Which ‘bee-friendly’ plants attract the most bees?

4th year (2017) update

Rosi Rollings
December 2017

Best plant for bees: still *Helenium autumnale*!
Shown here with honey bee and yellow-faced solitary bee, probably male *Hylaeus communis*

Which 'bee-friendly' plants attract the most bees?: 4th year (2017) update on our findings

Summary

This report provides the findings from the 4th year of our formal research which aims to quantify the relative attractiveness of 'bee-friendly' garden plants.
Note: These findings build on the method described, in, detail in the 2014 research paper available at rosybee.com/research.

The scope of the study in 2017 included:

- 75 plants including
    - 62 perennials, 3 biennials and 10 annuals
    - 18 plants that are new to the study with a particular focus on annuals

The additional plants take the four-year scope to a total of 97 plants studied, of which 71 plants have more than one year's data.

In previous years, it has been clear that weather has a significant impact on the behavior of both bees and plants. This year it was very hot and dry in May and June and then cooler and wetter in July and August. Temperatures in mid -June reached above 30 degrees for many days and caused the following specific impacts

- Bumblebees were greatly in numbers and, on the hottest days, some were found hiding under leaves for shade.
- Some plants flowered for a shorter time (the research bed was watered twice during June at a level which kept the plants alive but not enough to produce lush growth)

Another factor that had significant influence on this years' results was a 68% increase in the number of honey bees. This caused those plants that are more attractive to honey bees to be 'promoted' in the rankings.

Other factors (see full report section 4.2.1) indicate that the increase in honey bee numbers was probably due to a shortage of wild or agricultural forage and generating more reliance on garden flowers i.e. it was not an indication of a honey bee population growth. The massive reduction in oil-seed rape as a local agricultural crop may have been a factor and this pattern may have been repeated across the country as oil-seed rape production is apparently down by 20% since neonicotinoid-coated seed was banned.

Overall though, we observed a reasonable degree of consistency with previous years with 8 out of the 'top 10' performing plants remained the same as those from the previous three years, although *Helenium autumnale* remains the overall top performer, there have been changes within the top 3:

- *Helenium autumnale* (previously 1st)
- *Origanum onities* (previously blended with *Origanum vulgare* at 5th)
- *Calamintha Nepeta* (previously 4th).

This year's study produced some findings that reinforced those of the previous years and one new consideration:

New finding

- When honey bees make up 50% of all bees observed, they appeared to be 'out-competing' wild bees on some plants. A balance between bee species is

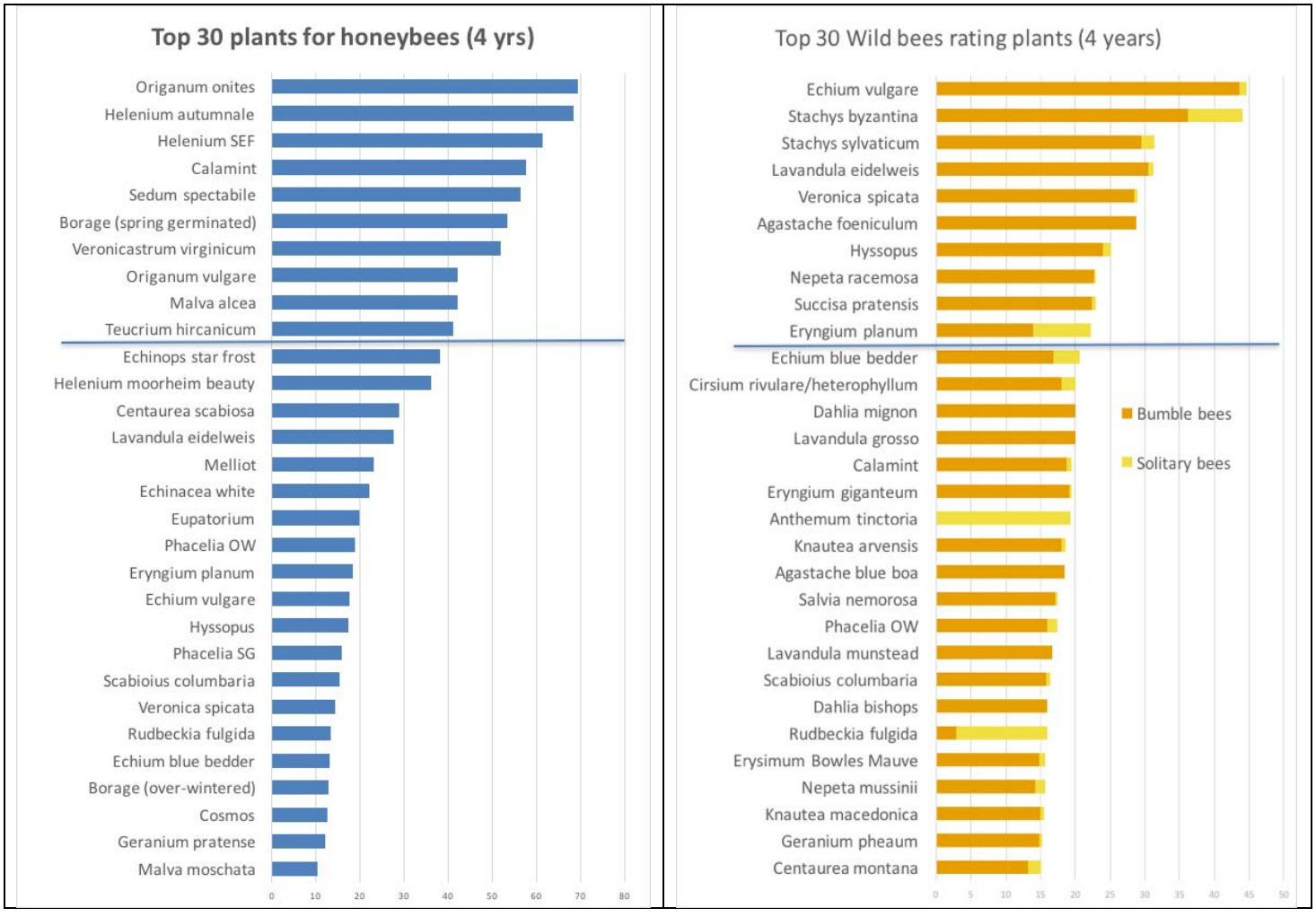
important for overall plant ecosystems but if a range of different plants are provided this should reduce this risk of adverse competition.

Previous findings that still stand are:

- The primary finding is still that plants are not equally attractive to bees, even when you focus on 'bee-friendly' plants and the variation is significant for anyone wanting to maximize the amount of bee-food any area of land can provide.
- Healthy plants with more flowers attract more bees: the old gardeners' adage of 'right plant for the right place' is important, not only for a sustainable garden, but also for the direct impact on the pollinators each plant may support
- Generally, native and non-native plants continue to appear equally attractive to bees and, except where some specific bees and plants have a more unique inter-dependency, most bees do not care as long as the plant's structure allows them to reach the nectar or pollen.

