Kendal Pollinator Project
Final Report – 2019

Introduction

The Kendal Pollinator Project (KPP) was set up as a three year "Citizen Science "project in the community which would be managed by Kendal-based local charity South Lakes Action on Climate Change Towards Transition (SLACCtt). The main objectives foresaw the creation of improved pollinator habitats within Kendal (along the canal path); subsequent monitoring and recording of the six plots; collaboration with national science projects and, through the involvement of young people, demonstration of the importance of community-based practical work to improve habitats for pollinator species within urban areas. These objectives have developed and expanded through the three year life of the project.

Partners: *Funding and Support*

The support of our generous funders and supporters has been gratefully received:

- The Centre for Ecology and Hydrology (CEH) at Lancaster University have provided expert advice throughout the duration of the project. They advised on the methodology for surveys that would be at the heart of the scientific research side of the project and have been involved in the preparation of this report.
- The Ernest Cooke Trust provided initial year funding which enabled the project to involve 350 children and 20 adult volunteers during 2017.
- Horticare adult volunteers with learning difficulties sowed and cared for approximately 2000 wildflower plugs.
- Kendal Conservation Volunteers (KCV) have helped with advice and practical support with initial planting and plot management. KCV mowed the plots in 2017, provided approximately 2600 wildflower plugs and assisted with planting.
- Kendal Town Council (KTC) have provided funding and support throughout the project, most recently helping with the removal of the project's fencing from the canal path.
- South Lakeland District Council (SLDC), as owner of the canal path, have provided support, advice and funding.
- South Lakes Action on Climate Change Towards Transition (SLACCtt) have provided management and hosting for the project and the involvement of their volunteer base at key times. SLACCtt volunteers erected boundary posts and rails and signage at each plot, assisted with investigations, helped with repairs to damaged plot boundaries and signage, raked cut grass from plots where schools were not able to do this and assisted with wildflower plug planting. At the end of the project SLACCtt volunteer involvement was essential in removing the posts, rails and signs.

Original Objectives

The initial objectives of the project were to:

1. create new or improved pollinator habitats in public spaces within Kendal;
2. engage at least five schools as project partners, inviting them to take part in scientific projects on pollinator habitats, which would use data collected from project sites;
3. provide opportunities for project partners to link to national science projects;
4. engage at least two local community groups as project partners in projects which build public understanding of the importance of, and needs of, insect pollinators
5. demonstrate the success of community-based practical projects for improving habitats for native pollinator species within urban areas.

During the life of the project, most of these have been achieved and others have been added. At different times during the project children from six schools and two community groups have been involved. Parents,

group leaders, teachers and SLACCtt volunteers have also been involved. At the time of writing it is hoped that at least two partner schools will create wildflower environments within school grounds to allow continuation of the learning opportunities gained through participation in the project. The same children who were involved with the Pollinator Project at another partner school are involved in a one year project with Lancaster University researching pollinators and the factors that affect them, building on their existing work with bees. Opportunities for partner schools to apply for research grants were provided during the project. Project sites were established within Kendal (the canal path) at which partner schools and groups undertook research and surveys to allow comparison of the performance of wildflower species over three years and the resulting impact on pollinating insect species. And the practical experience gained at the project sites has been built-on with classroom work and, at the time of writing, art workshops.

School and Community Involvement

The following schools and community groups have been involved in the citizen science part of the project:

Castle Park Primary School
Crosthwaite Primary School
Ghyllside Primary School
Heron Hill Primary School
Kendal Sea Cadets
Kingfishers Wildlife Watch Group (affiliated to Cumbria Wildlife Trust)
Kirkbie Kendal School
Stramongate Primary School

How the Monitoring Was Undertaken: Scientific Method

Initial Year: 2017; Establishment of Study Plots, Baseline Surveys and Planting

In 2017 six study plots on the canal path in Kendal were marked out with fencing and each school and youth group was allocated a study plot (with the exception of Crosthwaite Primary which would carry out the investigations on their own school grounds due to their distance from Kendal). The canal towpath is a walking and cycle route along the filled-in section of the Lancaster Canal routed into Kendal. It is near to several of the schools and groups and is a well-used walk to school route for many pupils. During the project Kirkbie Kendal School transferred their study plot to Ghyllside.

Six plots were split into two groups of three, each group having different characteristics. The southern group (near Kirkbie Kendal School and Leisure Centre) were larger, more open and with thicker grass growth. The northern plots (adjacent to allotments and Parr Street canal bridge) were smaller, very shallow soils, thinner vegetation growth).

Each plot was marked with a signpost that showed which school or group was looking after each plot and gave brief details of the project. These signs were the target of vandalism and by the end of the three years were in a poor condition. The fences themselves also needed periodic repairs due to damage.

Following consultation with plant scientists from CEH and establishment of the plots, initial 'baseline' surveys of wildflowers and insects were undertaken by the children. Subsequently, in September 2017, the project partners worked with volunteers to plant 1000 wildflower plugs on each of the six study plots – a total of 6000 wildflowers - from a list of locally suitable wildflowers with high benefit to native pollinating insects (the list of flower species planted is in Appendix One). In most cases, adult volunteers created planting holes, with children doing the planting.

The management regime that was decided for the study plots once the planting had been completed was that they should be left untouched without any form of mechanical or chemical intervention during the growing and seed-setting season up to September. During September, following seed setting and to keep

the nutrient level on the plots down for the following year, the plots were mown and the clippings raked off and composted.

