



The Pollinator Enhancement Study

Irish Peatland Conservation Council

Common Carder Bee © P. Farrell



Marmalade Hoverfly © P. Farrell



Druce's Crane's-bill © P. Farrell



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1. Executive Summary

2010-2020 was declared the International Decade of Biodiversity by the United Nations. Pollinators contribute to Irish biodiversity. They are facing increased threats today as a result of human management of open spaces such as community gardens, hedgerows, agricultural lands, waterways, private gardens and residential areas.

The Irish Peatland Conservation Council designed a pollinator inspired project for 2020 to gather information to inform community groups and Tidy Towns of the most cost-effective method and requiring minimal effort to increasing pollinator friendly plants within their local areas.

The project location was in the wildlife gardens at the Bog of Allen Nature Centre (see Figures 2 & 3). 5 quadrats measuring 1m x 1m² each were prepared on the 22nd of April 2020 based on the most popular management regimes for increasing pollinator friendly plants. Quadrats 1-4 were located to the South of the wildlife gardens (GPS: SF SF 70684 87161) and Quadrat 5 (GPS: SF 70701 87154) was located to the North east (see Figure 2). The grassland surrounding Quadrats 1-4 was allowed to grow uncut for the duration of the study. This had a significant influence on visiting pollinators and provided a local food source.

Details of the five quadrats are as follows:

Quadrat 1: Control, cut once a week with a shears throughout the study period,

Quadrat 2: Peat-free compost was placed on top of the grass layer with 10 seed bombs inserted 30cm apart to create a wildflower meadow,

Quadrat 3: cardboard was measured, wetted and placed on top of the grass to act as a weed barrier and peat-free compost spread on top with 10 seed bombs inserted 30cm apart creating a wildflower meadow.

Quadrat 4: allowed to grow creating a native wildflower meadow and

Quadrat 5: was an established wildflower patch allowed to grow. This was chosen to show what could be achieved in the long term.

The results were as follows:

Quadrat 1 showed one extreme in this survey. It had few plants which because of the cutting regime were not able to produce flowers. As a result there wasn't food for pollinators and only three visited this quadrat during the 7 weeks of summer. On the other extreme quadrat 5 which occurred in a well established flower bed had 17 different flowering plants and grasses and was visited by 75 pollinators. Quadrat 4 which was simply allowed to grow and produce flowering heads had 55 pollinators demonstrating the value of not mowing grass if you wish to promote pollinator friendly habitat.

3 survey sheets were designed for the study, a habitat assessment survey sheet (see Appendix 1), a vegetation survey sheet (see Appendix 2) and a pollinator survey sheet (see Appendix 3).

A habitat Assessment of the five quadrats was completed on the 10th and 13th of July 2020 (see Table 1).

27 pollinator survey days were completed from the 14th of July until the 21st of August 2020 recording the pollinators landing on plants or flying through the quadrat for 5 minutes per quadrat daily (see Tables 3, 4 & 5). Weather conditions such as temperature, percentage sunlight, wind speed and wind direction were also recorded (see Table 6).

6 vegetation survey days were completed from the 10th of July to the 21st of August 2020 and included the recording of plant percentage cover abundance in each quadrat, height and number of flowering heads present (see Tables 7-21).

The costs and time allocated to management of each quadrat is presented in Table A. Quadrats 2 and 3 cost a total of €7.50 each for seeds purchased. The cost of compost and 1 hour labour were not included however, these figures are based on an area of 1m x 1m. To put this into perspective, planting native wildflower seedbombs in a 50m² area would cost on average €3000 for 25,000 seed-

bombs alone. A 50m² would need a volume of 375000 litres of peat-free compost, and if the depth of compost is 15cm, the cost of compost for a project on this scale may add up to €67.425 . This figure is based on the purchase of peat-free compost at €8.99 for a 50 litre bag sourced from a garden centre. This is not a viable option for a large area and with limited funds available.

33 plant species were identified in the five quadrats in this study in total. 17 plant species were recorded in Quadrat 5 which was the highest of all Quadrats. Quadrat 1 had the lowest with 10 plants recorded (see Table 2). The top 5 most visited plants were Druce's Crane's-bill with 46 visits to this flower. Red Clover had 39 visitors, Ribwort Plantain with 37, Yorkshire Fog with 27 and Hedge Woundwort with 20 visiting pollinators recorded (see table 4). If the same species landed on multiple flowers in the quadrat, this was recorded as one visit and therefore, table 4 does not reflect the total tally.

219 pollinators in total across 29 species were recorded as part of the Pollinator Enhancement Study (including those in flight) with the highest numbers recorded in quadrats 2 and 5 (see table 3). In addition 39 non-pollinating invertebrates were also recorded during the study.

The most popular pollinator species group were the hoverflies with 117 recorded throughout the entire project including the Marmalade Hoverfly, White-footed Hoverfly and the Footballer Hoverfly (see Tables 3 & 5). 65 bees, 26 pollinating flies, 6 moths, 2 beetles, 2 butterflies and 1 wasp was recorded.

A one page article was written in Peatland News (see Figure 26), the Irish Peatland Conservation Council's newsletter detailing the results of the study which was circulated to 578 homes of IPCC's Friends of the Bog. This full report will also be added to IPCC's Wildlife Gardening Tips page at www.ipcc.ie.

17 posts were uploaded to IPCC's Facebook, twitter and Instagram accounts which reached 3,374 people, had a total of 282 engagements including likes, and shares (see Figures 5-25). A Press Release detailing the events of Heritage Week 2020 was issued on the 14th of August 2020 and was sent to 350 contacts and was also uploaded to the Irish Peatland Conservation Council's website ipcc.ie (see Figure 13). IPCC put together a video about the Pollinator Enhancement Study as part of Heritage Week 2020 which was uploaded to IPCC's Youtube Channel where there are 109 subscribers and also to facebook which attracted much attention and reached 1,487 followers, had 12 likes and 57 engagements (see Figure 8).

After compiling the data collected from the Pollinator Enhancement Study, it is obvious that the most cost and time effective method for increasing pollinator friendly plants and pollinators into a community garden is by allowing the grass to grow, flower and set seed. Native wildflowers such as Red Clover, Yarrow and Yorkshire Fog encourage hoverflies, bees and butterflies to visit and supply food for their journeys. Minimal effort is required and it will save on the cost of purchasing fuel for lawnmowers.

By letting a lawn flower and set seed, pollinators increase 20 fold. It requires minimal effort and time as shown within this study. Preparation time was 15 minutes which was simply to mark out the quadrat boundary. In a community garden, this may not be required.

Over the period of 7 weeks, a photo of each quadrat was taken to show the changes in plant species percentage cover from start to end (see Chapter 8).

Once the project was completed and the plants were no longer in flower, the grassland that was allowed to grow was cut first with a strimmers and then with a lawnmower. this will allow seeds to germinate next year.

All COVID-19 Guidelines were adhered to throughout the duration of the study.

It was discovered that there was an error that occurred in the excel datasheet when this report was first completed therefore, some figures were wrong. This has now been changed and updated.

3. Introduction

Pollinators are the backbone upon which many organisms depend on for food including humans. They move from flower to flower transferring pollen and allowing plant species to produce seeds. They provide a free service for farmers and gardeners as without them, foods such as strawberries, apples, pears and beans would be a thing of the past.

2010-2020 was declared the International Decade of Biodiversity by the United Nations. Pollinators are facing more and more threats today as a result of human management of open spaces such as community gardens, hedgerows, agricultural lands, waterways, private gardens and residential areas. The National Biodiversity Data Centre published a series of booklets on the National All Ireland Pollinator Plan 2015-2020 with the aim of supporting individuals and communities to become more aware of the importance of pollinators, their declining populations and actions they can undertake to support pollinators in Ireland. It is understood that the global declining populations of pollinators can be attributed to habitat loss, monoculture and disease, pesticides and insecticides. It is also acknowledged that a continuing decline in populations will have a negative impact on food production worldwide as it is accepted that pollinators pollinate 75% of all crops grown for human consumption.

It is common practice to mow the grass at least once a week from the beginning of the growing season. This removes the flowerheads of native Irish Wildflowers and therefore creates a niche for fast growing plants that out-compete the native flora which is an important supply of nectar and pollen for our pollinators. Regularly mowed areas are typically poor in plant species and biodiversity in comparison to wildflower meadows. Wildflowers such as dandelions and daisies that provide sources of nectar and pollen for pollinators, have become eyesores and regular mowing is a current trend.

Climate is another factor influenced by humans. If the weather becomes warmer, pollinators that are hibernating will emerge earlier however, many of the plants may not be in flower meaning that there is no food for them (National Biodiversity Ireland, 2015).

The Irish Peatland Conservation Council designed a pollinator inspired project for 2020 to gather information to inform community groups and Tidy Towns of the most cost-effective and time-friendly method for increasing pollinator friendly plants within their local areas.

The Pollinator Enhancement Study delves into the most effective grassland management regime and highlights the most popular flower visited by pollinators.

4. Aims and Objectives

4.1 Aim

To find a method of increasing pollinator friendly plants within a community garden setting to increase the abundance of pollinators in a way that is cost and time effective with minimum preparation work.

4.2 Objectives

- Prepare and monitor five 1m x 1m experimental quadrats at the Bog of Allen Nature Centre and mark out using rope and plastic stakes. The outline quadrats will allow for the continued monitoring of plants and pollinators within the boundary of the string and will remain until the project ends.
- Erect signs to show that there is a pollinator project ongoing and label the quadrats.
- Design 3 survey sheets, a Habitat Assessment Survey Sheet and include the following; location, recorders, date, quadrat number, GPS location, altitude, survey of suitable nesting/hibernation habitat for pollinators (bees & butterflies) near experimental plots, a Vegetation Survey Sheet including a plant species list, percentage abundance, plant height, number of plant flowerheads, and a Pollinator Survey Sheet including a pollinator species list, plant code observed on, time and weather conditions (Temperature, %sun/shade, wind speed and direction) and photographs.
- To record all plant species within the five quadrats to assess and compare the plant biodiversity.
- To complete a daily 5 minute survey of pollinators within the five quadrats observed during the experiment to monitor the most pollinator friendly plant and management regime using ID guides for butterflies, bees, moths and hoverflies.
- To compile the data and conclude with the most cost and time effective method for establishing a higher number of pollinator friendly plants for a community garden.
- To keep members of the public updated with the Pollinator Enhancement Study through online social media posts and through tours of the gardens at the Bog of Allen Nature Centre.
- To engage with members of the public and the Irish Peatland Conservation Council's facebook friends by producing a video showing the Pollinator Enhancement Study in practice as part of Heritage Week 2020.
- To complete a final report detailing the results of the study prepared for Kildare County Council and upload the report to the wildlife gardening tips page of the ipcc website ipcc.ie for members of the public to view.

5. Project Location and Description

The Pollinator Enhancement Study was carried out in the Wildlife Gardens at the Bog of Allen Nature Centre, located on the R414 road in Lullymore, Co. Kildare (See figure 1). The Bog of Allen Nature Centre is a peatland education centre owned by the Irish Peatland Conservation Council, an environmental charity dedicated to the protection and conservation of Irish Peatlands. The wildlife gardens located to the rear of the centre are managed free of harmful chemicals and weeds are physically removed. The lawns are typically mowed once a week. Within the gardens is an area specifically for conveying bog formation with wetland habitats such as a lake, fen and bog. Raised beds are located to the East of the gardens with vegetables and wildflowers grown such as chives, potatoes, beetroot and poppy. An insect hotel and log piles were specially constructed and incorporated into the wildlife gardens for mining bees and pollinators. There is a good cover of native and non-native pollinator friendly species including a blackthorn hedgerow, sedum, tutsan, raspberry, the butterfly bush and heather providing an abundance of nectar and pollen all year round.

