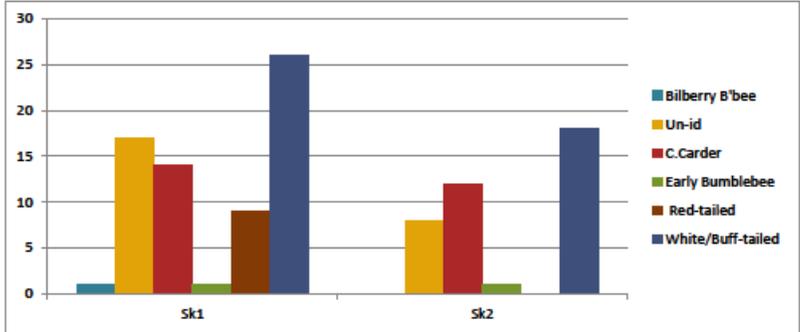


**Skelshaw 2018**

Flower	No. of BB visits
Yellow-rattle	29
White Clover	17
Red Clover	16
Eyebright	3
Meadow Buttercup	3
Common Knapweed	1
Meadow Vetchling	1
Bush vetch	1
<b>Grand Total</b>	<b>71</b>

	2016	2017	2018
Total bumblebees	433	170	107
Total species	9	5	6
Average temp	17	20	20
No. visits	5	5	3
Total m transect	885	633	633
<b>Bumblebees per 1000m</b>	<b>97.85</b>	<b>53.7</b>	<b>56.35</b>

Section	Bilberry B'bee	Un-id	C.Carder	Early Bumblebee	Red-tailed	White/Buf-tailed	Total
Sk1	1	17	14	1	9	26	68
Sk2		8	12	1		18	39
<b>Total</b>	<b>1</b>	<b>25</b>	<b>26</b>	<b>2</b>	<b>9</b>	<b>44</b>	<b>107</b>

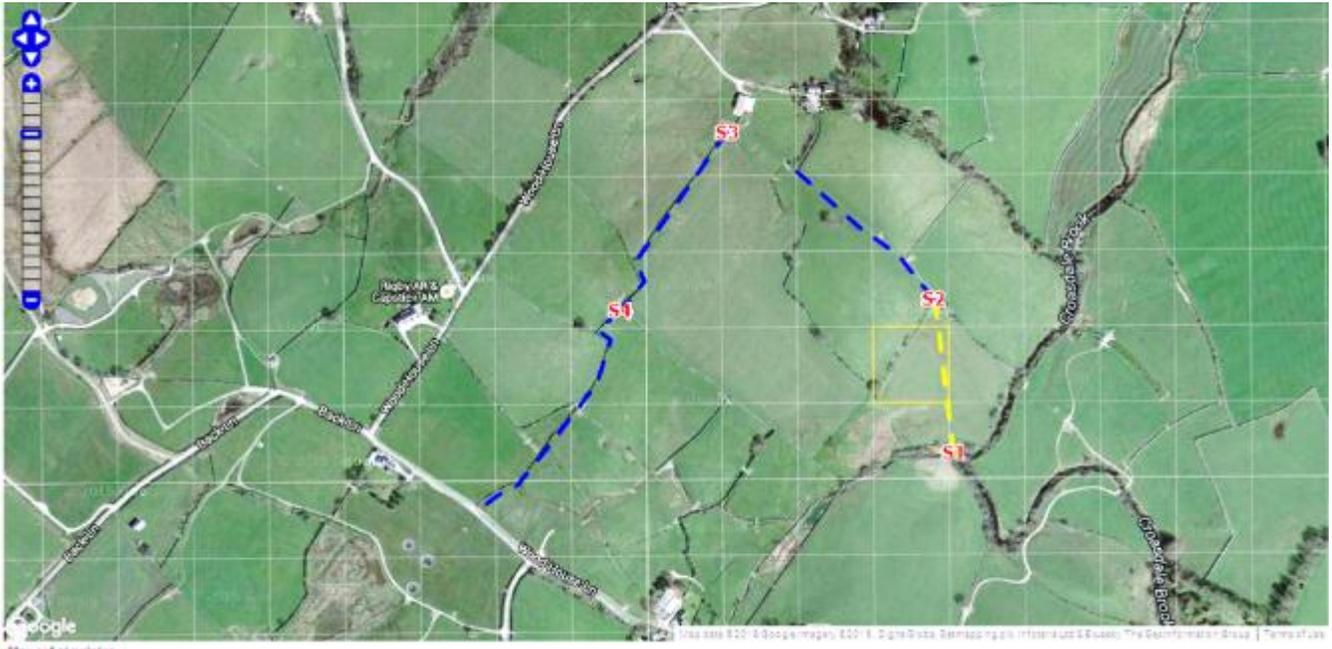
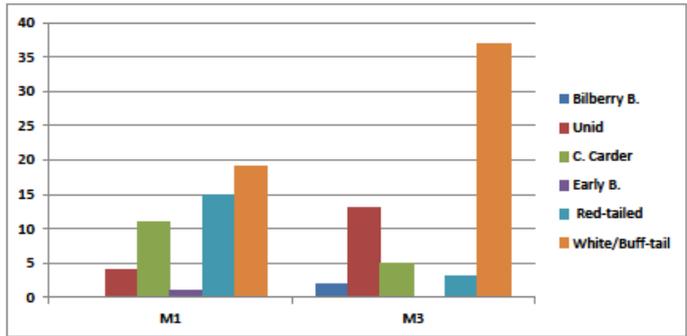