The plan was to repeat the surveys of the flowers and insects on each plot in 2018 and 2019 to see how the existing and new flowers responded. The final results would indicate whether the planting of wildflowers has an impact on the actual recorded number of flowering plants and also on pollinating insects in the subsequent years.

Second Year: 2018

During 2018 there were a number of logistical and methodological issues that had to be managed. For instance there were several instances of vandalism to the plot fencing and signage. Unexpected mowing of the three northern plots also took place twice, a significant change to the management regime. This disrupted the ability of some of the young people to be able to undertake surveys on their plots. On the other hand it allowed observation of the vegetation response to an unplanned change.

Notwithstanding this, ten surveys (five of wildflowers and five of insects) were undertaken by children from the project partners between May and July. The methodology was kept similar to that used in 2017 for all surveys to ensure that the data would be comparable, both with other plots in 2018 but also compared back to the baseline surveys in 2017 and the surveys planned for 2019.

Dock was cleared during the initial year. In 2018 there was a significant quantity of dock on the southernmost of the six plots (South Plot One). A discussion was undertaken with CEH as to whether this should be removed or left in place. The decision was to leave it in place and attempt to observe any impact on species diversity on that plot.

Third and Final Year: 2019

The final year saw a full set of surveys done on each of the study plots – six of flowers and six of pollinating insects. There were no unplanned mowings this year and less vandalism to contend with.

Wildflower Investigation Method

The wildflower investigation used metal quadrats allocated randomly across the investigation plots to sample wildflowers. Each plot was divided into one metre squares and marked using tape. Random number generators were used to allocate each group of children a square and they were shown how to do the survey (for example, to count flower stems not individual flowers or flower heads). If groups of children finished with one square then they were allocated another – the idea being that the more squares that were studied the more consistent the results would be. There were adults on hand to help with identification and the children themselves recorded the results on tally sheets (an example flower tally sheet is in Appendix Two).

All the children used the same study guide (Field Study Centre Grassland 1) to aid identification. This guide seemed to be sufficiently detailed for citizen science but also sufficiently simple to be usable by children as young as 8.

Surveys took place in all weathers. In 2017 the surveys took place over a period from early June to early July. In 2018 and 2019 attempts were made to reduce the spacing between the surveys and all flower surveys took place in June. Flower surveys recorded the number of flower stems belonging to each individual species. Summary data for the flower surveys is shown in Appendix Three.

Pollinating Insect Investigation

The pollinating insect survey took place on the same investigation plots. Partners used a home-made guide prepared by the Project Coordinator to identify pollinating insects from 7 different groups (with the

exception of two moth species, individual insect species weren't recorded):

- Bumble bees
- solitary bees
- social bees
- pollinating beetles
- hoverflies
- butterflies
- two specific species of moth

Insect surveys were more difficult to organise as they were more weather dependent than flower surveys. The methodology called for insect surveys to be undertaken during calmer weather. Clearly this wasn't always the case on survey dates and on several occasions insect surveys had to be re-organised.

The survey method for the insect surveys was for the same plots to be marked out using tape into six 5m wide transects. The children then walked down each transect as slowly and quietly as possible visually identifying any insects they saw in the grass or flying over the transect. They recorded what they found on a tally sheet.

Weather and the time of day at the time of the insect surveys could have a significant impact on the results. Evening surveys produced low tallies, and cloudy afternoons had lower counts than sunny afternoon. However all surveys produced a range of recorded insects.

Method Changes and Comments

The methodology was retained mostly unchanged during the three years to ensure comparability of results. The number of insect transects undertaken in each of the three years was almost exactly the same: it would be counter-productive to try to increase the number of transects undertaken on a given plot at a given time because disturbing the insects has a big impact on their presence.

The number of flower quadrats was increased however in order to increase the robustness of the flower survey results. This had to be done whilst not rushing the children and still trying to minimise the amount of trampling during the surveys. The increase in quadrat numbers year on year was achieved mainly through greater familiarity of the adult helpers with the methodology and organisational process but the following also had an impact:

- Weather (heavy rain during flower surveys would reduce the time spent doing surveys; bad weather during insect surveys would lead to postponement).
- Number of children (group sizes varied between five and sixty). Very large groups were split into smaller parties who did their surveys at slightly different times but their results are included with the same group.
- Amount of flowers and insects found (more species and individual insects and flowers take longer to identify and record).

Variations in Results

Before looking at the results it's important to note the constraints and limitations of the surveys and how these could have had an impact on the accuracy and comparability of the results. In particular:

- Variation in the dates during June and July when the surveys were undertaken.
- As referred to above, the weather on the day has a significant impact on insects observed and over a period of time affects the amount and type of flowers observed.
- Time of day of survey: this is particularly important for the insect surveys. Some groups undertook insect surveys in the evening when insect numbers would be expected to be lower.

- The presence of substantial amounts of dense grasses on the southern plots compared to much lower levels of grasses on the three northern plots.
- Proximity of allotments (northern plots) and gardens (all plots) allowing spread of other species.
- Lack of control plot(s).
- Inconsistent application of survey methodology and identification errors. Whilst a lot of children worked hard to follow the sampling and identification methodology, it's likely that this was not consistent within each group and between each group. For almost all groups different children (and sometimes adult helpers) were involved each year so some inconsistency of methodology between years should be expected.