Choosing the location of the five quadrats for the study was key and was based on the typical management regime that would be found in some communal spaces, that being an area of regularly mowed grassland, where plans are envisioned for a wildflower meadow. Therefore, one location for four of the plots was an area of grassland to the South of the wildlife gardens (see Figure 1) that could be managed appropriately. A wildflower patch bordering the east of the Insect Eating greenhouse was chosen as the established wildflower plot as shown in Figure 2.



Figure 1. Satellite imagery showing the location of the Bog of Allen Nature Centre along the R414 with the wildlife gardens to the rear. Grid Reference: SF 70660 87145
Image: Google maps 2020.



Figure 2. map showing the location of the 5 quadrats at the Bog of Allen Nature Centre, Lullymore, Co. Kildare

6. Methodology

6.1 Desktop Study

The Irish Peatland Conservation Council completed an extensive review of the most popular gardening methods used to increase the percentage abundance of pollinator friendly native wildflowers. Forest Research (2020) suggests that a diversity in plant species has a knock-on effect by attracting more bees, butterflies and many other invertebrates. Dr. Una Fitzpatrick (2019) of the National Biodiversity Data Centre said that we have become accustomed to “tidy” and manicured lawns however, this is unsuitable for pollinators such as bees. Allowing the grassland to grow encourages wildflowers and provides a source of pollen and nectar for pollinators. This is especially important for wild bees who do not make their own honey and therefore do not store food. Finding a food source is critical for their survival. Choosing wildflower seed mixes is another method used regularly to enhance to plant diversity and to create an aesthetically appealing space. The How to Guide, Creation and management of a wildflower meadow, a booklet part of the National Biodiversity Ireland’s All Ireland Pollinator Plan 2015-2020 provided advice on using native wildflower seeds to create a meadow rich in wildflowers, the importance of location and the type of seed mixes best suited for what you want to achieve.

A review of the National All Ireland Pollinator Plan 2015-2020 highlighted 81 actions to support Ireland in preventing further pollinator population decline. Action 2 suggested a reduction in mowing to allow a native wildflower meadow to grow. Action 11 suggests developing a native wildflower meadow. It is assumed this action has been identified as through the years our perception of the perfect garden or roadside grassy verge is manicured lawns with bright beautiful flowers that are aesthetically pleasing but lack pollen and nectar rich plants. Throughout the project, no pesticides or harmful chemicals were used in the study area and the entirety of the wildlife gardens. This ties in with Action 16 (NBDC, 2016 Local Communities).

A post on social media by Seed Bomb Ireland (2020) revealed an interesting way of limiting the amount of work in order to plant native wildflower seeds. It was suggested that you place a piece of cardboard on your grassy area selected. On top of the cardboard, place compost and plant your seeds at the correct distance to give space for growth. The cardboard acts as a weed barrier and therefore, it is not necessary to remove the grass layer.

The purchasing of seed bombs may increase the cost of your project as the greater the area the greater the number of seed bombs required . You can purchase 20 seed bombs (9-10 seedbombs 30cm apart in a 1m x 1m plot) (see Table A) for €15 (seedbomb.ie) but always follow guidelines to assess the amount of seed bombs that you may need to buy. A typical 50 litre bag of Peat-Free

Quadrat	Cost	Labour in preparation and maintenance (hours)	Area
1	€0	00.45hrs	1m x 1m
2	€7.50 for 10 Seed bombs	1hr	1m x 1m
3	€7.50 for 10 Seed bombs	1hr	1m x 1m
4	€0	00.15hrs	1m x 1m
5	€0	00.15hrs	1m x 1m

Table A. showing the cost and labour in hours involved in preparing the five quadrats at the Bog of Allen Nature Centre. Cost of seedbombs calculated based on the purchase of 10 seedbombs from seedbomb.ie.

compost costs €8.99 from a garden centre. Once again, the project area matters when choosing a management regime or creating a wildflower meadow. The Irish Peatland Conservation Council have compost bins on-site and therefore, there is no extra cost for compost included in Table A. Area size is a factor that could increase the cost of a project. IPCC's costs are based on a 1m x 1m plot size.

There are many other ways to go about creating a wildflower meadow such as removing the grass layer. Depending on the condition of the soil, compost may be needed. this option was not explored in this project as the aim was to develop a method that required minimal effort. If you incorporate the two methods within this study whereby compost and wildflower seed bombs are used, costs would increase significantly depending on the area. Planting native wildflower seedbombs in a 50m² area would cost on average €3000 for 25,000 seedbombs alone. A 50m² would need a volume of 375000 litres of peat-free compost, and if the depth of compost is 15cm, the cost of compost for a project on this scale may add up to €67.425 . This figure is based on the purchase of peat-free compost at €8.99 for a 50 litre bag sourced from a garden centre. Therefore, the total cost to plant native wildflower seedbombs creating a wildflower meadow by adding would be €70,425. This is not a viable option for a large area and if funds are limited.

There are many factors to consider when monitoring various types of pollinators. For butterflies and bees it is best to survey between 11am and 5pm when the temperature is a minimum of 13°C with at least 60% sunshine or when the temperature is above 17°C and the sun is no longer a limiting factor. Wind is another limiting factor. Using the beaufort scale, wind should have a value below 5 when monitoring pollinators (see figures 3 & 4).



All Ireland Pollinator Plan hardback books by the National Biodiversity Data Centre used to research methods for the Pollinator Enhancement Study 2020. image © P. Farrell.

Plot Number:
Date:
Time:
Temperature:
% Sun/Cloud:
Wind Speed:
Wind Direction:
☐ **Did you take a picture?**

Figure 3. Recording information for the pollinator survey.

Beaufort Scale for wind speed:

- 0 - smoke rises vertically
- 1 - slight smoke drift
- 2 - wind felt on face
- 3 - leaves in slight motion
- 4 - dust raised, small branches move
- 5 - small trees in leaf sway
- 6 - large branches move & trees sway

Figure 4. The Beaufort Scale used to assess wind conditions during the pollinator survey.

6.2 Field Study

After completing the desktop study, IPCC began the preparation of the 5 plots at the Bog of Allen Nature Centre.

Equipment

- 1m x1m sheet of cardboard
- String (20m in length)
- 12 Pegs
- Native wildflower seeds (Seedbombs)
- Recording sheets: Habitat Assessment Recording Sheet (see appendix 1), Pollinator Recording Sheet (see appendix 3) and the Vegetation recording Sheet (see appendix 2).



Pollinator Enhancement Recording Sheets (see Appendix 1, 2 & 3)

1. On the 22nd of April 2020, five 1m x 1m quadrats were prepared and marked out using rope and pegs. The quadrats were then prepared according to a chosen management regime. They are as follows;

- Quadrat 1: was the control and was cut weekly
- Quadrat 2: Compost sourced from IPCC on site compost bins was placed on top of the grass (The grass was not removed), 10 seedbombs were mixed into the compost. The plot was watered to allow seeds to germinate.
- Quadrat 3: A 1m x 1m piece of cardboard was cut out and placed on top of the grass within the plot. Compost sourced from IPCC's compost bins was placed on top and mixed with 10 seedbombs
- Quadrat 4: The plot was left to grow and was not cut for the entirety of the study
- Quadrat 5: This was an area of wildflowers and garden escapes in the wildlife gardens at the centre. No management was required to prepare this quadrat as it was a baseline for all other quadrats.

2. Recording sheets were designed for the purpose of this study A), A Habitat Assessment (see appendix 1), B). A vegetation Assessment Recording Sheet (see appendix 2), and C). A Pollinator

Survey Sheet (see appendix 3)

3. A habitat Assessment was completed for all quadrats on the 10th of July 2020 prior to any other survey which included a hand drawn map of the location, an assessment of the vegetation present, the habitat type ie. the management, the presence of pollinator hibernation areas, the date and the recorded (see Appendix).

4. Once a week a vegetation survey was completed on the following dates: 10th of July, 13th of July, 17th of July, 24th of July, 4th of August, 10th of August and 21st of August 2020. this survey comprised of recording all plant species within the quadrat, their % abundance, height and the number of flowerheads.

5. A pollinator survey was completed each week day from the 14th of July to the 21st of August totaling 27 days. This was a timed survey count where pollinators landing on the flowering vegetation were observed and recorded for 5 minutes per quadrat.

6. The data collected was databased and the final report prepared.

The native wildflower seeds were given time to germinate and the first survey took place on the 10th of July 2020.

6.3 The Process involved with the preparation of the Pollinator Enhancement Study

1. A suitable site was chosen at the South of the gardens at the Bog of Allen Nature Centre in an area that would typically be mowed once a week. Here quadrats 1, 2, 3 & 4 were prepared. Quadrat 5 was located to the North East of the gardens in an area rich with wildflowers. It was marked out with rope and left alone.



2. Using meter sticks, four 1m x 1m plots were measured.

3. Rope and pegs were used to mark the four quadrats.



4. Peat-free compost was placed over the grass layer in quadrat 2.

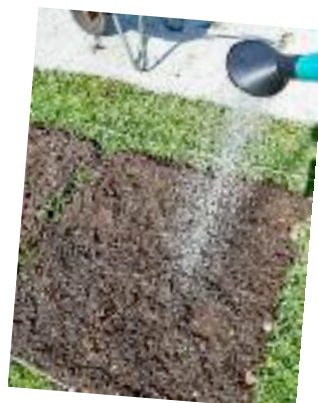


5. A 1m x 1m piece of cardboard was cut out and saturated in rainwater to minimise the risk of movement.

6. The cardboard was placed on top of the grass layer in quadrat 3. It was covered with compost.



8. The seeds were watered and allowed to germinate. Quadrat 1 was cut each week, quadrat 4 was allowed to grow and quadrat 5 was marked out and monitored.



7. Native Wildflower seeds from a seed bomb were mixed into the compost in quadrats 2 & 3.

7. Results

7.1 Habitat assessment

Name of Site:	Control (uncut)	Native Wildflower Meadow with seeds and compost	Native wildflower seeds with cardboard weed block and compost	Native Wildflower Meadow (Uncut)	Established Wildflower Patch
Plot/Quadrat No.	1	2	3	4	5
Grid Reference:	SF 70684 87161	SF 70684 87161	SF 70684 87161	SF 70684 87161	SF 70701 87154
Date:	10/07/2020	10/07/2020	10/07/2020	14/07/2020	14/07/2020
Quadrat size:	1mx1m	1mx1m	1mx1m	1mx1m	1mx1m
Recorders:	PF	PF	PF	PF	PF
Elevation (m):	89.9	87.7	89.3	88.3	89.3
Accuracy (m):	7.3m	7.3	7.2	25.1	11.2
Type of habitat					
Garden	X	X	X	X	X
Wildflower meadow		X	X	X	X
Topography					
Flat	X	X	X	X	
Sloped					X
Land Use					
Private	X	X		X	X
Educational	X	X	X	X	X
Pollinator hibernation/nest site?					
Bare soil	X	X	X	X	
Long grass	X	X	X	X	
Insect hotel	X	X	X	X	
Log pile	X	X	X	X	X
Hedgerow	X	X	X	X	X
Earth bank					X
Sand pit					
Stone wall cavity	X	X	X	X	X
Did you create this nesting area for the survey? Y/N	N	N	N	N	N

Table 1. The results of the habitat assessment for each quadrat completed on the 10th and 13th of July 2020 at the Bog of Allen Nature centre as part of the Pollinator Enhancement Study 2020.