The following charts provides a summary of the cumulative results for the 4 years of data showing plants for honey bees separate from wild bees (bumblebees and solitary bees).

Summary charts of the top performing plants for bees by type of bee, averaged over the 4 years of our study



For more details please refer to full research results at www.rosybee.com/research/

Personal notes from the author

Flowers are meant to have pollen and nectar so they can reproduce and provide food for pollinators in the process. Sadly, many plants have been bred purely to make then more aesthetically pleasing and, as a result, many plants have become sterile, no longer providing pollinator-food or making that food inaccessible. Over the years of this study I have found that my attitudes to plants have changed and that I can no longer appreciate plants on a purely aesthetic basis when there are so many beautiful and viable plants available. I hope that plant breeders and judges will also consider pollinators more in the future when developing new plants.

Also, as a keeper of honey bees, I am now planning to keep fewer bees because I am concerned that, in times of flower shortages, honey bees out-compete wild bees. Honey bees are not a viable substitute for the full range of specialist pollination services that wild bees provide, so it's important that we do not add any further pressure on wild bees' ability to thrive. More research is required to understand this balance but provision of more flowers as food for all pollinators will never be a bad thing!

I am planning to continue this research for another year and am always on the look-out for new plants to test.

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Which 'bee-friendly' plants attract the most bees?

4th year (2017) update – Full report

1. Recap of previous research

From 2011 to 2014 we tested a variety of plants that are commonly recommended for bees. Over time we eliminated ones that did not appear to perform well and tried more. By 2014, with the help of some input from the LASI unit at Sussex University, we had developed a method for quantifying our plant trials and completed our first full formal field study results. We have now added a 3 further years' worth of data and more plants to our findings.

The results we publish are based on the findings from our site in south Oxfordshire, (Rosybee plant nursery) which is on very heavy (but improved) clay. Over time the six-acre site is being developed as a 'bee haven' with areas of wildflowers and of annual borage and phacelia sowings. We also keep honey bees and sheep. All of this activity probably increases the general bee populations but will not impact the main findings of the research which concern relative attractiveness of plants to bees.

This research takes time as each plant must to be grown to maturity before valid data can be captured.

2. 2017 season study

The scope of the study in 2017 included:

- 75 plants including
    - 62 perennials, 3 biennials and 10 annuals
    - 18 plants that are new to the study with a particular focus on annuals

This takes the four-year scope to a total of 97 plants studied plants of which 71 plants have more than one year's data.

3. Research method

The research methods have remained the same: bees and other pollinators are counted on each plant, at least weekly, for the period each plant was in flower. Our research bed is laid out so that each plant type fills an area of one square meter of ground, allowing a measure of 'bees per square meter' to be calculated. The counting is done by a 'snapshot' method: all the bees that are on the plant at the moment of observation are counted. We only count on days when the bees are flying i.e. when it's not raining, blowing a gale or below 10 degrees.

The outputs of this method are:

1. The average number of bees, per square meter for each plant
2. The number of weeks each plant flowers for

We also capture weather and other factors that may have a contextual influence on the results, such as the health of the plant.

Based on the first few years of study, we realized that there are sufficient variations between how plants and bees behave each year that more years of data will help to provide more robust results. There are still many more herbaceous perennials and sub-shrubs to quantify although our focus remains on those that are likely to be highly attractive to bees.

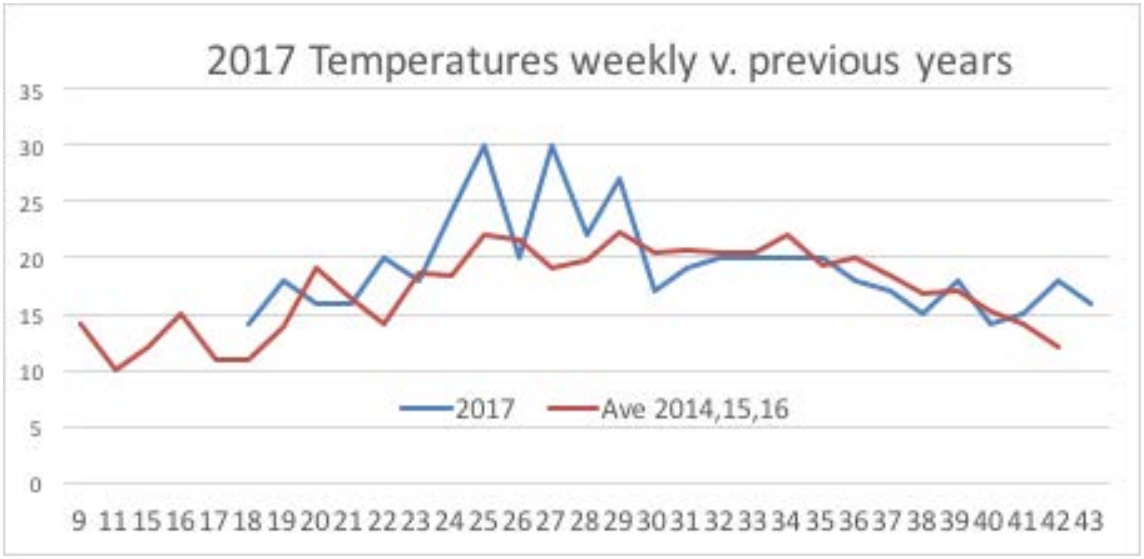
4. Ratings method

Both length of flowering and the number of bees attracted, at any given time, contribute to the value each plant can provide to bees and other pollinators. (10 bees at a time for 2 weeks = 2 bees at a time for 10 weeks) The rosybee rating combines these two factors: average bees attracted per square meter x length of flowering. We calculate a measure for each plant and then a ranking for the range of plants within the study. For a more complete description of the method please refer to our 2014 research paper.