Care needs to be taken therefore not to draw strong conclusions from the data except where the significance is very strong.

Results and Discussion

Despite the number of potentially confounding factors, survey results show some degree of consistency. For example, although not statistically strong, averaged quadrat and transect survey results (all three years) from both the northern and southern sets of plots show a positive relationship between flower and insect numbers (figures one and two).

Figure One: Average Number of Insects v Average Number of Flowers (Southern Plots, All Three Years)

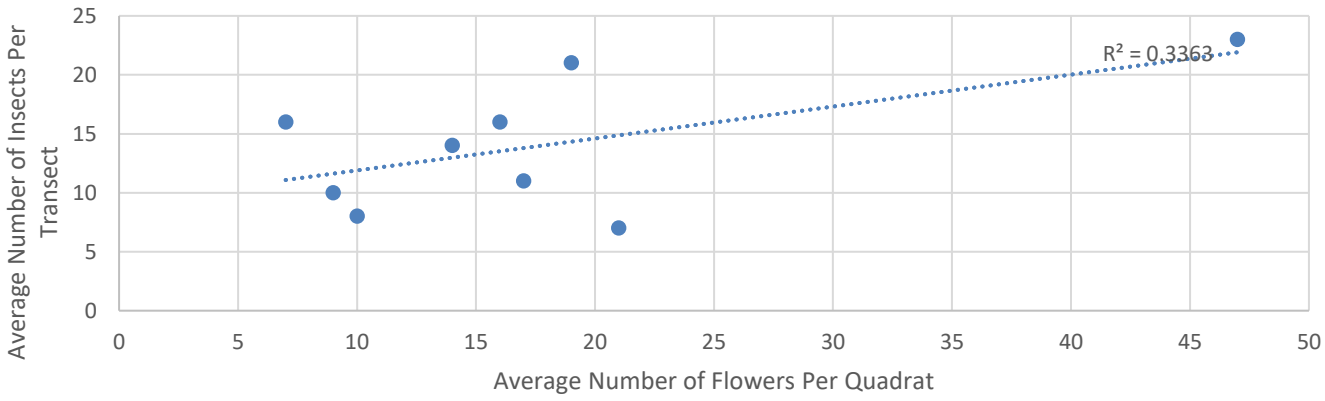
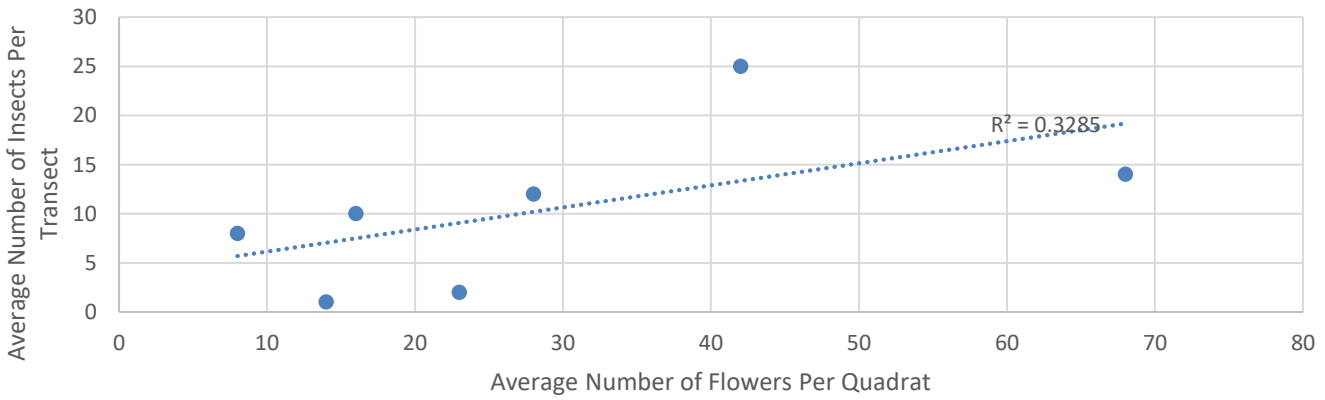


Figure Two: Average Number of Insects v Average Number of Flowers (Northern Plots, All Three Years)



The character of the two sets of plots (northern and southern) as described above have some significant differences. During the project, grass growth on the three northern plots was substantially less than on

the southern plots where up to one metre of growth was observed. This led to initial identification of some of the planted flower species emerging on the northern plots but not so much on the southern plots where some species were crowded out. Large species such as nettle, bramble, thistle, hogweed are observed on the southern plots and not on the northern plots. Given the amount of cover from a dock plant, it was a significant presence on the southern plots. It is interesting to note that range of flower species was slightly greater overall on the southern plots than the northern ones.

Looking at the flower species an analysis of the five most prevalent on each of the plots in each year was undertaken (charts in Appendix Three). This was to focus on those pollinating flower species that have the most potential on plots with these characteristics. Comments are also made here about which were planted in 2017 and which weren't. The key observations for the three northern plots were:

- Red clover was planted in 2017 but was also observed all three years. It had shown a large increase by 2019 to become the most prevalent species on the northern plots overall.
- White clover (not planted) was also very significant.
- Oxeye daisy was not present in 2017. It was planted and by 2019, although not in huge numbers, it was present on all three plots. It was not significant on 2018, taking two years to establish.
- Of the other species that were planted, there were small showings for black knapweed and cow parsley but only in 2018 and only on one plot.