Habitat Assessment Results Continued

The habitat assessment for all five quadrats was completed over 2 different survey days, the 10th and the 13th of June 2020. The vegetation present was recorded as well as the habitat management, the presence of pollinator nesting/hibernation areas, topography, land use, GPS readings and plot number as shown in table 1. The location of all quadrats are shown in figure 4. The photographs were all taken on the 19th of August 2020. The results of the habitat assessment are as follows;

Quadrat 1: This quadrat is located in the gardens of the Bog of Allen Nature Centre in an area that would typically be mowed once a week to the South of the gardens (see figure 2). The vegetation within this 1m x 1m plot was cut each week from the beginning of the survey on the 10th of July 2020 to the end on the 21st of August 2020. It was used as a control to standardise the study. Rather than using a lawn mower, the grass was physically cut with a shears so as to limit damage to the rope around the other plots. The habitat assessment for Quadrat 1 was completed on the 10th of July 2020 prior to the grass being cut. This made it easier to identify the species growing within the plot. There was no shrub layer or moss layer however the herb layer had a number of plant species with the tallest plant recorded at



Image : Quadrat 1 © P. Farrell

18cm. The following species were identified and their cover in the quadrat was estimated (see Table 7); 25% white clover, 10% red clover, 40% yorkshire fog, 3% creeping buttercup, 5% Ribwort Plantain, 1% silverweed, 20% perennial rye grass and 1% dandelion. This quadrat remained species poor with one additional species greater plantain recorded on the 24th of July with a percentage abundance of 1% and on the 4th of August with a percentage abundance of 2%. This quadrat was 1 of 4 located to the South of the gardens. Outside the quadrat there was a number of other plant species such as Knapweed, Ragwort, Red Clover, White Clover and Hogweed. .



Image : Quadrat 2 © P. Farrell

Quadrat 2: This quadrat was located beside quadrat 1 to the South of the nature gardens (see figure 2). Compost mixed with native wildflower seeds were spread over the grass within this 1m x 1m quadrat. The grass layer was not removed and the vegetation was left uncut. This created a wildflower meadow which became more grassy over the duration of the study. The following species were identified and their cover in the quadrat was estimated (see Table 10); 10% White Clover, 20% Red Clover, 50% Yorkshire Fog, 10% Ribwort Plantain, 1% Common Field Speedwell, 1% Perennial Rye Grass, 1% for Greater Plantain, 2% Smooth Sow-thistle as it was only beginning to grow and 1% Dandelion. The herb layer had a height of 39cm and there was no moss layer present.

Quadrat 3: This quadrat was located beside quadrat 2 (see figure 2). A piece of cardboard measuring 1m x 1m was cut and placed on top of the grass layer within this quadrat. On top, compost sourced locally and native wildflower seeds were placed on top and allowed to germinate. This again created another wildflower meadow however, many of the plant species were not in flower. The area of the exposed compost changed over time with few species recorded at first. The bare soil layer was 95%, moss layer was absent, the herb layer reached a height of 10cm. The herb layer measured a height of 39cm. The following species were identified and their cover in the quadrat was estimated (see Table 13); 4% Yarrow, 10% Creeping Buttercup, 2% for Dandelion, 5% Red Clover, 3% Perennial Ryegrass and 2% Ribwort Plantain.



Image : Quadrat 3 © P. Farrell



Image : Quadrat 4 © P. Farrell

Quadrat 4: This was the last quadrat located to the South of the wildlife gardens (see figure 2). This plot was allowed to grow naturally until the very end of the study. It was uncut and unmanaged creating another wildflower meadow. The Herb layer measured a height of 25cm. The following species were identified and their cover in the quadrat was estimated (see Table 16); 20% Red Clover, 10% White Clover, 15% Ribwort Plantain, 10% Yarrow, 1% Silverweed, 15% Yorkshire Fog, 6% Creeping Buttercup, 1% Greater Plantain and Cock's Foot 22%. There was a well developed moss layer in this quadrat with 100% cover.

Quadrat 5: This 1m x 1m quadrat was located to the South East of the wildlife gardens in an area where wildflowers and garden escapees dominate (see figure 2). This quadrat was unmanaged but monitored. Vegetation height reached 115cm. The following species were identified and their cover in the quadrat was estimated (see Table 19); 27% Hedge Woundwort, 10% Lady's Mantle, 30% Druce's Crane's-bill, 1% Nipplewort, 1% Black Medick, 10% Scutch Grass, 3% Hogweed, 5% Ribwort Plantain, 4% Creeping buttercup, 1% Bramble, 2% Wild Strawberry and 1% Day Lily . Other plants noted outside of the quadrat included Tutsan, *Yorkshire Fog*, Day Lily, Hedge Woundwort, Druce's Crane's-bill, Wild Strawberry, *Buddleia*, Oxeye Daisy, Raspberry.



Image : Quadrat 5 © P. Farrell

The grassland surrounding quadrats 1-4 was allowed to grow uncut for the duration of the study. Devil's-bit Scabious, Scarlet Pimpernel, Creeping Forget-me-not, Knapweed and Meadow Vetchling are additional plants that grew in this uncut lawn.

7.2 Vegetation Survey

Common name	Latin Name	1	2	3	4	5
Black Medick	<i>Medicago lupulina</i>			x	x	x
Cock's Foot	<i>Dactylis glomerata</i>				x	
Common Field Speedwell	<i>Veronica persica</i>		x	x	x	
Couch Grass (Scutch)	<i>Elymus repens</i>	x	x		x	x
Creeping Buttercup	<i>Ranunculus repens</i>	x	x	x	x	x
Dandelion	<i>Taraxacum officinale</i>	x	x	x	x	
Daylily	<i>Hemerocallis species</i>					x
Dove's-foot Cranes-bill	<i>Geranium molle</i>			x		
Druce's Cranes-bill	<i>Geranium x oxonianum</i>					x
Field Forget-me-not	<i>Myositis arvensis</i>		x	x		
Greater Plantain	<i>Plantago major</i>	x	x		x	
Hedge Woundwort	<i>Stachys sylvatica</i>					x
Lady's Mantle	<i>Alchemilla vulgaris</i>					x
Nipplewort	<i>Lapsana communis</i>					x
Perennial Rye Grass	<i>Lolium perenne</i>	x	x	x	x	
Red Clover	<i>Trifolium pratense</i>	x	x	x	x	x
Ribwort Plantain	<i>Plantago lanceolata</i>	x	x	x	x	x
Scarlet Pimpernel	<i>Anagallis arvensis</i>		x	x		
Silverweed	<i>Argentina anserine</i>	x			x	
Smooth Sow-thistle	<i>Sonchus oleraceus</i>		x			
White Clover	<i>Trifolium repens</i>	x	x	x	x	x
Wild Strawberry	<i>Fragaria vesca</i>					x
Yarrow	<i>Archillea millefolium</i>			x	x	
Yorkshire Fog	<i>Holcus lanatus</i>	x	x	x	x	x
Prickly Sow-thistle	<i>Sonchus asper</i>		x			
Creeping cinquefoil	<i>Potentilla reptans</i>		x			x
Purple-leaved Yellow-Sorrel	<i>Oxalis corniculata var. atropurpurea</i>			x		
Garden Celandine	<i>Chelidonium majus</i>			x		
Irish Spurge	<i>Euphorbia hyberna</i>			x		
Selfheal	<i>Prunella vulgaris</i>				x	
Hogweed	<i>Heracleum sphondylium</i>					x
Blackthorn	<i>Rubus fruticosus</i>					x
Water Mint	<i>Mentha aquatica</i>					x
Total no. of plants recorded in each quadrat		10	15	16	15	17

Table 2. Showing the species list of the 33 plants recorded in each quadrat during the weekly vegetation surveys at the Bog of Allen Nature Centre as part of the Pollinator Enhancement Study.

7.3 Pollinator Survey Results

Quadrat

Pollinator Species Groups	1	2	3	4	5	Total
Butterflies				1	1	2
Moths		2	2	1	1	6
Bees	1	12	3	10	39	65
Wasps				1		1
Hoverflies	1	46	13	27	30	117
Pollinating Flies	1	5	2	14	4	26
Beetles			1	1		2
Other (Not pollinators)	1	21	5	7	5	39
Total pollinators	3	65	21	55	75	219
Total no. of all species recorded	4	86	26	62	80	258

Table 3. Showing the total number of pollinators within different species groups which were recorded in all of the 5 quadrats during the Pollinator Enhancement Study including those recorded in flight. Quadrats 1-4 were located on a managed grassland and quadrat 5 was located in the wildlife gardens (see figure 4).

Quadrat

Plant Code	Species Common Name	1	2	3	4	5	Total
N	Hedge Woundwort	0	0	0	0	20	20
K	Druce's Crane's-bill					46	46
Y	Ribwort Plantain	1	25	2	8	1	37
H	Creeping Buttercup		6	5	1	1	13
Q	Lady's Mantle					2	2
R	Nipplewort					1	1
B	Black Medic					1	1
C2	Smooth Sow-thistle		3				3
D2	White Clover	1	1	1	1		4
F2	Yarrow			4	4		8
L	Field Forget-me-not		1				1
W	Red Clover	1	16	3	19		39
G2	Yorkshire Fog		6	6	15		27
E	Common Field Speedwell		2				2
O	Hogweed		1				1
J2	Cock's Foot				3		3
L2	Prickly Sow-thistle				1		1
Total no. of pollinators on all plant species		3	63	21	52	72	209

Table 4. The total number of pollinators that landed on plants within the 5 quadrats during the Pollinator Surveys from the 14th of July until the 21st Of August 2020. An additional 10 pollinators flew through the quadrats without landing on any plant.

A total of 33 plant species were recorded throughout the Pollinator Enhancement Study (see table 2) and 219 pollinators were recorded in total excluding the 39 non-pollinating species (see table 3) but included pollinators that did not land on a flower within each quadrat. Quadrat 5 had the heighest numbers of plants with 17 recorded and 75 pollinators observed. Quadrat 1 had the least number of plants with 10 species recorded and only 3 pollinators observed. Couch Grass, Creeping Buttercup, Red Clover. Ribwort Plantain, White Clover and Yorkshire Fog were recorded in all quadrats. Quadrat 2 had the same number of plants when compared to Quadrat 4 where the plants within this plot were allowed to grow without the addition of compost or wildflower seeds, however, Quadrat 2 had the higher number of pollinators observed. 16 different plants were recorded in quadrat 3 but only 21 pollinators were observed. Table 4. shows only that 17 out of the 33 plant species recorded were attractive to pollinators. The most popular plant with 46 visiting pollinators was Druce's Crane's-bill. This is not a native species but a garden escape that grows wild at the Bog of Allen Nature Centre. Red Clover with 39 pollinators was second in popularity and is a native plant species. Note, some pollinators landed on multiple flowers and were counted as one visit however, all the flowers it landed on were recorded in table 4. The figures in Table 4 exclude those pollinators that were observed in flight within quadrats.

7.4 Pollinator Species list and pollinator numbers observed

		Quadrat Number					
Pollinator Species Name		1	2	3	4	5	Total
Common Name	Latin Name						
Bees							
Common Carder Bee	<i>Bombus pascuorum</i>	1	9	1	7	9	27
Honey Bee	<i>Apis mellifera</i>			1	2	21	24
Orange-legged furrow bee	<i>Halictus rubicundus</i>					1	1
White-tailed Bumblebee	<i>Bombus lucorum</i>		2	1		4	7
Buff-tailed Bumblebee	<i>Bombus terrestris</i>		1			3	4
Sweat bee	<i>Lasioglossum</i>					1	1
Solitary leaf cutter bee	<i>Megachilidae</i>				1		1
Wasp							
	Vespidae species				1		1
Hoverflies							
Marmalade hoverfly	<i>Episyrphus balteatus</i>		1			3	4
Hoverfly	<i>Euphodes species</i>	1					1
Hoverfly	<i>Syrphus ribessi.</i>		1		1		2
Bumblebee Hoverfly	<i>Volucella bombylans</i>				1		1
Common snout hoverfly	<i>Rhinga campestris</i>			1		1	2
Hoverfly	<i>Platycheirus fulventris</i>		12	3	9		24
White-footed hoverfly	<i>Platycheirus albimanus</i>		1			2	3
Hoverfly	<i>Melanostoma species</i>		2	5	2	3	12
Syrphidae	Family Syrphidae		29	4	14	20	67
Footballer Hoverfly	<i>Helophilus pendulus</i>					1	1
Flies							
Fly	<i>Campyloneura virgula</i>		1	1			2
	Order Diptera	1	1	1	11	1	15
Fleshfly	<i>Sacrophagidae</i>		1			1	2
Yellow dung fly	<i>Scathophaga stercoraria</i>		2		3	1	6
Blue bottle	<i>Calliphora vomitoria</i>					1	1
Butterflies							
Green veined white	<i>Pieris napi</i>					1	1
Ringlet	<i>Aphantopus hyperantus</i>				1		1
Moths							
	Lepidoptera		2	1		1	4
Shaded-broad bar	<i>Scotopteryx chenopodiata</i>			1			1
Ghost Moth	<i>Hepialus humuli</i>				1		1
Beetles							
Common Red Soldier Beetle	<i>Rhagonycha fulva</i>			1	1		2
Total number of pollinators identified		3	65	21	55	75	219

Table 5. Shows the list of identified pollinating species observed throughout the Pollinator Enhancement Study and the numbers recorded for each species per quadrat.