5. Contextual findings

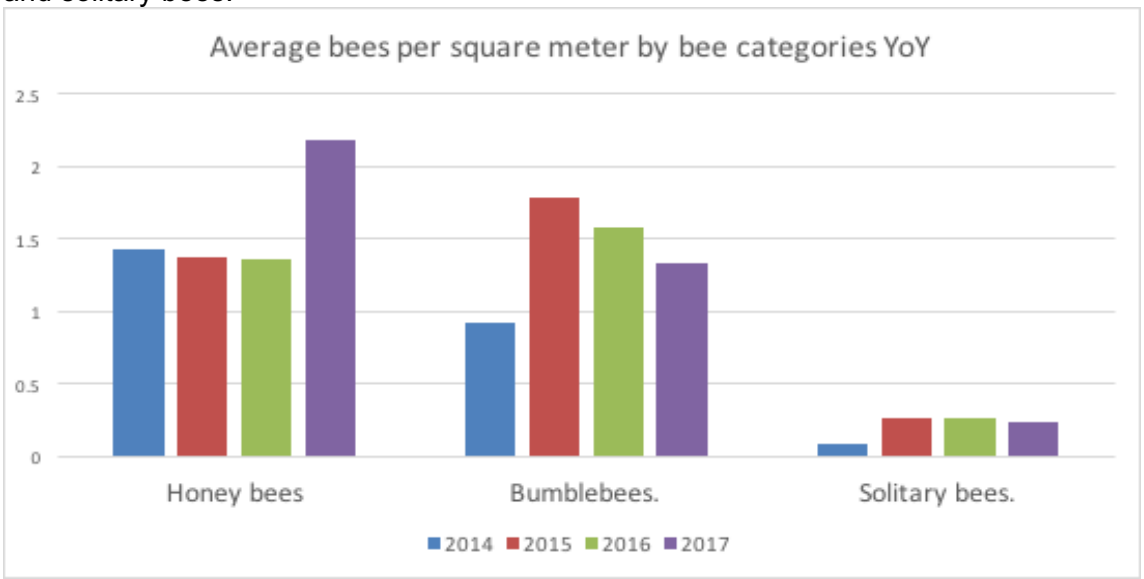
5.1 Weather

This years' weather differed from previous years by being particularly hot during May and June then cooler and wetter in August. The bold red line below shows how 2017 differs from the previous years. The hot weather generally suits honey bees and solitary bees but is not liked by bumblebees that are fluffier and originate from mountainous areas. As we only count bees on days when it's not raining the wet of August does not show and the lower August temperatures were sufficient for all bees to still be flying on dry days.



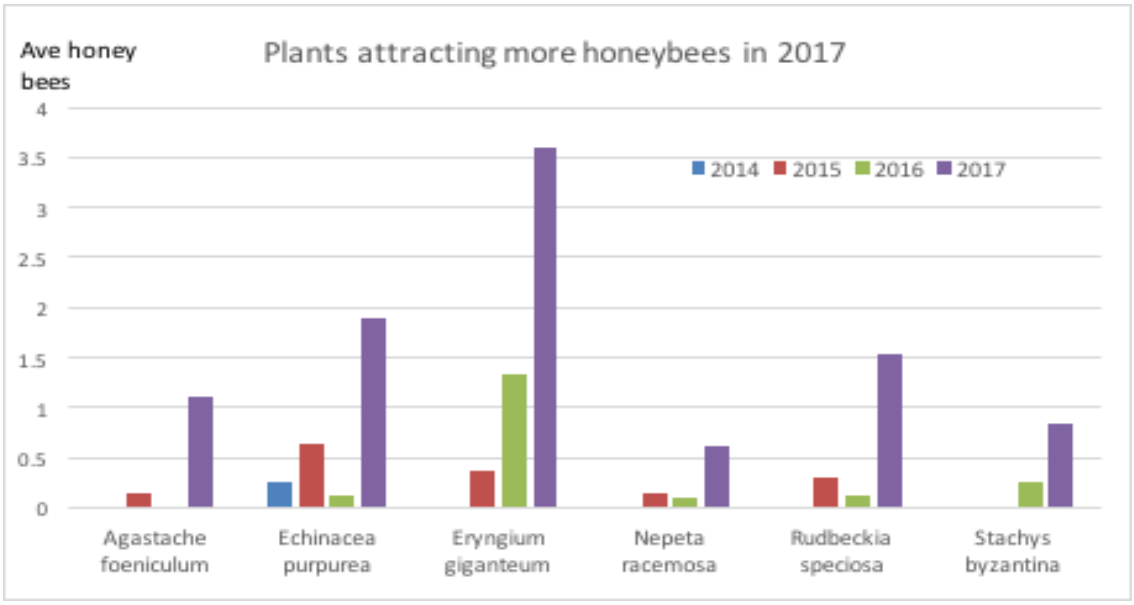
5.2 Bee numbers

The average number of bees counted was greater than in previous years but the increase was entirely caused by more honey bees with a slight decrease in bumblebee and solitary bees.



Honey bees increased by 68% on 2016 numbers and accounted for 49.7% of all bees observed in 2017. The nearest source of honey bees is our own hives which are 100m from the research beds. However, our honey bee hives experienced the worst season in our 9 years as beekeepers, with multiple changes of queens, resulting in smaller colonies, compounded with weather conditions that also reduced honey production.

There were also several plants that honey bees visited which they have virtually ignored in previous years. These plants are shown below.



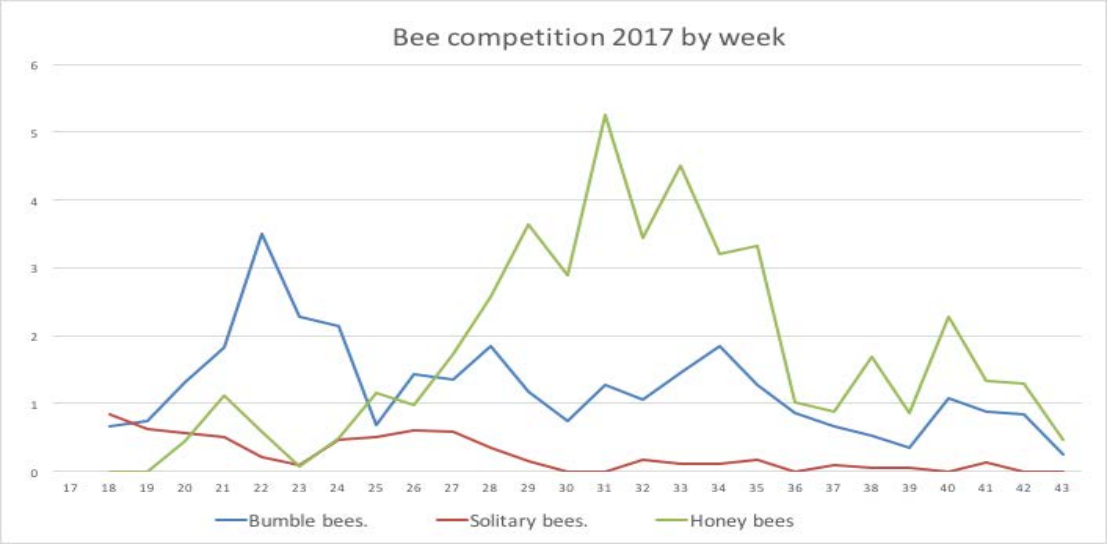
So, with fewer honey bees in the vicinity but increased numbers observed on our research plants I have to consider that there may have been a local shortage of honey bee forage sources. At rosybee, we continue to grow an acre of borage and phacelia and in 2017 this flowered well, as did the other normal wild sources of honey bee forage such as willows and brambles. However, there was a noticeable reduction in oil-seed rape crops; the nearest being approximately a mile from our site. This would have impacted honey bees in June but would not account for the increased number during their peak in August. I have to conclude there were some other food shortages which I have not been able to identify which resulted in the honey bees being much more interested in our relatively small areas of planting and much less fussy than usual.