The key observations for the three southern plots were:

- Meadow buttercup (not planted) was easily the most dominant flowering plant. It has a significant presence on the northern plots but is not as dominant as in the south.
- There is some red clover, where it was able to compete with the taller species, and some white clover although there seems to be less white clover in the later years.
- There is a small showing for cow parsley on one plot. There is some hogweed and dock whereas on the northern plots there is not much dock (one plot, 2017 only) and no hogweed. It is possible that there might have been some confusion in identifying cow parsley and hogweed.
- There is one reference to yarrow (planted) but only on one plot in one year.

It's also important to note that cowslips (planted) did appear but they show much earlier than the surveys (the surveys were in June-July) so they don't appear in the results. Additionally, flowers planted in autumn 2017 that do not appear or which only make a small appearance in the survey results might still flower in subsequent years. The highest average total number of flowers per quadrat *and* the highest range of flower species was observed in 2018.

Southern plot one and northern plot one show lower results for some of the surveys. There are possible explanations for this. In terms of insect numbers, the groups that surveyed these plots were not school groups and had to undertake surveys in the evening when insect numbers might be expected to be lower. There was a large presence of dock on southern plot one. Northern plot one is the most strongly shaded plot of the three northern plots.

The mowing of the three northern in error (twice) during the 2018 growing season was unfortunate and unplanned and meant that surveys comparable with other years was difficult. However surveys were still done in 2018 on northern plot three to see what still managed to grow. Following each of the unplanned mowings, red clover was observed to return very quickly. At the end of August it was still the main flower observed anecdotally on all the northern plots. It's also interesting to note that, although it's difficult to draw a strong conclusion based on just one plot, the largest number of flowers per plot of any of the flower surveys during the three years was on this plot when the survey was undertaken after it had been mown.

In relation to insects, although there is a slight positive relationship between insect and flower numbers shown above, the average number of insects per transect was remarkably consistent for all three years. There was a slightly higher number of insect groups recorded in 2019 compared with 2017. Similar to the flower survey results being strongest in 2018, 2018 was also the year when the largest number of insect groups were recorded on each plot. As already mentioned, it is difficult to make strong statements about the insect results as the year to year variances were not that large.

Other Discussion Points - Flowers
There are other issues where the project has produced some or limited evidence but which are mentioned here as they might be of general interest and might benefit from additional trials:

1. Buttercups, hogweed, red clover and cow parsley require limited management (periodic mowing) but could be reliable nectar producers in the sort of environment found on the canal path as long as they are not very overshadowed or otherwise crowded out.
2. To assist with this, if seeking to establish wildflower areas, the plants in question prefer low fertility, so avoiding the import of fertile topsoil might be important as would the removal of cuttings and / or more frequent mowing either side of flowering.
3. Linear features, 'gaps' in planting and areas of low fertility, stony ground can be important in providing refuges for nectar producing flowers and 'highways' for insects.

Learning and The Future
Other than the art workshops, the formal three year project is now complete. However there are a number of points for the future, both in terms of what learning has taken place and follow-on activities that will be taking place. This information has been obtained from surveys of teachers, adult leaders and helpers and from discussions with some of the children themselves.

First, the *overall impact of the project*. Table One gives some headline statistics that provide some idea of the overall impact of the project. In particular, the total number of children that have been involved.

Table One: Project Impact Over Three Years	
Total Flowers Counted	6036
Total Insects Counted	2038
Total Children Involved	720

What did schools and groups do aside from the surveys?
Schools and groups found the project particularly useful because of the close links between the project and the coverage of pollination and the environment within the science curriculum. For one school in particular the cross over between the project and their existing work with bees in school was particularly valuable.

These links were developed with the children in most of the groups by discussing:
- Why the surveys were being done;
- The wider importance of pollination;
- The role that the children themselves were playing the in project and why this was important;
- Why science experiments don't always come up with the answers that are expected.

Two schools elaborated on what they covered in class:
"We introduced the topic by discussing the importance of pollinating insects, looking at news stories related to a decline in bee populations. We talked about why the children thought this project was important and what its ultimate aim might be. Before the surveys we discussed the methods used and how these were scientific including the things that were the same- (size of the plot, method of recording etc)

and what things were different (the exact plot surveyed). We talked about what we would expect/ hope to find out at the end of the surveys and then looked at the results to see if we were correct."

"The project was very beneficial to the school and children involved. It gave the children a chance to work together on a set project, showing team work skills in collecting and recording the information. It gave the children a sense of what real scientific enquiries involve and they gained a great sense of pride and achievement in their involvement in this 'grown up' project. Children also gained knowledge about different plant species and different pollinating insects, knowledge that many were then keen to continue using in their own green spaces. It was also positive to get the children outside to do something very focussed that meant they needed to show a real appreciation for the natural world and for green spaces in Kendal. They also needed to use very close observational skills while being systematic and logical in their approaches."

How are schools and groups using the project to develop future plans?
It is very significant to note that all of the groups that were involved in the project in 2019 have got ideas about how to use and / or build on their involvement in the pollinators project. Very significantly, two of the schools are planning to create wildflower areas within their school grounds. A third school created a wildflower meadow on their grounds during 2019 and this is being used in a project with Lancaster University to compare with the University's Eco-Hub. A fourth school has been using the identification charts within their existing grounds. One of the groups already does a wildlife identification session each year but they might start to keep records of what they find. And finally the sixth group is looking at doing similar studies in different environments such as coastline and near inland waterways.