**Myttons 2018**

Flower	No. of BB visits
Meadowsweet	36
Red Clover	16
Common Knapweed	13
Tufted vetch	8
Meadow Buttercup	4
Yellow-rattle	4
White Clover	3
<b>Grand Total</b>	<b>84</b>

	2016	2017	2018
Total bumblebees	662	288	110
Total species	9	5	6
Average temp	17	19	19.7
No. visits	5	5	3
Total m transect	1084	479	479
<b>Bumblebees per 1000m</b>	<b>122.1</b>	<b>120.25</b>	<b>76.54</b>

Section	Bilberry B.	Unid	C. Carder	Early B.	Red-tailed	White/Buf-tail	Total
M1		4	11	1	15	19	50
M3	2	13	5		3	37	60
<b>Total</b>	<b>2</b>	<b>17</b>	<b>16</b>	<b>1</b>	<b>18</b>	<b>56</b>	<b>110</b>

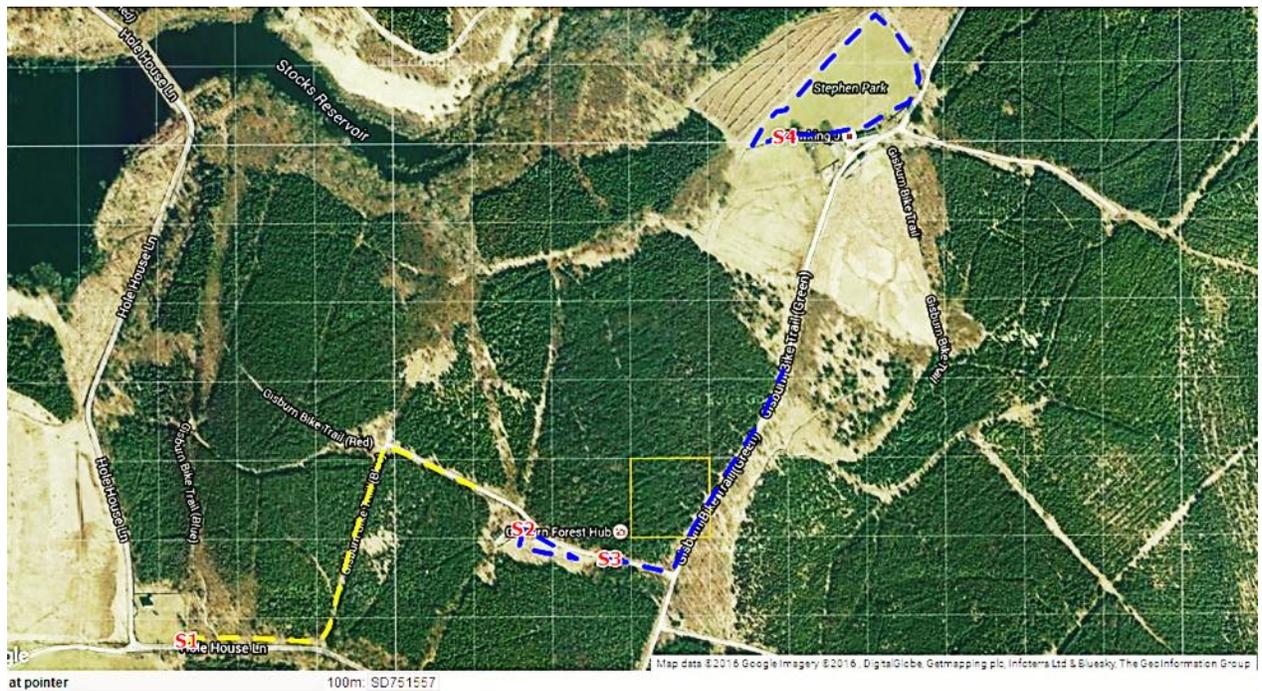
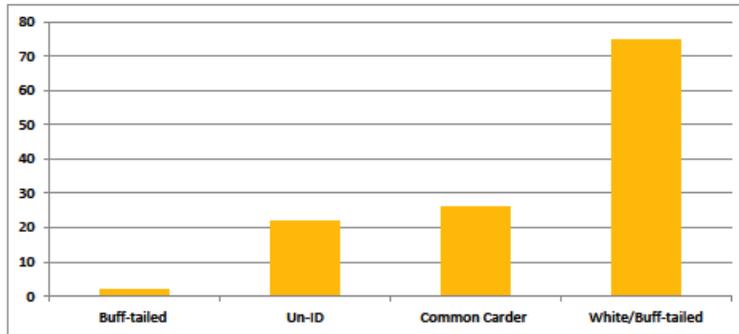