5.2.1 Honey bee dominance and competition

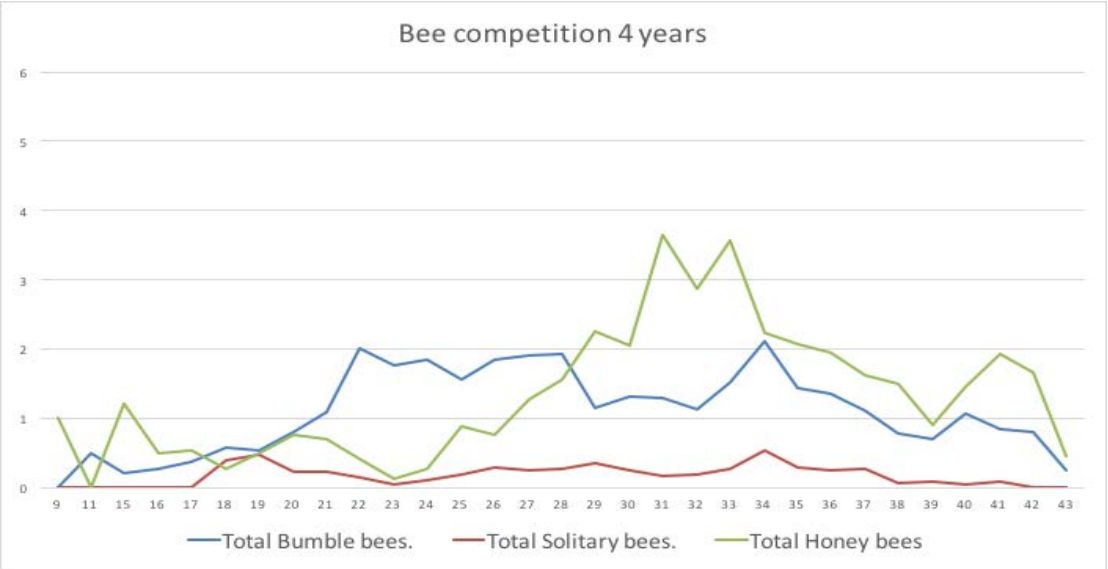
In 2017, bees accounted for 85% of all pollinators but honey bees accounted for 50% of that total, up by 68% on previous years. In fact, honey bees were so dominant this year that those plants that are particularly attractive to honey bees tended to rise up the rankings overshadowing plants that are valuable to attract wild bees; 8 out of the top 10 rated plants are mainly attracting honey bees.

There is also some indication that when honey bees are strongly attracted to a plant, they actively discourage foraging by other bee species. I have observed that when a plant begins to flower it may attract bumblebees and solitary bees and then as it reaches full flower, the honey bees begin to arrive and other bee species are no longer observed. Calamint, and Helenium ‘Sahins ‘early flowerer’ are both examples of where this pattern was observed.

The chart below shows how the numbers of wild bees and honey bees change each week through the season.



The chart shows a reduction in bumblebee numbers during the period of peak honey bee numbers between weeks 27 and 35. This could be due to lifecycle but the 2017 pattern is much more extreme than that seen in the same chart for all 4 years. (Note the bumble bee drop in week 25 relates to high temperatures rather than honey bee pressure.)



5.2.2 Bumblebee observations

The total number of bumblebees observed in the research beds were slightly down on previous year, particularly the common carders, but in addition to competition with honey bees there are a few other factors that may have a bearing:

A disproportionate number of the bumblebees where ‘cuckoo’ bumblebees; they made up 12% of all bumblebees counted v. 2% in previous years. The ‘cuckoos’ may have been a further cause of stresses on the bumblebee population. The reason for the increase in ‘cuckoos’ is unclear but will probably revert to normal levels next year as the number of cuckoos must exceed host bumblebee nests.

This years’ rains during August meant that we had excess pasture for the sheep and so allowed about two acres to grow long enough for the clover to flower from July through to

September. This clover attracted many species of bumblebee and so may have reduced their reliance on the research beds. However, the clover is not favourite with the common carders that were the most reduced.

5.2.3 Solitary bee observations

Although the overall numbers of solitary bees observed was slightly reduced, the number of species significantly increased. In previous years, I have seen red mason bees early in the season, then a few wool carder bees on the various stachys followed by lots of lassioglossums on the heleniums. This year, the lassioglossums failed to appear in such large numbers but we saw several species of andrenas and colletes bees on the anthemis tinctoria and then the eryngium planum. In total, 29 species of solitary bee were sighted in 2017.

The increase in species is probably partly due to my growing experience in spotting new species but I am optimistic that this is also due to the increasing range of plants on offer for them.

6. The Plant Results

As we have noted before, healthy plants attract more bees than unhealthy ones: this year the hot dry June weather stressed several plants that were flowering at that time and appeared to shorten their flowering time and hence reduced their ratings for this year. 'Unhappy' plants this year included

- Lavandula eidelweis – flowered for 8 weeks v. the previous average of 11
- Teucrium hircanicum – flowered for only 9 weeks v. 11

The need for the 'right location' also impacted the Perovskia which we planted in 2015 and should have matured for an initial 'count' this year but was clearly not happy in our heavy clay soil. Its 'unhappiness' was demonstrated by failing to grow much, producing limited flowers and attracting almost no bees (although some pot-grown plants kept in the polytunnel attracted more) and so I decided to remove them from this years' research results.

6.1 Bee-plant ranking

Having established there are some differences in plant performance between the years, it seemed more relevant to focus on the cumulative rating and to use this as the basis for our reporting. The cumulative rating combines the effect of all other variables such as weather and plant health, exactly as the bees (or a gardener) would experience over time.

The 2017 results showed, again, a reasonable degree of consistency with previous years with 8 out of the 'top 10' performing plants remained the same as those from the previous three years but although Helenium autumnale remains the overall top performer, there have been changes within the top 3:

- *Helenium autumnale* (previously 1st)
- *Origanum onities* (previously blended with Origanum vulgare at 5th)
- *Calamintha Nepeta* (previously 4th).

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Several plants went down in the ranking but generally these were plants that are attractive to wild bees rather than honey bees: *Echium vulgare, Stachys byzantina. Teucrium hircanicum* also dropped but due to shorter flowering as mentioned above.