What did the children say they got out of the project?
The children said a range of things. Almost all of them said that they enjoyed doing something like this outdoors, some 'real science'. They enjoyed it particularly because it was based along a path many of them use so they could do look at flowers and insects when they were there with their families. A number of children said that they checked what was growing on their group's plot when they were passing.

Others said that they had been looking at flowers and insects in other locations and in family gardens. Some talked about planting flowers at home. Some reflected the classroom learning, starting to understand that in the natural world outcomes vary and how plants and insects are integral to each others' and our survival.

Providing ID charts and survey equipment to schools and groups
The project has been assisting with this by passing the survey equipment to those groups who said they would be able to use it in the future. Many of the children had said how much they were enjoying carrying on looking for flowers and insects and some of them will be able to continue to use the identification charts as a result.

Following removal from the plots, the fencing was also made available for re-use, this time by holders of the adjacent allotments.

Art Workshops
It was thought to be important to give the children ways to express their experiences with the project and what they learned other than just in discussions. As a result, a partnership with a local community artist has been formed and at the time of writing art workshops in two of the partner schools are being undertaken to give some of the children who were involved with the project the opportunity to do this. It is intended that the art that results from the workshops will be displayed as collage boards within the host schools and elsewhere, depending on the format of what comes out of the workshops.

Conclusions
- Large number (720) of children involved;

- Significant leveraging of learning by complementing classroom and outdoor real science;
- Continuation of learning in some form by all partner schools and groups after the project has formally finished;
- Messages about the importance of pollination being taken to many others by children;
- Evidence that some of the planted flower species have returned in the years following the planting but a number of the planted species have not returned, or have not returned yet;
- Some evidence that in terms of pollen load red clover would be the central species for any planting on similar ground in this area, supplemented possibly by white clover and ox-eye daisy and that cutting an area where red clover is present might cause it to regrow vigorously.

Appendix One: List of Flower Species Planted in Autumn 2017

Field Scabious

Lady's Bedstraw

Black Knapweed

Bird's Foot Trefoil

Wild angelica

Ox-eyed Daisy

Red Clover

Cowslip

Cow parsley

Yarrow

Appendix Two: Flower Species Survey Tally Sheet

Investigation 2: Wildflower Survey Results Chart

School: ……

Date of collecting samples: ……

Quadrat number: ……

Wildflower identified	Number of flowering stems in quadrat
Thistle	
Greater plantain	
Ribwort plantain	
Common Nettle	
Common sorrel	
Sheep's sorrel	
Dock	
Dog violet	
Bugle	
Wild thyme	
Germander speedwell	
Selfheal	
Common Knapweed	
Black Knapweed	
Field Scabious	
Betony	
Common Mouse-ear	
Common Chickweed	
Daisy	
Eyebright	
Yellow rattle	
Oxeye Daisy	
Cowslip	
Dandelion	
Hawkbit	
Cat's-ear	
Common Ragwort	
Meadow Buttercup	
Silverweed	
Bird's-foot Trefoil	
Lady's bedstraw	
Lesser trefoil	
White clover	

Red clover	
Cuckooflower (Mayflower or Lady's Smock)	
Hogweed	
Cow parsley	
Hedge parsley	
Sweet Cicely	
Yarrow	
Meadowsweet	
Other 1 (please take photo)	
Other 2	
Other 3	