Table 5 is a brief summary of the pollinators identified during the Pollinator Enhancement Study. It was not possible to identify all. 7 species of bees, 10 hoverflies, 1 wasp, 5 pollinating flies, 2 butterflies, 2 moths and 1 beetle were identified however, not all to species level. The most common identified pollinator was the Common Carder Bee observed 27 times in total. The Honey Bee was most observed in Quadrat 5. The most common identified hoverfly was the *Platycheirus fulventris*. A number of pollinators were not identified to species level but were identified to family level to be included in the overall total.

7.4 Weather

Date:	14/07/2020	15/07/2020	16/07/2020	17/07/2020	20/07/2020	21/07/2020	22/07/2020
Temperature:	14°C	19.4°C	22.9°C	16.3°C	23.9°C	23.3°C	20.3°C
% Sun:	50%	80%	20-50%	10-30%	20-100%	50-100%	10-30%
Wind Direction:	SW	SW	W		W	W	E
Wind Speed:	2	3	0-2	0-2	0-3	0-2	0-4
Notes							Misting rain

Date:	23/07/2020	24/07/2020	27/07/2020	28/07/2020	30/07/2020	04/08/2020
Temperature:	21.1°C	22.8°C	24.3°C	18.9°C	20.6°C	17°C
% Sun:	10-80%	50-100%	40-100%	10-100%	5-10%	50-80%
Wind Direction:	E	W	W	SW	SW	E
Wind Speed:	0-3	0-2	5	0-3	0-3	5
Notes	Misting					

Date:	05/08/2020	06/08/2020	07/08/2020	10/08/2020	11/08/2020	12/08/2020
Temperature:	18°C	11°C	19°C	17°C	19°C	23°C
% Sun:	20%	0	90%	0	0	80
Wind Direction:	N	E	N	0	0	0
Wind Speed:	1-3	2	3	1	0	0
Notes	Veg wet, rain showers					

Date:	13/08/2020	14/08/2020	17/08/2020	18/08/2020	19/08/2020	20/08/2020	21/08/2020
Temperature:	22°C	22.5°C	17°C	22.1°C	17°C	26°C	17°C
% Sun:	10	0-10%	0	0	0	20-100%	0
Wind Direction:	E	0	0	0	NE	N	SE
Wind Speed:	2	0	0	0	0-4	6	4
Notes							

Table 6. Showing the average temperature, percentage sun, wind speed and the wind directions recorded for each quadrat from during the Pollinator Enhancement Study at the Bog of Allen Nature Centre, Co. Kildare in 2020.

The weather was recorded during the daily pollinator surveys from the 10th of July to the 21st of August 2020. Temperature, percentage sun, wind speed and wind direction were noted. The beaufort scale for windspeed was used. Temperature and weather conditions are limiting factors that effect the ability of pollinators to forage eg. a high wind speed. It also provides an answer as to why no pollinators were observed on a particular day. An average of the temperatures per day as recorded per quadrat was taken. The highest temperature recorded was 26.9° C and the lowest was 11° C. The percentage sun was no longer a limiting factor once temperatures rose above 17°C. For most days, wind speed was less than 3 on the Beaufort scale however, on the 27th of July and the 4th of August, wind speed reached 5 on the Beaufort scale. On the 22nd and 23rd of July and the 5th of August there were mild to very wet conditions yet temperatures remained over 17°C.

8. Photographic Monitoring of All five Quadrats over the duration of the Pollinator Enhancement Study 2020



(From left) Survey images taken during the vegetation survey in Quadrat 1 on the 10th and 17th of July and the 4th, 10th and 21st of August 2020. Images: P. Farrell & N. Madigan



(From left) Survey images taken during the vegetation survey in Quadrat 2 on the 10th and 17th of July and the 4th, 10th and 21st of August 2020. Images: P. Farrell & N. Madigan



(From left) Survey images taken during the vegetation survey in Quadrat 3 on the 13th and 17th of July and the 4th, 10th and 21st of August 2020. Images: P. Farrell & N. Madigan

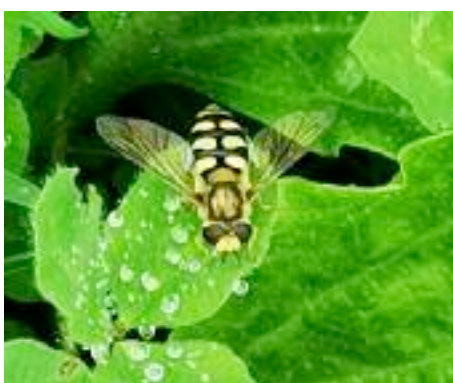


(From left) Survey images taken during the vegetation survey in Quadrat 4 on the 13th and 17th of July and the 4th, 10th and 21st of August 2020. Images: P. Farrell & N. Madigan



(From left) Survey images taken during the vegetation survey in Quadrat 5 on the 13th and 17th of July and the 4th, 10th and 21st of August 2020. Images: P. Farrell & N. Madigan

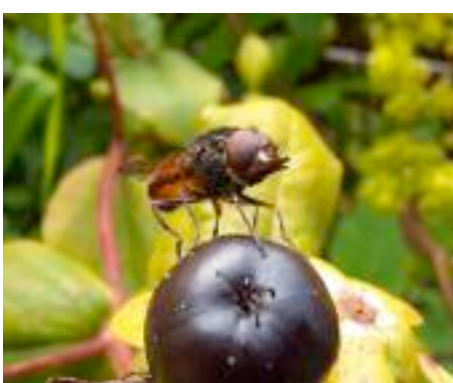
9. Gallery



(From Left) Marmalade Hoverfly (*Episyrphus balteatus*), Hoverfly (*Euphodes corollae*) female and the White-footed Hoverfly (*Platycheirus albimanus* group). Images: P. Farrell



(From left) Hoverfly (*Platycheirus fulviventris*) male, Hoverfly (*Syrphus ribessi*) and the Orange-legged Furrow Bee (*Halictus rubicundus*). Images: P. Farrell



(From left) Honey Bee (*Apis mellifera*) on Druce's Cranes-bill, Common Snout-nosed Hoverfly (*Rhinga campestris*) and the Solitary Leaf Cutter Bee (*Megachilidae*).



(From left) Ribwort Plantain (*Plantago lanceolata*), Hedge woundwort (*Stachys sylvatica*) and Yorkshire Fog (*Holcus lanatus*). Images: P. Farrell

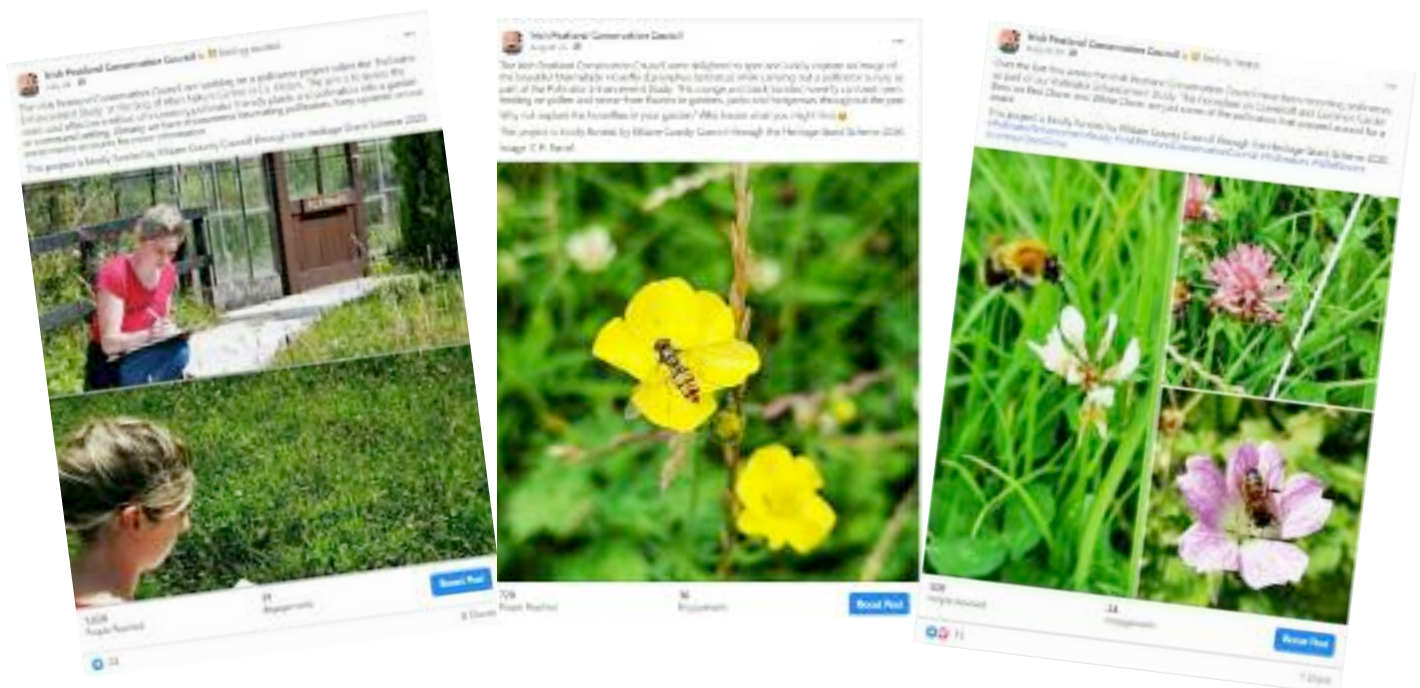
10. Social Media

A one page article was written in Peatland News (see Figure 26), the Irish Peatland Conservation Councils newsletter detailing the results of the study and will be sent to 578 of IPCC's Friends of the Bog.

17 posts were uploaded to all of the Irish Peatland Conservation Councils media platforms. 6 posts on facebook (see Figures 5, 6, 7, 10, 11 & 12) reached a total of 2,450 people and had a total of 157 engagements which includes likes, reactions, comments and shares. 5 similar posts were uploaded to twitter with 2,244 impressions and 42 engagements from IPCC's followers (see Figures 14-18) and 5 were uploaded to Instagram where posts reached 924 followers and had a total of 83 likes (see Figures 19-25).

Due to the current pandemic and restrictions as a result of COVID-19, the Irish Peatland Conservation council went virtual for Heritage Week 2020. A video displaying the 5 study plots and photography of the pollinators observed was designed and uploaded to IPCC's Youtube page where there are 109 subscribers and the video had 33 views. The video can be found here https://www.youtube.com/watch?v=ps-UNU-mUh0&ab_channel=IrishPeatlandConservationCouncil. It was also uploaded to IPCC's facebook account for all members of the public to view. This video reached 1,487 followers, had 12 likes and 57 engagements. A Press Release detailing the events of Heritage Week 2020 was issued on the 14th of August 2020 and was sent to 350 contacts and was also uploaded to the Irish Peatland Conservation Councils website ipcc.ie (see Figure 13). The Project and event were published on the Heritage Week website for members of the public to access (see Figure 9).

The finished report will be uploaded to the Wildlife Gardening Tips Page on the Irish Peatland Conservation Council's website ipcc.ie making this available to all members of the public.



Figures 5, 6 & 7. Social media posts on facebook introducing the Pollinator Enhancement Study and pollinators observed throughout the study.