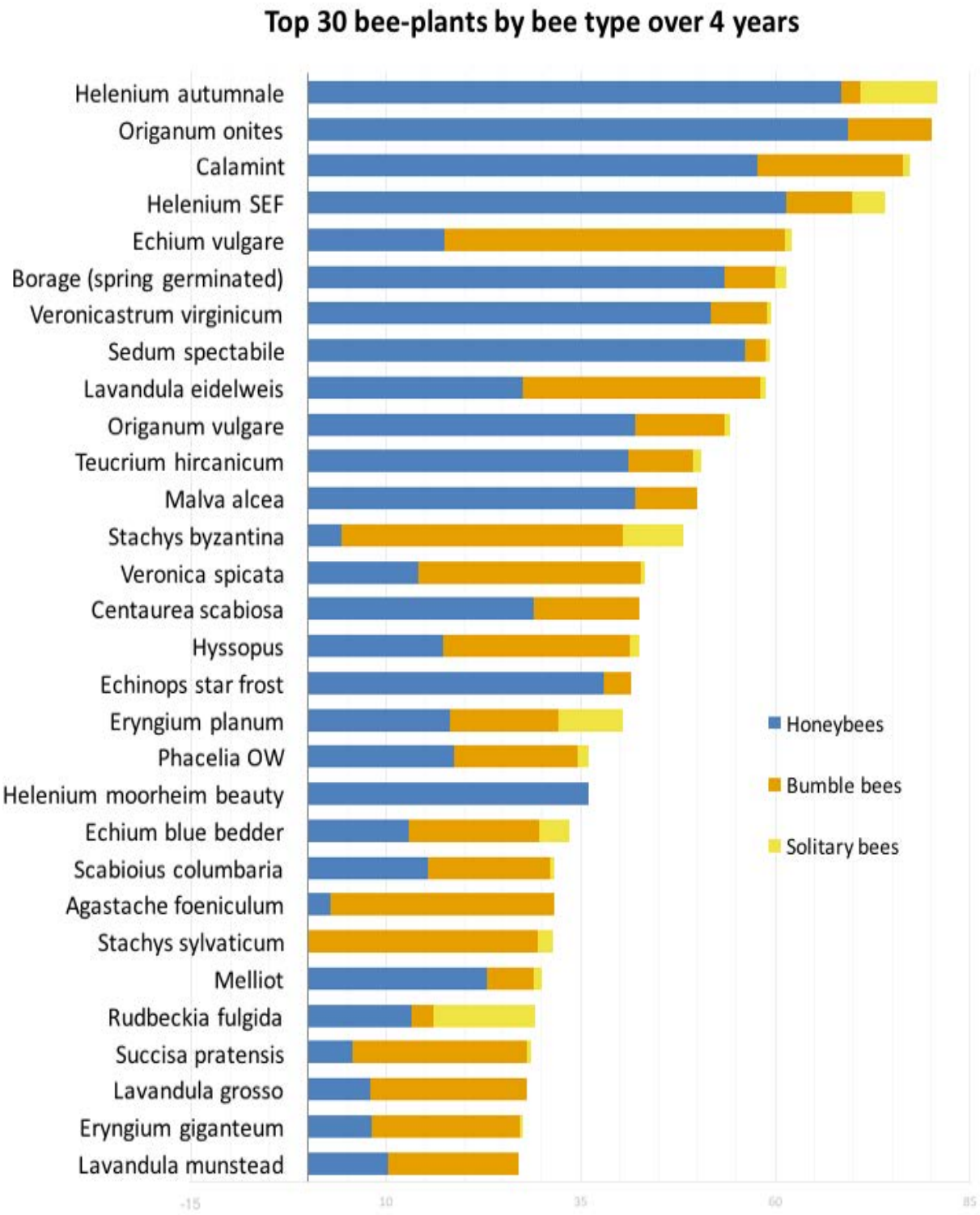
Several new plants studied this year performed very well but others need a further year to grow and mature before they can provide meaningful results. The new entrants to our 'top 30' included

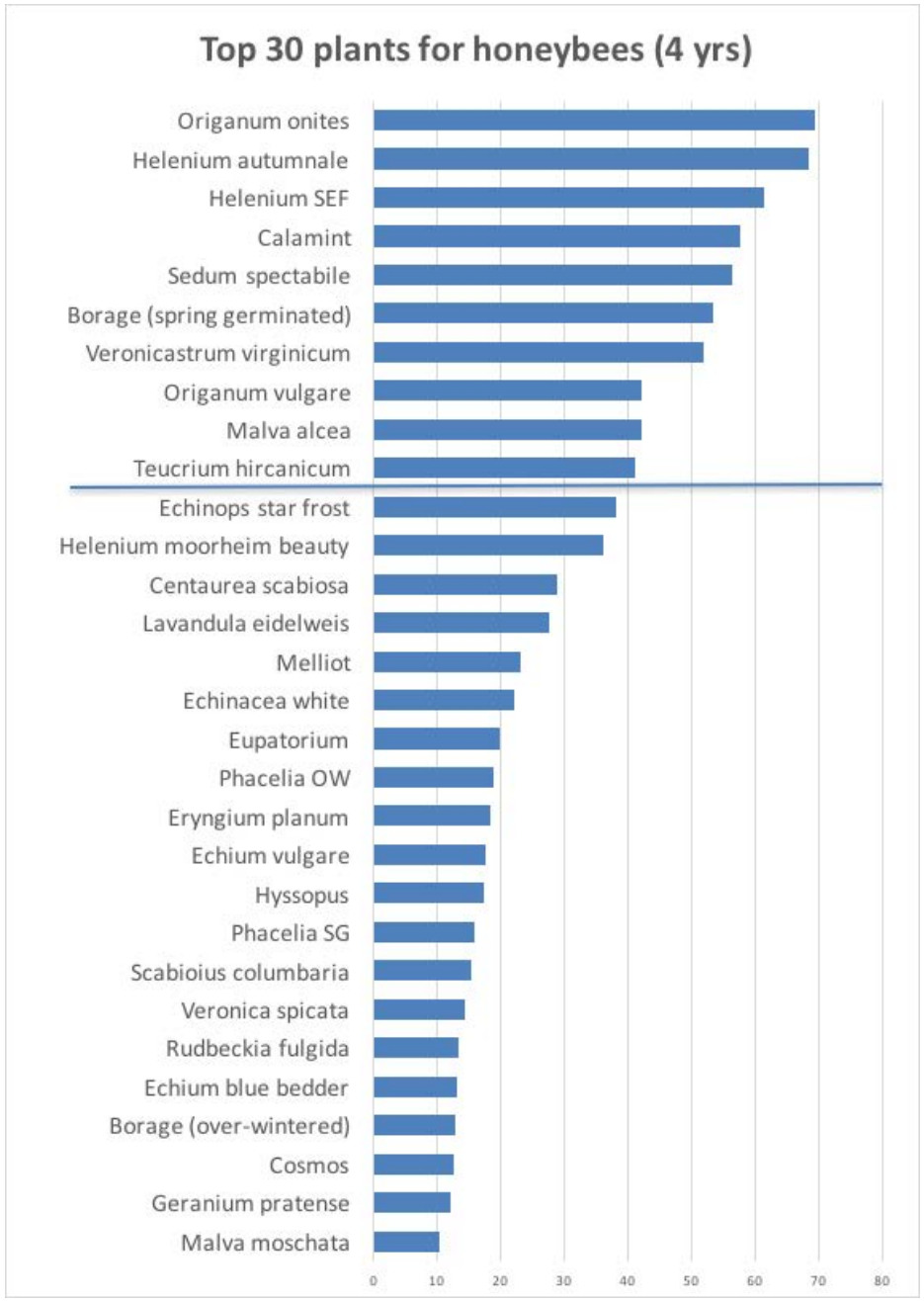
- *Origanum onites*
- *Malva alcea* – early indications are that this may flower longer than the native '*moschata'*.
- *Helenium* 'moorheim beauty' – part of the plan to test more heleniums and already looks like another star.