**Gisburn Forest 2018**

Flower	No. of BB visits
Yellow-rattle	70
White Clover	12
Eyebright	8
Red Clover	4
Thistle	1
Meadow Buttercup	1
Meadow Vetchling	1
<b>Grand Total</b>	<b>97</b>

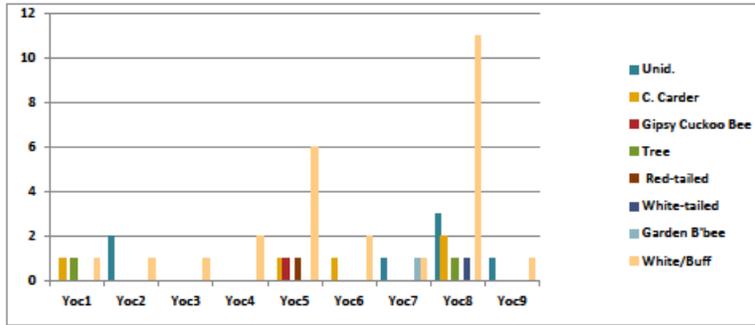
	2016	2017	2018
Total bumblebees	464	166	125
Total species	10	4	3
Average temp	14	18.5	17.25
No. visits	5	4	4
Total m transect	1706	578	578
<b>Bumblebees per 1000m</b>	<b>54.4</b>	<b>71.8</b>	<b>54.07</b>

Buff-tailed	Un-ID	Common Carder	White/Buff-tailed	Total
2	22	26	75	125



**Yockenthwaite 2018**

Flower	No. of BB visits
White Clover	10
Red Clover	7
Knapweed	6
Yellow-rattle	5
Unidentified flower	2
Betony	2
Thistle	1
Eyebright	1
Melancholy Thistle	1
Meadowsweet	1
Meadow Vetchling	1
Selfheal	1
Rough Hawkbit	1
<b>Grand Total</b>	<b>39</b>



Section	Unid.	C. Carder	Gipsy Cuckoo Bee	Tree	Red-tailed	White-tailed	Garden B'bee	White/Buf	Total
Yoc1		1		1				1	3
Yoc2	2							1	3
Yoc3								1	1
Yoc4								2	2
Yoc5		1	1		1			6	9
Yoc6		1						2	3
Yoc7	1						1	1	3
Yoc8	3	2		1		1		11	18
Yoc9	1							1	2
<b>Total</b>	<b>7</b>	<b>5</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>26</b>	<b>44</b>

	2016	2017	2018
Total bumblebees	160	97	44
Total species	6	6	7
Average temp	17	23	22.25
No. visits	5	5	4
Total m surveyed	942	942.00	942
<b>Bumblebees per 1000m</b>	<b>33.9</b>	<b>20.6</b>	<b>11.68</b>