Appendix Three: Insect Groups Survey Tally Sheet

Investigation 3: Pollinating Insect Survey Results Chart

School: ……

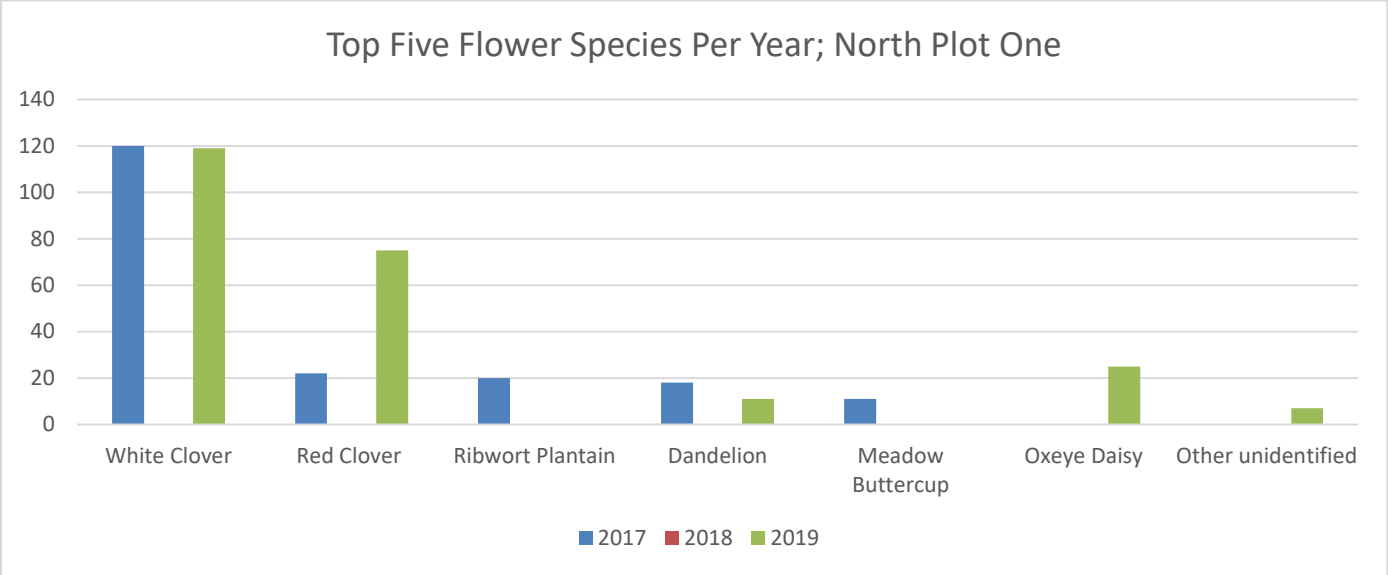
Date of collecting samples: ……

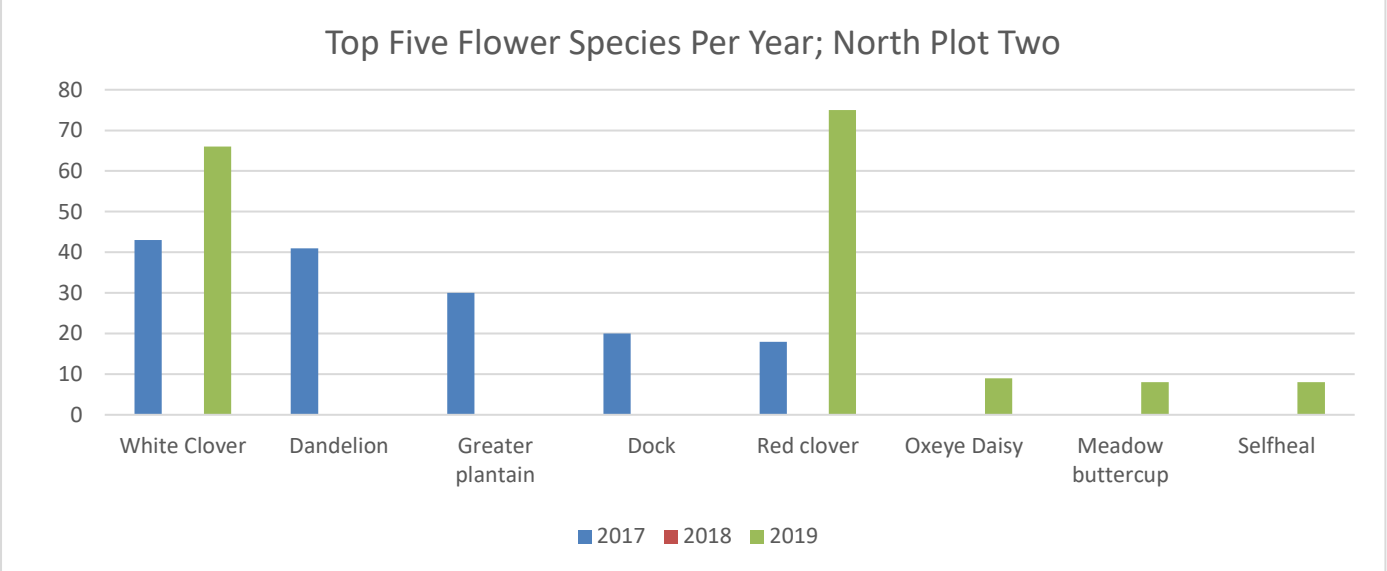
Transect number: ……

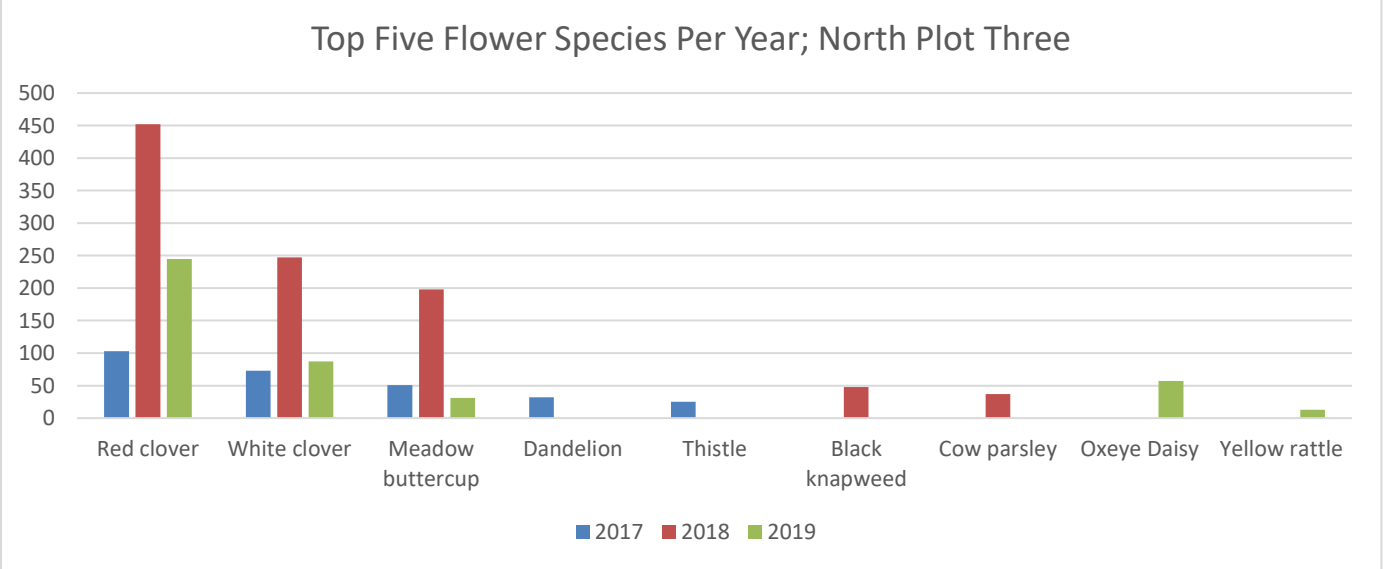
Insect type	Tally for transect	Repeat 1	Repeat 2	Average of repeats
Bumble bees				
Social bees				
Solitary bees				
Pollinating beetles				
Hoverflies				
Butterflies (all)				
Peacock				
Orange tip				
Meadow Brown				
Common Blue				
Tortoiseshell				
Small Copper				
Red Admiral				
Small White				
Hummingbird Hawk moth				
Six-spot burnet moth				