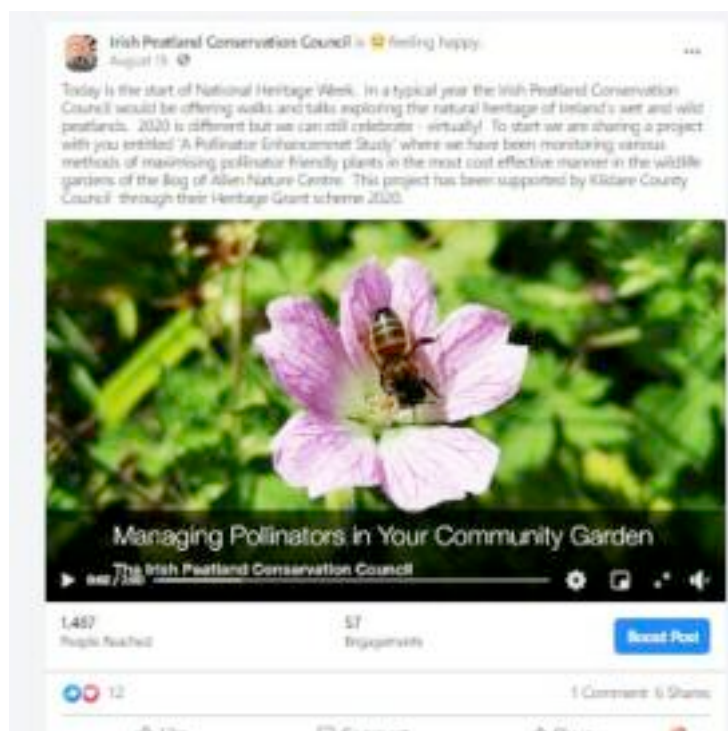


Figure 8. Managing Pollinators in Your Community Garden video uploaded to IPCC's facebook account as part of Heritage Week 2020.

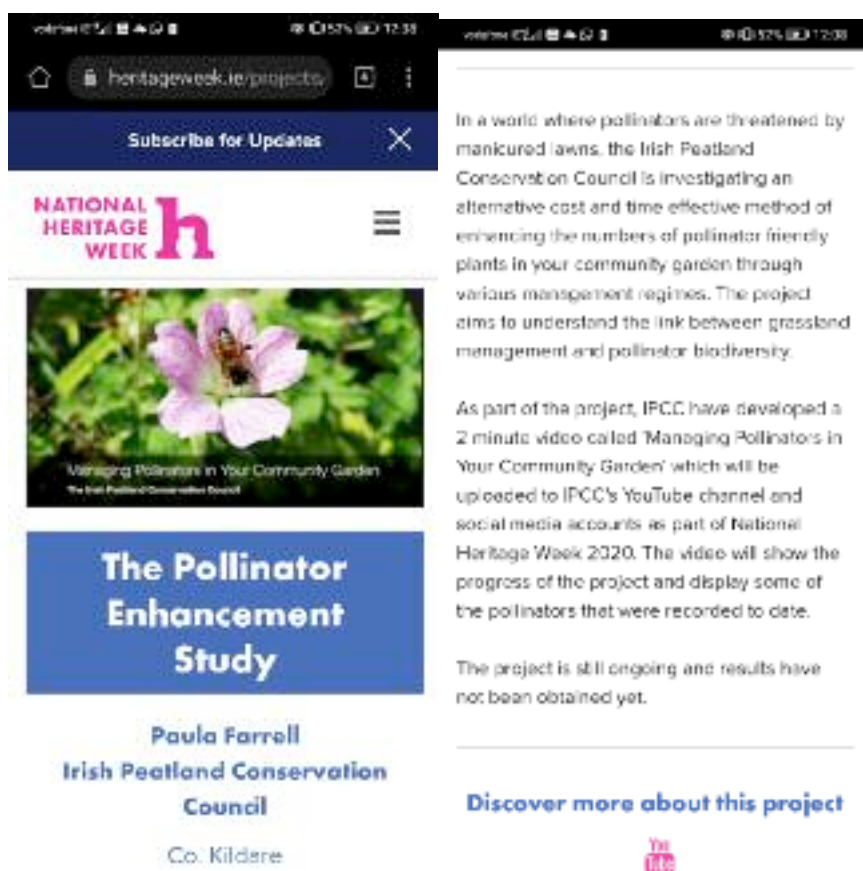


Figure 9. The Pollinator Enhancement Study displayed on the Heritage Week 2020 website.



Figures 10, 11 & 12. Social media posts uploaded to IPCC's facebook account showing the pollinator friendly plants recorded.

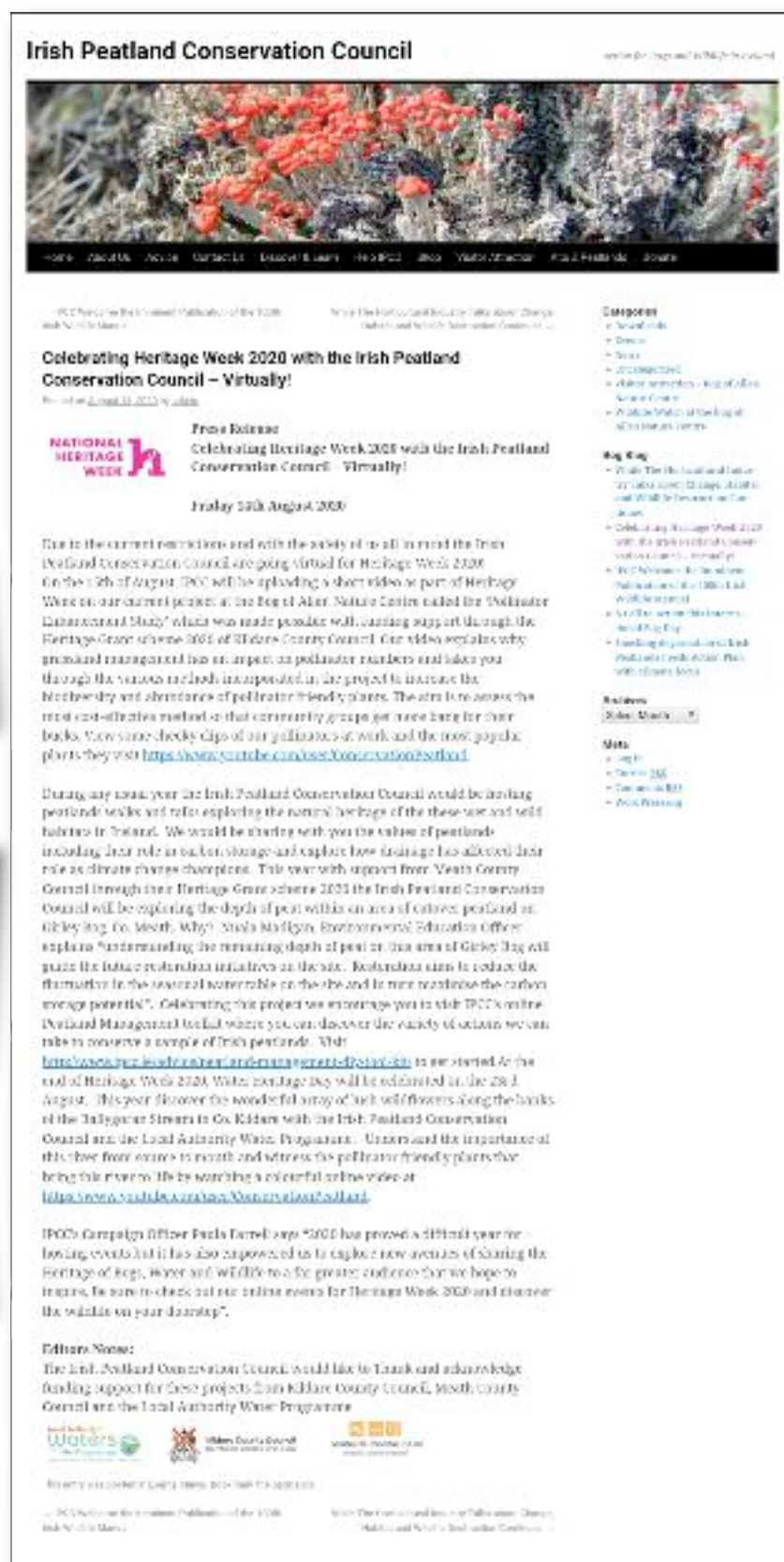


Figure 13. A Press Release published on the Irish Peatland Conservation Councils website ipcc.ie

Figures 14-18. Social Media posts uploaded to IPCC's twitter account.

Tips for you from our 'Pollinator Enhancement Study'



Pollinators recorded during the pollinator survey on the five quadrats at the Bog of Allen Nature Centre. (Left to right) Marmalade hoverfly, Orange-legged hoverbee and a honeybee. Images: S.S. Farrell.

The Irish Peatland Conservation Council (IPCC) undertook a project to answer questions for local community groups on a cost effective method of increasing pollinator friendly plants in community gardens.

Pollinators are under enormous threat as a result of the way we manage gardens and communal spaces. Plant biodiversity is low in areas that are regularly mowed which makes it difficult for pollinators to find food.

Method



Five plots were prepared at the Bog of Allen Nature Centre using the most popular grassland maintenance methods (see Table 1). These included allowing the grass to grow to create a native wildflower

meadow (Q4), placing cardboard down on grass as a weed barrier and planting a native wildflower seed mix on a fresh layer of compost (Q3), placing compost and seeds over grass (Q2) and doing nothing but monitor an established wildflower patch (Q5) with both native and garden escape plant species. A control (Q1) was also created where grass was cut weekly.

A vegetation survey of the 5 plots was completed weekly and a pollinators were observed for 5 minutes in each plot daily in the early afternoon.

Results

31 pollinator friendly plants were identified including Creeping buttercup and Yarrow. 23 species of pollinators were observed and the most popular plants visited were Red Clover, Yorkshire Fog and Druce's Crane's-bill. The beautiful Marmalade Hoverfly is one pollinator that appeared during the survey. While Q5 had the highest total number of pollinators and of plants it shows what can be

achieved by stopping mowing in the long term. Q3 had a higher number of wild flowers and grasses (showing the benefit of suppressing grass and sowing seeds) while Q2 had the greatest number of pollinators excluding Q5 because it had an abundance of native species. In conclusion, letting the lawn grow allows more native wildflowers to flourish with minimal effort and in turn increases the numbers of visiting pollinators. This project will be used to inform community groups on how to enhance their local area for pollinators. - Paula Farrell.

Quadrat	Total no. of plants	Total no. pollinators
Q1	15	5
Q2	15	35
Q3	15	21
Q4	17	25
Q5	17	25

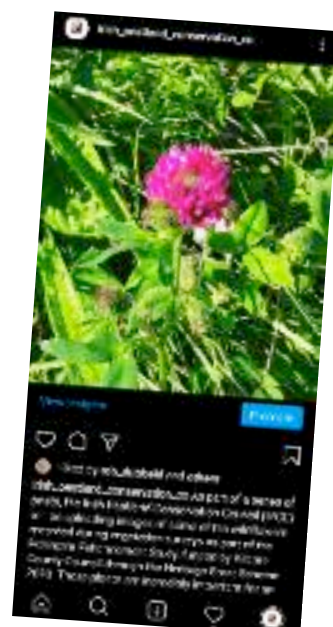
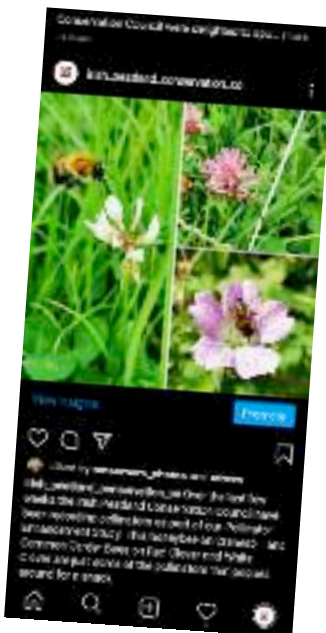
Table 1. Showing the total number of pollinator friendly plants and the total number of pollinators observed over a 5 minute period in each quadrat.