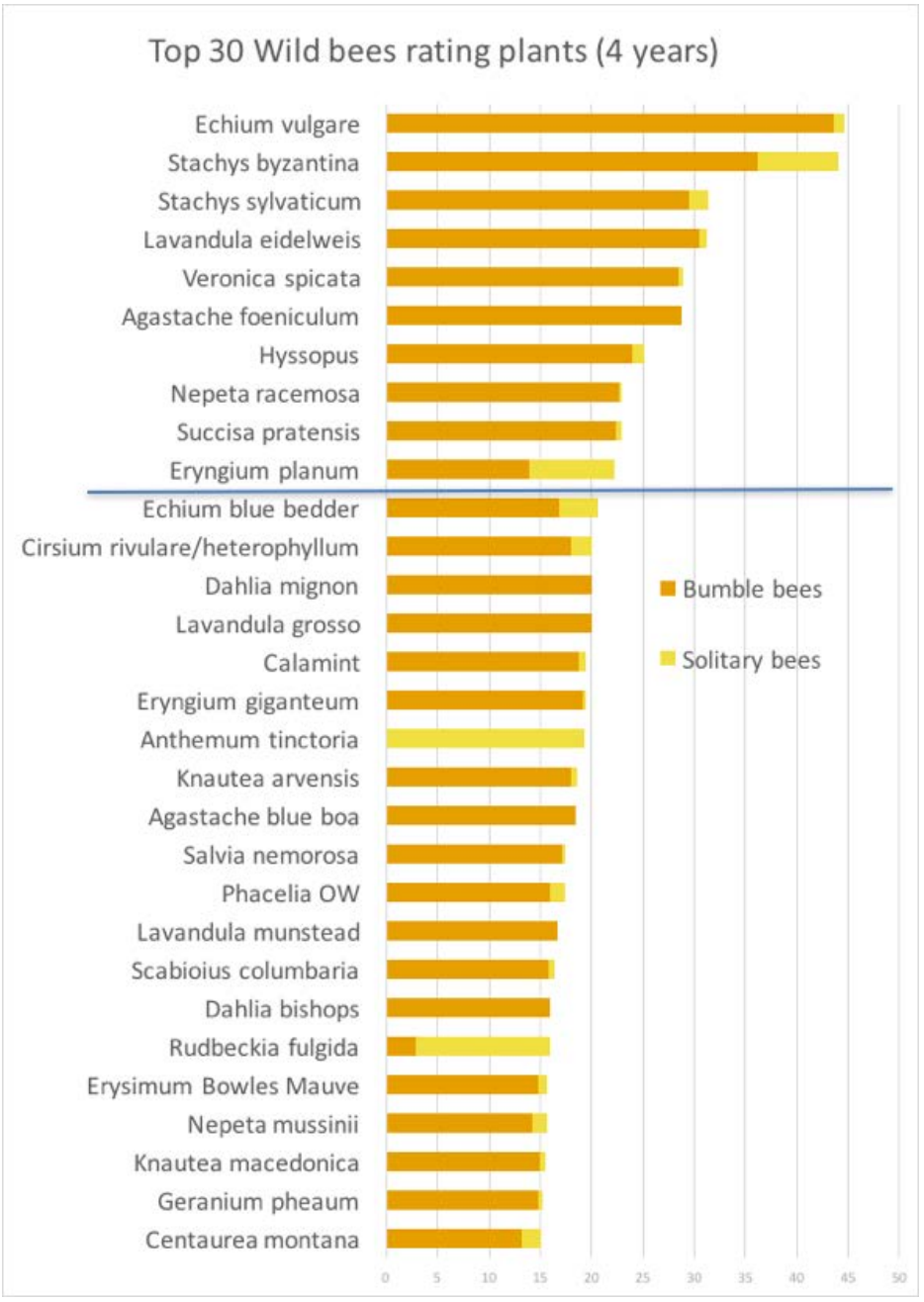
Although *Origanum onites* appears for the first time in this years' results, I realized last year that a patch of white *origanum* was included in the pink *origanum vulgare* and seemed to flower later and longer than the pink. When I looked back in my records I found that I had purchased something labelled as 'pot marjoram' from a supplier back in 2013 and some of it must have made it into the research bed. Now grown on its own, it clearly does out-perform the '*vulgare'* in terms of length of flowering and hence I am confident with its 2nd place in the ranking.

For the purposes of continuity and comparison I have so far been describing the ratings for all bees but as mentioned previously, I believe it is necessary to consider honey bees and wild bees separately. Therefore, the following charts show the ratings for the 'top 30' plants both combined and then separately.

Note: combined ratings for all 97 plants tested to date can be found in Appendix 1.