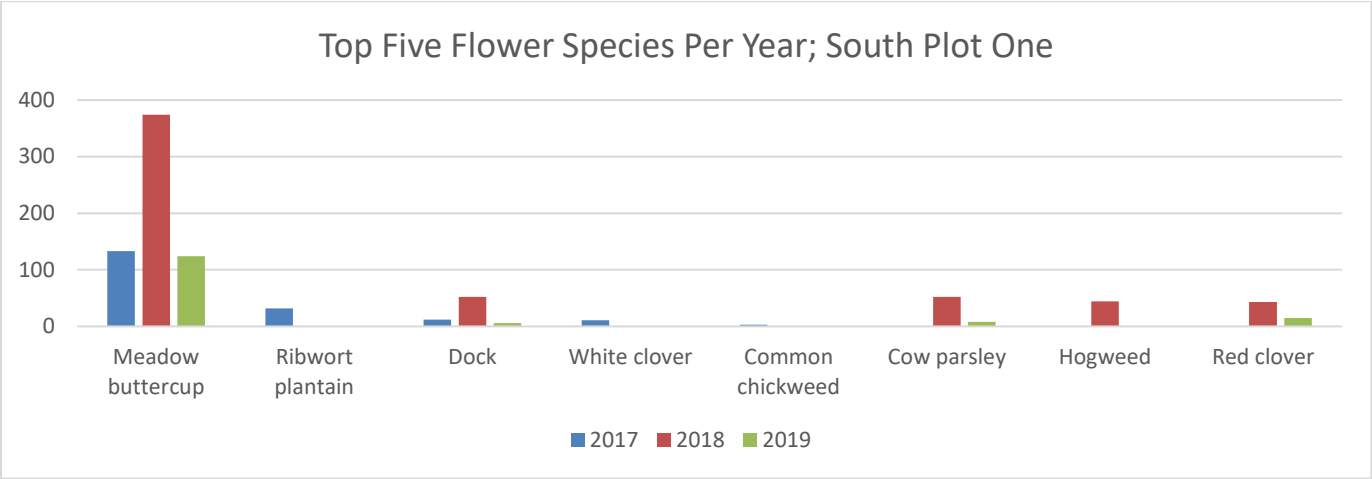
Appendix Four: 'Top Five' Flower Species Plot by Plot and Year by Year

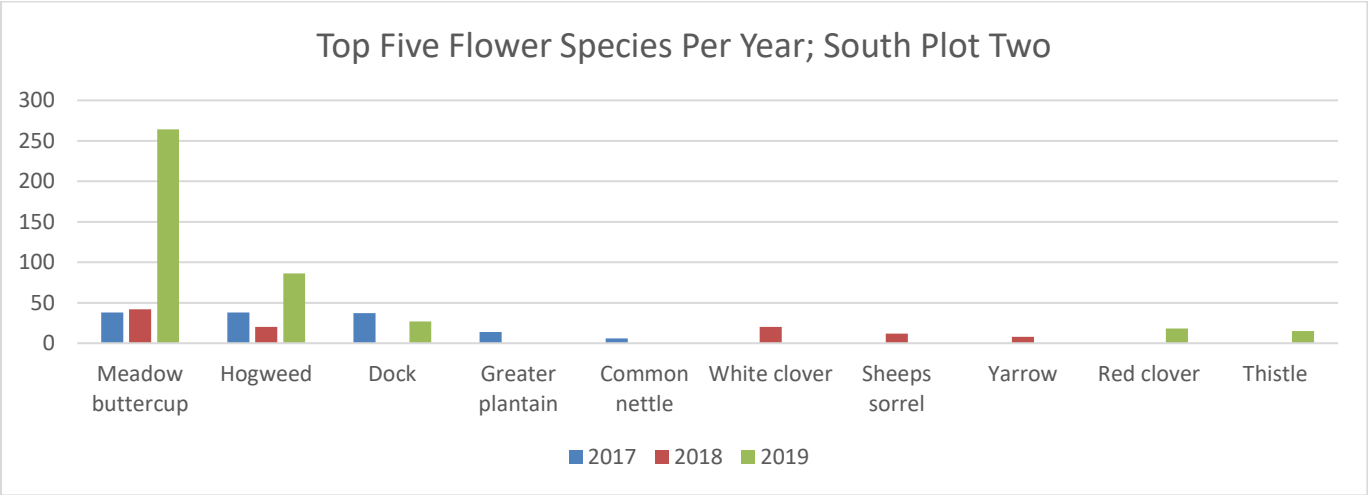
NB: 1. whilst all results for each plot are shown on one chart, the number of flowers are only shown for the top five species in that year. Those species that did not make it into the top five on a given year are shown as zero. This does not mean that there were actually zero flowers for that species in the given year, only that they were not in the top five. 2. North plots one and two were not surveyed in 2018 due to mowing.