This project was funded by Kildare County Council through the Heritage Grant Scheme 2020.



15 IPCC Peatland News No. 76 Autumn 2020

Figure 26. A one page article on the Pollinator Enhancement Study in Peatland News Autumn 2020 edition.



Figures 19-25, Social media posts uploaded to IPCC's Instagram account.

11. Discussion

After research on the most popular methods for managing grasslands, preparation for the Pollinator Enhancement Study began on the 22nd of April 2020. Quadrats 1-4 were located to the South of the wildlife gardens and were the managed plots. Quadrat 5 was the unmanaged plot and was located to the North East (see Figure 2). This established plot was to provide a baseline of the plant species richness and pollinator abundance if left wild for a number of years. Over a period of weeks, Quadrats 2 and 3 were watered regularly to allow for the germination of the planted native wildflower seeds. During this time, survey sheets were designed (see Appendices 1, 2 & 3) and these surveys were then conducted from the 10th of July. The habitat assessment was completed once for each quadrat on the 10th and 13th of July. The elevation remained relatively around 89m for all quadrats with some fluctuations due to the accuracy (see table 1). All quadrats were a maximum of 20 meters from a pollinator/hibernation site. For example, the stone wall of the Bog of Allen Nature Centre building is already known to have a honeybee hive inside the wall cavity as there is much activity with honeybees outside of it. On site is also a pollinator log pile constructed for mining bees and an Insect Hotel. The raised beds located to all the quadrats have patches of bare soil suitable for pollinators. Finally, close to quadrat 5 are logs stacked up. All of these provide suitable nesting and hibernation sites for all pollinators. The grassland around Quadrats 1-4 was allowed to grow and the following species were noted Devil's-bit Scabious, Scarlet Pimpernel, Creeping Forget-me-not, Knapweed and Meadow Vetchling.



Log Pile in close proximity to Quadrat 5 in the wildlife gardens at the Bog of Allen Nature Centre.

Image : © P. Farrell

Quadrat 1, the control, was managed in typical fashion whereby the grass is cut from the beginning of the growing season to the end. Each week the plot was cut and remained species poor as shown in the Chapter 8 with a maximum of 10 plants (see Table 2) recorded and only 3 pollinators were observed (see Table 3). Ribwort Plantain, White Clover and Red Clover were both equal with only 1 pollinator recorded on each (see Table 4). Yorkshire Fog was the most abundant plant with 76% abundance recorded for on the 21st of August (see Table 7) and had the highest number of florets recorded above all other species within quadrat 1 (see table 9). The growth rate of all plant species was recorded to assess whether shading might effect other plants. Ribwort Plantain was recorded as the tallest plant in Quadrat 1 on the 10th of July measuring 26cm (see Table 8) but was 11cm by the 21st of August due to the weekly cutting. Red Clover and Silverweed were measured at a height below 13cm on the 10th of July but were measuring a minimum of 18 cm by the 21st of August.

15 plants (see Table 2) and 65 pollinators (see Table 3) were recorded in Quadrat 2 from the 10th of July to the 21st of August 2020. Yorkshire Fog and Red Clover had a percentage cover abundance of 25% on the 21st of August. Ribwort Plantain had the highest numbers of visiting pollinators than other plant species within the quadrat. 25 pollinators were recorded on this plant (see Table 4). The most common pollinator observed within this quadrat were hoverflies with 27 recorded (see Table 5). Although Yorkshire Fog dominated at 50% abundance on the 10th of July (see Table 11), this was reduced to 25% abundance on the 21st of August as Ribwort Plantain took over. A maximum of 14 Ribwort Plantain flowerheads were recorded throughout the survey (see Table 12) while 35 Red Clover flowers were recorded on the 21st of August 2020. This did not impact the pollinator numbers recorded on Ribwort Plantain.

A total of 16 plant species (see table 2) and 21 pollinators (see Table 3) were recorded in Quadrat 3 with Yorkshire Fog the most popular plant attracting 6 pollinators (see Table 4). *Melanostoma sp.* is a hoverfly and was the most recorded species within this quadrat. By the 21st of August 2020, Ribwort Plantain, Red Clover, Yarrow and Couch Grass equally dominated at 20% cover each (see Table 13). Many of the plants remained low growing with the maximum height recorded of 39.5cm (see Table

14). Only 6 of the 16 plant species identified produced flowers with 23 flowers recorded from Yorkshire Fog on the 10th of August 2020 (see Table 15). In conclusion, the seeds planted did not produce an array of plants that attracted pollinators and suggests one of two things, either there was not enough soil for seedlings to develop and grow or the seeds planted within this quadrat may not have been suitable or have had enough growing time prior to surveying. The wildflower seedbomb should have produced more native wildflowers including Devil's bit Scabious, Cornflower, Selfheal, Oxe eye daisy, Corn Marigold and Corn Poppy.

15 plants (see Table 2) and 55 pollinators (see Table 3) were recorded in Quadrat 4. The greatest number of species with the various pollinator groups were the hoverflies with 14 observed (see table 5). The most popular plant attracting 19 pollinators was Yorkshire Fog (see Table 4). By the 21st of August, Cock's Foot dominated at 22% however, Red Clover, Ribwort Plantain and Yorkshire Fog had an average 20 flower heads on most survey days but Cock's Foot Grass had the greatest with 40 florets recorded on the 21st of August 2020 (see Table 18). The greater number of florets on Cock's Foot did not show an increase in pollinator numbers on this grass.

The results show that Quadrat 5, the Established Wildflower patch had a species list of 17 plants identified (see table 2) and had the highest number of pollinators with 75 observed (see Table 3). Druce's Crane's-bill was the most abundant plant within this quadrat on the 21st of August 2020 with a percentage cover of 30% (see Table 19). This plant while not native, was also the most popular plant visited by 46 pollinators (see Table 4). The taller plants seemed to dominate (see Tables 19 & 20) possibly shading out lower growing plants such as Red Clover and White Clover which were more abundant in the other 4 quadrats. Ribwort plantain reached a height of 60cm on the 21st of August which was much taller than that recorded in quadrats 1-4 showing that there is a competition for light and plants must be of a certain height to prosper. Table 21 shows that the numbers of flowers does not necessarily have an impact on pollinator numbers. Druce's Crane's-bill had 10 flowers recorded on the 21st of August and still had the highest number of pollinators than any other species within the quadrat.

Note: A limitation of the study is the difference in perception of percentage abundance for plant species from different recorders.

219 pollinators and 33 species of plants were recorded over a period of 7 weeks from the 10th of July to the 21st of August 2020. 209 pollinators were recorded landing on plants within the quadrats whilst an extra 10 were included in the total tally however, they did not land on flowers or were recorded in flight. The plant with the most recorded visiting pollinators was Druce's Crane's-bill with 46 pollinators recorded and Red Clover was second with 39 pollinators recorded. It is important to note that if a pollinator landed within a quadrat, this counted as 1 visit in the total tally (Table 3 & 5) but every flower it landed on was recorded eg. 1 pollinator may have landed on Druce's Crane's-bill and Hedge Woundwort and therefore the numbers in Table 4 do not reflect the total numbers of visiting pollinators. Hoverflies were the most abundant pollinator species group observed with a total of 101 hoverflies recorded including those that were identified and those that were not identified. 29 species that were not classified as pollinators were recorded as casual records. These included the Sloe Bug, Green Shield Bug, Blue-tailed Damselfly and Emerald Damselfly. The most plant species rich Quadrat was number 5 with 17 plants recorded and the poorest was Quadrat 1 with only 10 plant species listed. Of the managed plots (Quadrats 1-4), Quadrat 3 was in first place for plant species richness with 16 plants recorded and Quadrat 2 had the highest number of pollinators with 65 recorded.

While weather is a significant factor, this did not seem to have a significant effect on pollinator numbers especially on the 27th of July where the wind rose to a speed of 5 on the Beaufort Scale (see Table 6). Pollinators were still recorded on this day. The 26th of August was the only day where temperatures dropped below 13°C. 3 out of 27 days were recorded to have slight to very bad rain indicating that for most of the study, temperatures and weather were ideal conditions for monitoring

pollinators.

Table A shows the costs involved in prepping the plots for this Pollinator Enhancement Study. Quadrat 2 and Quadrat 3 cost €7.50 each to prepare however, this is based on an area of 1m x 1m and where labour is typically 1 hour. Compost and labour are not included in this cost.

There are many other ways to go about creating a wildflower meadow such as removing the grass layer. Depending on the condition of the soil, compost may be needed. This option was not explored in this project as the aim was to develop a method that required minimal effort. If you incorporate the two methods within this study whereby compost and wildflower seed bombs are used such as in Quadrats 2 and 3, costs would increase significantly depending on the area. Planting native wildflower seedbombs in a 50m² area would cost on average €3000 for 25,000 seedbombs alone. A 50m² would need a volume of 375000 litres of peat-free compost, and if the depth of compost is 15cm, the cost of compost for a project on this scale may add up to €67,425. This figure is based on the purchase of peat-free compost at €8.99 for a 50 litre bag sourced from a garden centre. Therefore, the total cost to plant native wildflower seedbombs creating a wildflower meadow by adding would be €70,425. This is not a viable option for a large area and if funds are limited.

Mowing the grass as in Quadrat 1 increases the time with regards to maintenance (see Table A) where each week the vegetation was cut with a shears, while Quadrats 2 and 3 needed to be watered regularly during the hot summer days. If time is limited, then the most suitable method for creating a wildflower meadow is following Quadrat 4 and allowing the native wildflowers and grasses to grow uncut until all species have flowered. You then may decide to cut the vegetation.

Once the study was completed and all plants had finished flowering, the grassland where Quadrats 1-4 were located was cut first with a strimmers and then with a lawnmower. Cutting the grassland short allows for seeds to germinate next year. A lawnmower and strimmers is not very practical for a larger grassland therefore, a sickle, scythe or tractor might be needed.

Originally, this study was designed to include a methodology where the grass layer is removed, however, after research and careful consideration, it was decided that there were other options that required less physical effort and therefore more suited to large scale projects and community groups. Therefore, compost was required in the preparation of Quadrats 2 and 3.

All COVID-19 guidelines were adhered to throughout the Pollinator Enhancement Study and social distancing between staff and volunteers was upheld.

12. Conclusion

When it comes to encouraging wildflowers into your community gardens, there are a number of things that you need to consider;

1. What is my budget?
2. How much time do I have to prepare the area and maintain it ie. sowing, adding compost, watering and weeding?
3. How much work do I want to put into developing a wildflower meadow?
4. Do I want an aesthetically appealing wildflower meadow or one that will bring the highest numbers of pollinators?

The results of the Pollinator Enhancement Study show that placing compost and native wildflower seeds (Quadrat 2) would encourage a greater number of pollinators however, this is subject to the seed mix sowed and the seed bank already within the compost if sourced on site as was in this study. However, with this method, there is a cost and that is to purchase wildflower seeds and compost if not sourced on site which could vary greatly depending on the area you wish to enhance. Purchasing wildflower seeds and compost will increase your budget. It also requires more effort and management preparing the area and watering on a regular basis.

Creating a wildflower meadow by allowing the grass to grow as in quadrat 4, is not only cheaper as the cost of fuel for the lawnmower is zero and has minimal effort involved, it also yields a high proportion of native wildflowers that encourages more pollinators to your garden. Red Clover, Yarrow and Yorkshire Fog are important plants and provide a much needed supply of pollen and nectar allowing our pollinators to continue with their work. What we think is beautiful is not necessarily attractive to pollinators so don't fret about meadows that are somewhat grassy in appearance. Our pollinators love native Irish wildflowers and grasses, so why not let the grass grow and see what nature brings to your doorstep.