Top 30 bee-plants by bee type over 4 years
Helenium autumnale
Origanum onites
Calamint
Helenium SEF
Echium vulgare
Borage (spring germinated)
Veronicastrum virginicum
Sedum spectabile
Lavandula eidelweis
Origanum vulgare
Teucrium hircanicum
Malva alcea
Stachys byzantina
Veronica spicata
Centaurea scabiosa
Hyssopus
Echinops star frost
Eryngium planum
Phacelia OW
Helenium moorheim beauty
Echium blue bedder
Scabioius columbaria
Agastache foeniculum
Stachys sylvaticum
Melliot
Rudbeckia fulgida
Succisa pratensis
Lavandula grosso
Eryngium giganteum
Lavandula munstead
Honeybees
Bumble bees
Solitary bees
-15
10
35
60
85


Top 30 plants for honeybees (4 yrs)
Origanum onites
Helenium autumnale
Helenium SEF
Calamint
Sedum spectabile
Borage (spring germinated)
Veronicastrum virginicum
Origanum vulgare
Malva alcea
Teucrium hircanicum
Echinops star frost
Helenium moorheim beauty
Centaurea scabiosa
Lavandula eidelweis
Melliot
Echinacea white
Eupatorium
Phacelia OW
Eryngium planum
Echium vulgare
Hyssopus
Phacelia SG
Scabioius columbaria
Veronica spicata
Rudbeckia fulgida
Echium blue bedder
Borage (over-wintered)
Cosmos
Geranium pratense
Malva moschata
0
10
20
30
40
50
60
70
80


Top 30 Wild bees rating plants (4 years)
Echium vulgare
Stachys byzantina
Stachys sylvaticum
Lavandula eidelweis
Veronica spicata
Agastache foeniculum
Hyssopus
Nepeta racemosa
Succisa pratensis
Eryngium planum
Echium blue bedder
Cirsium rivulare/heterophyllum
Dahlia mignon
Lavandula grosso
Calamint
Eryngium giganteum
Anthemum tinctoria
Knautea arvensis
Agastache blue boa
Salvia nemorosa
Phacelia OW
Lavandula munstead
Scabioius columbaria
Dahlia bishops
Rudbeckia fulgida
Erysimum Bowles Mauve
Nepeta mussinii
Knautea macedonica
Geranium pheaum
Centaurea montana
Bumble bees
Solitary bees
0
5
10
15
20
25
30
35
40
45
50

When the data is separated for honey bees and wild bees, the first striking conclusion is that the top performers are quite different and very few plants appear on both charts. Those plants that may be considered good all-rounders are

- *Echium vulgare*, ranked 1st for wild bees and 20th for honey bees
- *Calamint*, ranked 4th for honey bees and 15th for wild bees
- *Lavandula x-intermedia* 'eidelweis' ranked 4th for wild bees, 14th for honey bees

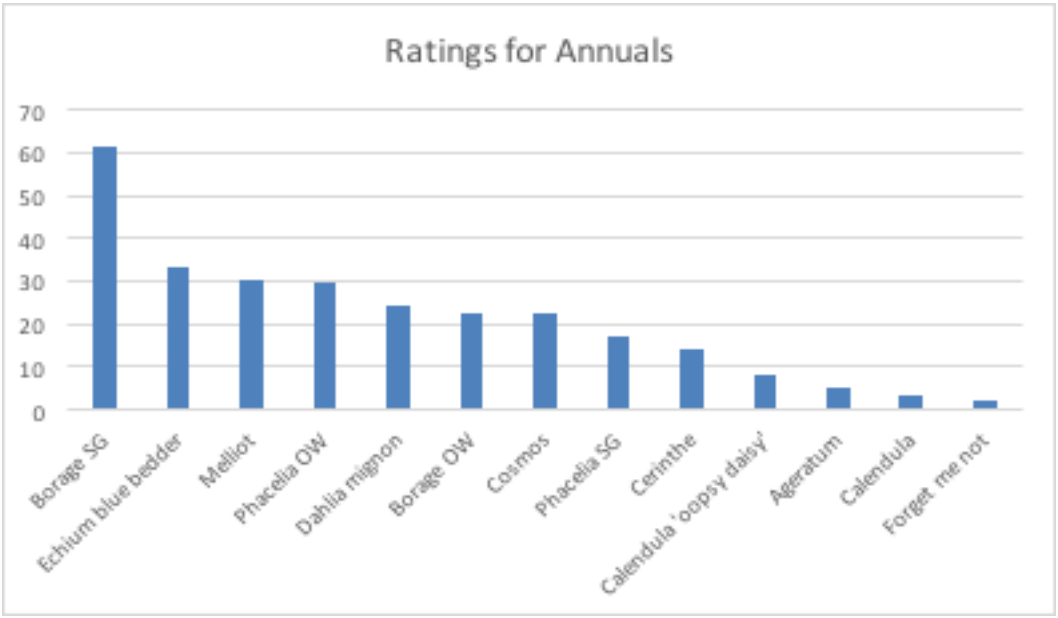
Having two separate rankings does seem to support the commonly cited advice to make sure you have a good range of plants in your garden.

6.2 Annuals

This year I chose to include more annuals in the research as annuals continue to be a popular choice for many gardeners, providing reliable summer-long colour. All the new annuals where chosen based on recommendations from a variety of anecdotal sources and because they could be easily grown from seed. Although none of these made it into the 'top 30' some have merit worth noting.

Annual	2017 ranking	Comments
Cosmos - a tall unnamed pink version	32	Flowered late but for 18 weeks until the first frost
Dahlia mignon - seeds from Blooms for Bees trial	39	Struggled to survive slugs but once it started flowering it did ok
Cerinthe major	51	Attracted mainly carder bumblebees which 'buzz' pollinate it
Calendula 'oopsy daisy' Dwarf variety	60	Not many bees attracted but great colour for pots and mainly attracted leafcutter bees
Ageretum'blue mink'	66	15 weeks of flower mainly attracted hoverflies but not in large numbers

None of the above score as well as annual borage or even *echium* 'blue bedder" which have both ranked in the 'top 30 consistently but tend to get large and untidy so may not be as aesthetically pleasing as many standard annuals. The ratings for all 11 annuals (with variations for Borage and Phacelia where we counted both over-wintered germination and spring germination separately).



6.3 Native v non-native

As in previous years, we found that there continues to be very little difference in bee-attraction between native and non-native plants.

The biggest difference between the native and non-native plants still seems to be that the native plants (in our sample of 26 out of 97) flower later and those that flower earliest attract few bees.

The chart below shows the average number of bees (per square meter) each week on the native and non-native plants. The two lines follow each other quite closely except for the early weeks; until week 20 (early May) only non-native plants flowered and until week 24 (early June) those native plants that were in flower attracted few bees compared with the non-native plants flowering at that time. With the exception of *origanum*, only non-native plants flowered after week 41;