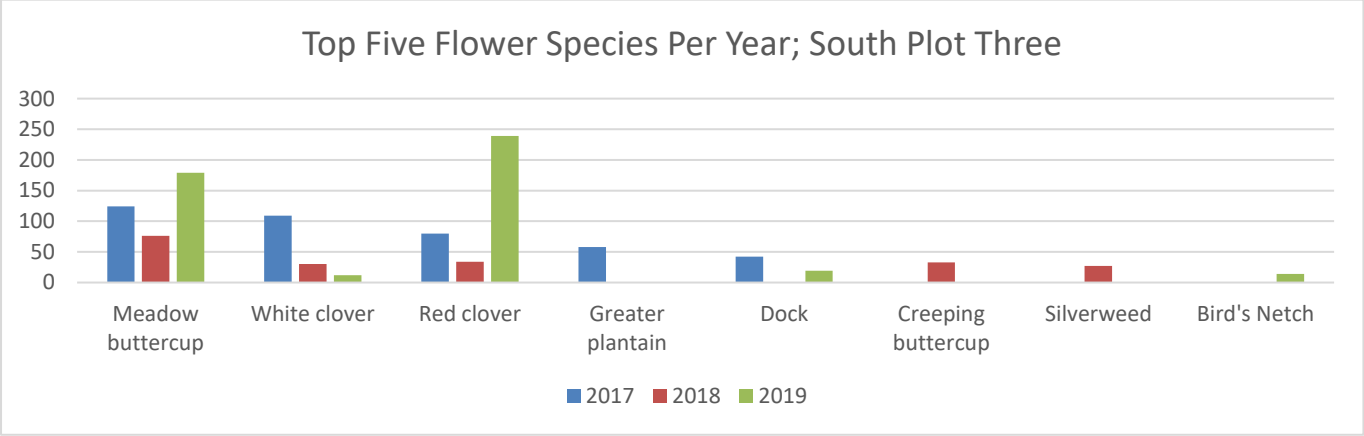







Top Five Flower Species Per Year; South Plot One
400
300
200
100
0
Meadow buttercup
Ribwort plantain
Dock
White clover
Common chickweed
Cow parsley
Hogweed
Red clover
2017
2018
2019


Top Five Flower Species Per Year; South Plot Two
300
250
200
150
100
50
0
Meadow buttercup
Hogweed
Dock
Greater plantain
Common nettle
White clover
Sheeps sorrel
Yarrow
Red clover
Thistle
2017
2018
2019


Top Five Flower Species Per Year; South Plot Three
300
250
200
150
100
50
0
Meadow buttercup
White clover
Red clover
Greater plantain
Dock
Creeping buttercup
Silverweed
Bird's Netch
2017
2018
2019

Appendix Five: Summary of Results of Flower Surveys

Quadrat Level Data	**2017**	**2018**	**2019**
Total Number of Quadrats	75	90	157
Total Number of Flowers in All Quadrats	1641	2300	2095
Average Number of Flowers per Quadrat	22	26	13
Plot Level Data			
Number of Plots Surveyed	6	4	6
Maximum Range of Species On Any One of the Plots	19	20	21
Minimum Range of Species On Any One of the Plots	7	20	9
Average Number of Species Recorded Per Plot	13	20	13
Plot Group Data			
Maximum Range of Species on Northern Plots	17	20	12
Minimum Range of Species on Northern Plots	8	20	9
Maximum Range of Species on Southern Plots	19	20	21
Minimum Range of Species on Southern Plots	7	20	12
Total Number of Species Recorded on Each Plot			
North Plot One	8	na	9
North Plot Two	14	na	11
North Plot Three	17	20	12
South Plot One	7	20	12
South Plot Two	14	20	21
South Plot Three	19	20	16

Appendix Six: Summary of Results of Plot by Plot Insect Surveys

Transect Level Data	**2017**	**2018**	**2019**
Total Number of Transects	49	51	52
Total Number of Insects in All Transects	605	728	705
Average Number of Insects per Transect	12	14	14
Plot Level Data			
Number of Plots Surveyed	6	4	6
Maximum Range of Species Groups on Any One Plot	7	7	7
Minimum Range of Species Groups on Any One Plot	2	1	0
Total Number of Insect Groups Recorded on Each Plot			
North Plot One	2	na	4
North Plot Two	7	na	7
North Plot Three	7	7	7
South Plot One	7	7	6
South Plot Two	4	7	6
South Plot Three	4	6	6