13. References

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Appendix 1: Habitat Assessment Survey Sheet

Pollinator Enhancement Study 2020 Habitat Assessment Survey Sheet

Name of Site:	Date:	Recorders:
GPS Location:	Plot Number:	Quadrat Size:
Time:	Elevation:	

Type of habitat <input type="checkbox"/> Garden <input type="checkbox"/> Amenity grassland (cut short) <input type="checkbox"/> Disturbed ground <input type="checkbox"/> Raised Bed <input type="checkbox"/> Grassy verge or hedgerow <input type="checkbox"/> Native wildflower meadow <input type="checkbox"/> Parkland with trees <input type="checkbox"/> Woodland <input type="checkbox"/> Other _____	Is there pollinator Hibernation/Nest Sites: <input type="checkbox"/> Bare soil <input type="checkbox"/> Long grass <input type="checkbox"/> Insect hotel <input type="checkbox"/> Log pile <input type="checkbox"/> Hedgerow <input type="checkbox"/> Earth bank <input type="checkbox"/> Sand Pit <input type="checkbox"/> Stone wall cavity Did you create a nesting area for this study? <input type="checkbox"/> Yes <input type="checkbox"/> No If yes, describe:	Habitat Description: describe habitat within the quadrat, habitat layers, species composition, height of layers, cover of layers, surrounding habitats
Topography: <input type="checkbox"/> Uneven <input type="checkbox"/> Flat <input type="checkbox"/> Hummocky <input type="checkbox"/> Sloped <input type="checkbox"/> Depression		
Land Use: <input type="checkbox"/> Recreational <input type="checkbox"/> Agricultural <input type="checkbox"/> Private <input type="checkbox"/> Grazing <input type="checkbox"/> Other _____		Notes:

Sketch of project site: Label and show location of quadrat



Appendix 2: Vegetation Survey Sheet

Pollinator Enhancement Study Vegetation Survey 2020

Plot Number:	Date:	Recorders:
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Method: Complete a vegetation survey of plants in flower once a week. Record % cover, height etc. Record plants that have flowered outside of vegetation survey. Include date.

Habitat Description: describe habitat within the quadrat, habitat layers, species composition, height of layers, cover of layers, surrounding habitats.

☐ Did you take a picture?

Code	Common Name (Tick box if present in quadrat)	Latin Name	Tick if in flower	% in quadrat	Height of plant in cm	How many individual flowers within quadrat?
A	<input type="checkbox"/> Bird's-foot Trefoil	<i>Lotus corniculatus</i>	<input type="checkbox"/>			
B	<input type="checkbox"/> Black Medick	<i>Medicago lupulina</i>	<input type="checkbox"/>			
E	<input type="checkbox"/> Common Field Speedwell	<i>Veronica persica</i>	<input type="checkbox"/>			
G	<input type="checkbox"/> Cow Parsley	<i>Anthriscus sylvestris</i>	<input type="checkbox"/>			
H	<input type="checkbox"/> Creeping Buttercup	<i>Ranunculus repens</i>	<input type="checkbox"/>			
I	<input type="checkbox"/> Daisy	<i>Bellis perennis</i>	<input type="checkbox"/>			
J	<input type="checkbox"/> Dandelion	<i>Taraxacum</i>	<input type="checkbox"/>			
K	<input type="checkbox"/> Druce's Cranebill	<i>Geranium x oxonianum</i>	<input type="checkbox"/>			
L	<input type="checkbox"/> Forget-me-not	<i>Myosotis arvensis</i>	<input type="checkbox"/>			
M	<input type="checkbox"/> Greater Plantain	<i>Plantago major</i>	<input type="checkbox"/>			
N	<input type="checkbox"/> Hedge Woundwort	<i>Stachys sylvatica</i>	<input type="checkbox"/>			
O	<input type="checkbox"/> Hogweed	<i>Hemioleum sphondylium</i>	<input type="checkbox"/>			
P	<input type="checkbox"/> Kidney Vetch	<i>Anthyllis vulneraria</i>	<input type="checkbox"/>			
Q	<input type="checkbox"/> Lady's Mantle	<i>Alchemilla vulgaris</i>	<input type="checkbox"/>			
R	<input type="checkbox"/> Nipplewort	<i>Lepus communis</i>	<input type="checkbox"/>			
S	<input type="checkbox"/> Oxeye daisy	<i>Leucanthemum vulgare</i>	<input type="checkbox"/>			
T	<input type="checkbox"/> Perennial Ryegrass	<i>Lolium perenne</i>	<input type="checkbox"/>			
U	<input type="checkbox"/> Ragwort	<i>Jacobaea vulgaris</i>	<input type="checkbox"/>			
V	<input type="checkbox"/> Red Campion	<i>Silene dioica</i>	<input type="checkbox"/>			
W	<input type="checkbox"/> Red Clover	<i>Trifolium pratense</i>	<input type="checkbox"/>			
X	<input type="checkbox"/> Red Dead Nettle	<i>Lamium purpureum</i>	<input type="checkbox"/>			
Y	<input type="checkbox"/> Ribwort Plantain	<i>Plantago lanceolata</i>	<input type="checkbox"/>			
Z	<input type="checkbox"/> Scarlet Pimpernel	<i>Angelia arvensis</i>	<input type="checkbox"/>			
A2	<input type="checkbox"/> Selfheal	<i>Prunella vulgaris</i>	<input type="checkbox"/>			
B2	<input type="checkbox"/> Silverweed	<i>Argentina anserina</i>	<input type="checkbox"/>			
C2	<input type="checkbox"/> Smooth Sow-thistle	<i>Sonchus oleraceus</i>	<input type="checkbox"/>			
D2	<input type="checkbox"/> White Clover	<i>Trifolium repens</i>	<input type="checkbox"/>			
E2	<input type="checkbox"/> Wild Strawberry	<i>Fragaria vesca</i>	<input type="checkbox"/>			
F2	<input type="checkbox"/> Yarrow	<i>Achillea millefolium</i>	<input type="checkbox"/>			
G2	<input type="checkbox"/> Yorkshire Fog	<i>Holcus lanatus</i>	<input type="checkbox"/>			
H2	<input type="checkbox"/>		<input type="checkbox"/>			
I2	<input type="checkbox"/>		<input type="checkbox"/>			
J2	<input type="checkbox"/>		<input type="checkbox"/>			
K2	<input type="checkbox"/>		<input type="checkbox"/>			

Notes:

Appendix 3: Pollinator survey recording sheet

Pollinator Enhancement Study 2020 Pollinator Recording Sheet

Plot Number:	Time:	Date:
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Restrictions

- Min temp is 13°C with 60% sun
- Temp. of 17°C - sun is not limiting
- Max wind - Beaufort 5

Method

Observe plots daily for 5 minutes and record pollinators visiting plants in flower. Use plant codes.

Beaufort Scale for wind speed:

- 0 - smoke rises vertically
- 1 - slight smoke drift
- 2 - wind felt on face
- 3 - leaves in slight motion
- 4 - dust raised, small branches move
- 5 - small trees in leaf sway
- 6 - large branches move & trees sway

Weather Description

Temperature: _____
 % Sun: _____
 Wind Direction: _____
 Wind Speed: _____

☐ Did you take a picture?

Butterflies		No. Observed	Plant Code
Common Name	Latin Name		
Green veined White	<i>Aurelia rapae</i>		
Holly Blue	<i>Carduelis arvensis</i>		
Large White Butterfly	<i>Pieris brassicae</i>		
Meadow Brown	<i>Maniola jurtina</i>		
Orange Tip	<i>Anticarsia carduorum</i>		
Painted Lady	<i>Vanessa cardui</i>		
Peacock Butterfly	<i>Aglais io</i>		
Red Admiral Butterfly	<i>Vanessa atalanta</i>		
Ringlet	<i>Aphantopus hyperantus</i>		
Small tortoiseshell	<i>Aglais urticae</i>		
Small White Butterfly	<i>Aurelia aurum</i>		
Speckled Wood	<i>Pararge aegeria</i>		

Solitary Bees		No. Observed	Plant Code
Common Name	Latin Name		
Robust mining bee	<i>Andrena cineraria</i>		
Common solitary bee	<i>Colletes succineus</i>		
Mason's Mason Bee	<i>Nematus masonella</i>		
Mining Bee	<i>Andrena fucicola</i>		
White faced bees	<i>Hylaeus spp.</i>		

Bees		No. Observed	Plant Code
Common Name	Latin Name		
Duff-tailed	<i>Bombus terrestris</i>		
Common carder bee	<i>Bombus pratorum</i>		
Early bumblebee	<i>Bombus lucorum</i>		
Forest carder bee	<i>Bombus sylvestris</i>		
Garden bumblebee	<i>Bombus hortorum</i>		
Heath bumblebee	<i>Bombus lucorum</i>		
Honey Bees	<i>Apis mellifera</i>		
Red-tailed	<i>Bombus lapidarius</i>		
White-tailed	<i>Bombus lucorum</i>		

Hoverflies		No. Observed	Plant Code
Common Name	Latin Name		
Common Smut	<i>Rhagoletis cingulata</i>		
The Pellucid Fly	<i>Volucella pellucens</i>		
Phantom Hoverfly	<i>Oreus melampus</i>		

Common Moths		No. Observed	Plant Code
Common Name	Latin Name		
Burnished Green	<i>Olethreutes chryseis</i>		
Brown-bordered Bee Hawkmoth	<i>Hemaris monacha</i>		
Climbing Moth	<i>Tyria jacobaeae</i>		
Crimson Spider	<i>Loxostege clematidis</i>		
Elephant Hawk Moth	<i>Deilephila elpenor</i>		
Green Carpet Moth	<i>Ctenopoma picturata</i>		
Hawkingbird Hawk Moth	<i>Macroglossum stellatarum</i>		
Large Yellow Underwing	<i>Noctua pronuba</i>		
Peppered Moth	<i>Biston betularia</i>		
Poplar Hawk Moth	<i>Laetia populi</i>		
Scarlet Tiger	<i>Callimorpha dominula</i>		
Silken Spider	<i>Scythopteryx chrysodactyla</i>		
Silvered Green-bellied	<i>Amorpha hirsutella</i>		
Small Mappin	<i>Alucita hirsutella</i>		
Spectacle	<i>Alucita laticornis</i>		
The Engrailed	<i>Engrailed cingulata</i>		
White Ermine	<i>Spilosoma luteola</i>		
Winged Green Moth	<i>Zygaena trifolii</i>		

Other Pollinators		No. Observed	Plant Code
Common Name	Latin Name		
Vespa	<i>Vespa</i>		
Beetles	<i>Chrysomelids</i>		
Flies	<i>Diptera</i>		

Other:

Office Use

Total Number of Pollinators

Appendix 4: Results showing the percentage abundance, height of pollinator friendly plants in and the number of flowerheads of pollinator friendly plants in Quadrat 1 over the 6 survey days during the Pollinator Enhancement Study 2020

Plant Species	10/07/2020	17/07/2020	24/07/2020	04/08/2020	10/08/2020	21/08/2020
Creeping Buttercup	3	5	1	8	5	1
Dandelion	1	1		5		1
Greater Plantain			1	2		
Perennial Ryegrass	15					
Red Clover	10	15	5	10	10	5
Ribwort Plantain	5	2	2	5	5	5
Silverweed	1	1	1	5	5	2
White Clover	25	15	15	25	45	5
Yorkshire Fog	40	50	50	40	30	76
Common Couch Grass						5

Table 7. The percentage abundance of the pollinator friendly plants recorded in Quadrat 1 over the six vegetation survey days as part of the Pollinator Enhancement Study.

Plant Species	10/07/2020	17/07/2020	24/07/2020	04/08/2020	10/08/2020	21/08/2020
Creeping Buttercup	11	12	5	7		6.5
Dandelion	9	5		8		7
Greater Plantain			3.5	19		
Perennial Ryegrass	19					
Red Clover	10	8.5	9		6	18
Ribwort Plantain	26	11	13			11
Silverweed	13	4	8	8	9	22
White Clover	15	4	4	9	22	10
Yorkshire Fog	19	7	14	8	34	14
Common Couch Grass						11

Table 8. The change in plant height measured in cm of the pollinator friendly plants recorded in Quadrat 1 over the six vegetation survey days as part of the Pollinator Enhancement Study.

Plant Species	10/07/2020	17/07/2020	24/07/2020	04/08/2020	10/08/2020	21/08/2020
Creeping Buttercup	3	0	0	0	0	0
Daisy	0	0	0	1	0	0
Field Forget-me-not	0	0	0	1	0	0
Perennial Rye-grass	2	0	0	0	0	0
Red Clover	5	0	0	0	0	0
White Clover	13	0	5	1	15	0
Yorkshire Fog	10	0	0	0	2	0

Table 9. The total number of flowerheads of each pollinator friendly plant recorded in Quadrat 1 over the six vegetation survey days as part of the Pollinator Enhancement Study.

Appendix 5: Results showing the percentage abundance, height of pollinator friendly plants in and the number of flowerheads of pollinator friendly plants in Quadrat 2 over the 6 survey days during the Pollinator Enhancement Study 2020

Plant Species	10/07/2020	17/07/2020	24/07/2020	04/08/2020	10/08/2020	21/08/2020
Common Field Speedwell	1	1	2		5	
Creeping Buttercup	5	5	5	5	10	10
Dandelion	1	1	1		2	2
Field Forget-me-not			2	2	5	
Greater Plantain	1					
Perennial Ryegrass			5			
Red Clover	20	20	20	25	30	25
Ribwort Plantain	10	15	7	10	13	15
Scarlet Pimpernel					5	1
Smooth Sow-thistle	2	2	2	1	5	5
White Clover	10	5	5	5		5
Yorkshire Fog	50	50	50	52	20	25
Prickly Sow-thistle		1	1			2
Common Couch Grass						10
Creeping Cinquefoil					5	

Table 10. The percentage abundance of the pollinator friendly plants recorded in Quadrat 2 over the six vegetation survey days as part of the Pollinator Enhancement Study.

Plant Species	10/07/2020	17/07/2020	24/07/2020	04/08/2020	10/08/2020	21/08/2020
Common Field Speedwell	21	30	36		26	
Creeping Buttercup		21	23	30	29	21
Dandelion	9	15	33		39	21
Field Forget-me-not			27	31	29	
Greater Plantain	7					
Perennial Ryegrass			23			
Red Clover	24	29	42	42	47	45
Ribwort Plantain	33	40	39	93	50	40
Scarlet Pimpernel					31	22
Smooth Sow-thistle	26	40	50.5	75	77	79
White Clover	17	16	16	29		19
Yorkshire Fog	19	44	34	65	66	59
Prickly Sow-thistle		21	30			66
Common Couch Grass						47
Creeping Cinquefoil					19	

Table 11. The change in plant height measured in cm of the pollinator friendly plants recorded in Quadrat 2 over the six vegetation survey days as part of the Pollinator Enhancement Study.

Plant Species	10/07/2020	17/07/2020	24/07/2020	04/08/2020	10/08/2020	21/08/2020
Common Field Speedwell	2	1	2		1	
Creeping Buttercup		1	0	1	1	0
Forget-me-not			2	37	15	
Perennial Ryegrass			2			
Red Clover	10	9	9	22	18	35
Ribwort Plantain	14	14	10	14	12	6
Scarlet Pimpernel					1	2
Smooth Sow-thistle	0	0	1	0	3	1
White Clover	5	4	1	1		0
Yorkshire Fog	5	24	10	27	20	15
Prickly Sow-thistle		0	0			1

Table 12. The total number of flowerheads of each pollinator friendly plant recorded in Quadrat 2 over the six vegetation survey days as part of the Pollinator Enhancement Study.

Appendix 6: Results showing the percentage abundance, height of pollinator friendly plants in and the number of flowerheads of pollinator friendly plants in Quadrat 3 over the 6 survey days during the Pollinator Enhancement Study 2020

Plant Species	13/07/2020	17/07/2020	24/07/2020	04/08/2020	10/08/2020	21/08/2020
Black Medic		1	2			
Common Field Speedwell					5	1
Creeping Buttercup	10	10	7	20	20	5
Dandelion	2	1	2	5	5	5
Field Forget-me-not			1			
Red Clover	5		2	5	10	20
Ribwort Plantain	2	2	2	7	15	20
Scarlet Pimpernel		1				
White Clover			2	10	5	5
Yarrow	4	4	5	10	10	20
Yorkshire Fog					10	
Dove's-foot crane's-bill		1	1			1
Purple-leaved Yellow-Sorrel			1			
Garden Celandine					5	
Perennial Ryegrass	3	3	3	5	5	10
Irish Spurge						1

Table 13. The percentage abundance of the pollinator friendly plants recorded in Quadrat 3 over the six vegetation survey days as part of the Pollinator Enhancement Study.

Plant Species	13/07/2020	17/07/2020	24/07/2020	04/08/2020	10/08/2020	21/08/2020
Black Medic		3.5	5			
Common Field Speedwell					5	7
Creeping Buttercup	5	21	21	18	30	34
Dandelion	3	5	7	15	13	15
Field Forget-me-not			4.5			
Red Clover	23		20		36	26
Ribwort Plantain	32	39	28		46	39.5
Scarlet Pimpernel		3				
White Clover			15	31	31	15
Yarrow		17	21	50	62	57
Yorkshire Fog					64	
Dove's-foot crane's-bill		2	3			10
Sorrell			1.5			
Garden Celandine					20	
Perennial Ryegrass	10	12.5	13			20
Irish Spurge						15

Table 14. The change in plant height measured in cm of the pollinator friendly plants recorded in Quadrat 3 over the six vegetation survey days as part of the Pollinator Enhancement Study.

Plant Species	13/07/2020	17/07/2020	24/07/2020	04/08/2020	10/08/2020	21/08/2020
Creeping Buttercup	0	2	0	0	0	0
Red Clover	1		3		5	0
Ribwort Plantain	6	0	0		1	2
White Clover			1	1	1	0
Yarrow		0	0	1	5	1
Yorkshire Fog					23	

Table 15. The total number of flowerheads of each pollinator friendly plant recorded in Quadrat 3 over the six vegetation survey days as part of the Pollinator Enhancement Study.

Appendix 7: Results showing the percentage abundance, height of pollinator friendly plants in and the number of flowerheads of pollinator friendly plants in Quadrat 4 over the 6 survey days during the Pollinator Enhancement Study 2020

Plant Species	13/07/2020	17/07/2020	24/07/2020	04/08/2020	10/08/2020	21/08/2020
Black Medic				5	1	
Common Field Speedwell			1			
Creeping Buttercup	6	5	8	6	5	5
Dandelion		4			5	5
Greater Plantain	1	1	1	2	5	1
Perennial Ryegrass						2
Red Clover	20	25	30	25	20	15
Ribwort Plantain	15	10	5		5	10
Selfheal						
Silverweed	1			2	2	1
White Clover	10	10	5	10	5	5
Yarrow	10	10	10	10	13	10
Yorkshire Fog	15	15	10	10	9	10
Cock's Foot	22	20	30	30	30	35
Common Couch Grass						1

Table 16. The percentage abundance of the pollinator friendly plants recorded in Quadrat 4 over the six vegetation survey days as part of the Pollinator Enhancement Study.

Plant Species	13/07/2020	17/07/2020	24/07/2020	04/08/2020	10/08/2020	21/08/2020
Black Medic				26	27	
Common Field Speedwell			11			
Creeping Buttercup	18	20	18.5	30	27	31
Dandelion		22.5			14	15
Greater Plantain	13	15	14	29	27	15
Perennial Ryegrass						34
Red Clover	20	25	28	40	35	32
Ribwort Plantain	25	27	28		37	31
Selfheal				21		
Silverweed	14			18	30	30
White Clover	10	14	13	28	29	24
Yarrow	22	25	24	52	61	38
Yorkshire Fog	23	29	33	7	65	43
Cock's Foot	27	26	32			52
Common Couch Grass						5

Table 17. The change in plant height measured in cm of the pollinator friendly plants recorded in Quadrat 4 over the six vegetation survey days as part of the Pollinator Enhancement Study.

Plant Species	13/07/2020	17/07/2020	24/07/2020	04/08/2020	10/08/2020	21/08/2020
Black Medic				0	1	
Creeping Buttercup	0	0	0	1	1	
Greater Plantain	0	0	0	2	2	2
Red Clover	26	0	20	8	12	3
Red Dead Nettle						
Ribwort Plantain	18	15	25		7	
White Clover	12	0	0	1	1	
Yarrow	0	0	0	1	1	
Yorkshire Fog	7	31	20		20	5
Cock's Foot	50	0	5			40
Perennial Rye Grass						3

Table 18. The total number of flowerheads of each pollinator friendly plant recorded in Quadrat 4 over the six vegetation survey days as part of the Pollinator Enhancement Study.

Appendix 8: Results showing the percentage abundance, height of pollinator friendly plants in and the number of flowerheads of pollinator friendly plants in Quadrat 5 over the 6 survey days during the Pollinator Enhancement Study 2020

Plant Species	13/07/2020	17/07/2020	24/07/2020	04/08/2020	10/08/2020	21/08/2020
Black Medic	1	2	2	5	5	2
Creeping Buttercup	4	5	2	5	8	3
Druce's Crane's-bill	30	30	30	30	35	35
Hedge Woundwort	27	30	30	25	20	20
Hogweed	3	1	1			1
Lady's Mantle	10	10	10	11	10	10
Nipplewort	1	3	3	5	5	5
Red Clover					1	
Ribwort Plantain	5	5	10	2	5	13
White Clover				5		
Wild Strawberry	5	2	2	1	5	2
Yorkshire Fog			1	5	5	
Daylily	3			1		2
Common Couch Grass	10	12	9	5		5
Blackthorn	1					1
Creeping cinquefoil					1	
Water Mint						1

Table 19. The percentage abundance of the pollinator friendly plants recorded in Quadrat 5 over the six vegetation survey days as part of the Pollinator Enhancement Study.

Plant Species	13/07/2020	17/07/2020	24/07/2020	04/08/2020	10/08/2020	21/08/2020
Bird's-foot Trefoil						
Black Medic	43	33	33	70	40	58
Creeping Buttercup	16	24	25	32	25	38
Druce's Crane's-bill	56	60	55	73	58	61
Hedge Woundwort	61	58	54	77	78	70
Hogweed	115	115	117			115
Lady's Mantle	55	57	41	66	66	33
Nipplewort	67	66	55	67	61	65
Red Clover					21	
Ribwort Plantain	57	57	53		69	60
White Clover				12		
Wild Strawberry	19	19	15		27	19
Yorkshire Fog			50	92	85	
Daylily						49
Common Couch Grass	76	55	63			74
Blackthorn						30
Day Lilies	58					
Blackthorn	44					
Creeping cinquefoil					23	
Water Mint						47

Table 20. The change in plant height measured in cm of the pollinator friendly plants recorded in Quadrat 5 over the six vegetation survey days as part of the Pollinator Enhancement Study.

Plant Species	13/07/2020	17/07/2020	24/07/2020	04/08/2020	10/08/2020	21/08/2020
Black Medic	9	4	1	2	6	5
Creeping Buttercup	3	0	2	1	2	0
Druce's Crane's-bill	23	19	25	13	13	10
Hedge Woundwort	41	30	100	4	4	20
Hogweed	0	0	0			0
Lady's Mantle	100	20	100	20	20	50
Nipplewort	3	2	0	1	6	5
Red Clover					0	
Ribwort Plantain	7	10	3		3	
White Clover				0		
Wild Strawberry	0	0	0		1	0
Yorkshire Fog			1	1	1	
Day Lily						0
Common Couch	5	10	0			0
Blackthorn						0
Creeping cinquefoil					0	
Water Mint						1

Table 21. The total number of flowerheads of each pollinator friendly plant recorded in Quadrat 5 over the six vegetation survey days as part of the Pollinator Enhancement Study.