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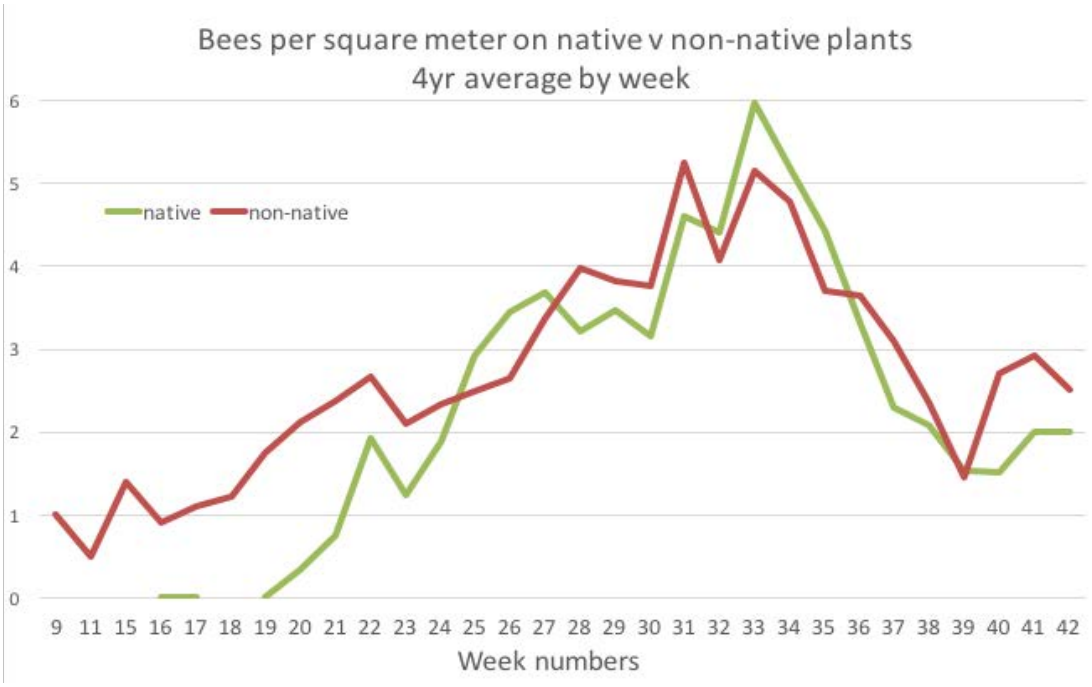

In terms of value to bees, the non-natives extend the food supply season at both ends but in spring, very few bees are flying to benefit until week 18. However those late flowerers are very useful to extend the season while bees are still flying and included *aster novi-belgii, dahlias, cosmos* and *nepeta mussinii*

7. Conclusions from 2017 study

This year's study produced findings that mainly reinforced those of previous years and with new finding. My conclusions are:

- The primary finding is still that plants are not equally attractive to bees, even when you focus on 'bee-friendly' plants and the variation is significant for anyone wanting to maximize the amount of bee-food any area of land can provide.

- Healthy plants with more flowers attract more bees: the old gardeners' adage of 'right plant for the right place' is important, not only for a sustainable garden, but also for the direct impact on the pollinators each plant may support
- Generally native and non-native plants continue to appear equally attractive to bees and, except where some specific bees and plants have a more unique inter-dependency, most bees do not care as long as the plant's structure allows them to reach the nectar or pollen.
- Weather clearly has an impact on both bees and plants but both are also very resilient.
- NEW - It's important to provide a range of different plants to attract both honey bees and wild bees and to limit adverse competition in times of bee-food shortage.

8. Future Research Plans

I originally intended to conduct a 5-year study and next year will be the 5th but several more recently included plants warrant more years of data to provide more robust results.

Specific plans for 2018, if possible, will include:

- Add data for plants that did not mature sufficiently in 2017 to produce meaningful results: *Geraniums* rozanne and magnificum, *cirsium heterodphylum*, valerian, *dahlia* 'bishops children'
- Try to monitor the impact of honey bees on the overall foraging behavior observed.
- Register the rosybee site as a 'Beewalk' transect so that the numbers and species of bee observed can be included in the national data sets.

Honey bee on cosmos in October

Appendix 1 – Ratings for all plants studied in 4 years

Ratings annually					
plant	2017	2016	2015	2014	average
Veronicastrum virginicum	105.0	33.3	69.3	30.0	59.4
Calamint	100.0	81.5	43.2		74.9
Helenium SEF	95.8	77.8	77.4	45.3	74.1
Lavandula eidelweis	95.0	39.2	42.1		58.7
Helenium autumnale	90.0	66.6	110.5	55.8	80.7
Borage (spring germinate	84.0		42.8	57.5	61.4
Origanum onites	80.1				80.1
Sedum spectabile	66.0	26.7	127.2	15.0	58.7
Echinops star frost	66.0	17.0			41.5
Knautea macedonica	61.0	33.6	21.3	14.4	32.6
Eryngium planum	58.0	60.8	22.5	20.0	40.3
Teucrium hircanicum	57.0	52.3	64.2	28.0	50.4
Stachys byzantina	54.2	36.7	53.8		48.2
Agastache foeniculum	52.0	22.0	35.4	17.0	31.6
Malva alcea	50.0				50.0
Echium vulgare	45.0	58.0	75.6	70.0	62.1
Veronica spicata	44.0	39.6	46.9	46.0	44.1
Hyssopus	43.0	31.2	35.6	62.0	43.0
Centaurea scabiosa	43.0		42.0		42.5
Aster novi belgii	41.0	16.0			28.5
Echium blue bedder	40.0		20.1	40.0	33.4
Scabioius columbaria	39.0	16.6	52.9	18.0	31.6
Origanum vulgare	36.0	70.7	67.3	41.7	53.9
Helenium moorheim beau	36.0				36.0
Stachys sylvaticum	36.0	26.9			31.4
Agastache blue boa	36.0	24.0	3.2		21.1
Phacelia OW	36.0	13.3	23.5	46.5	29.8
Nepeta racemosa	35.0	39.7	30.3		35.0
Echinacea purpurea	34.0	14.7	25.7	2.0	19.1
Rudbeckia fulgida	33.3	32.6	27.0	13.0	26.5
Salvia nemorosa	32.0	6.8	23.8	14.0	19.1
Nepeta mussinii	31.7	17.7	22.0	21.0	23.1
Cosmos	31.3		14.0		22.7
Melliot	30.0				30.0
Eryngium giganteum	30.0	24.0	28.5		27.5
Succisa pratensis	28.1	14.0	42.2		28.1
Lavandula grosso	28.0				28.0
Lavandula munstead	26.7	27.2			26.9
Anthemum tinctoria	26.0	12.6			19.3
Dahlia mignon	24.0				24.0
Echinacea white	24.0				24.0
Allium schoenoprasum	24.0	4.0	10.0	4.0	10.5
Rudbeckia speciosa	23.8	20.1	13.2		19.0
Dahlia bishops	22.0				22.0
Geranium pratense	22.0	16.7	12.0	19.0	17.4
Centaurea montana	22.0	9.3	11.8	19.0	15.5
Valerian	20.0				20.0
Cirsium rivulare/heteroph	20.0				20.0
Monarda Jacob Cline	18.7	23.7			21.2
Malva moschata	18.0		20.0	9.0	15.7
Phacelia SG	17.0				17.0
Geranium pheaum	15.0	16.0	18.9		16.6
Cerinthe	14.0				14.0
Allium roseum/unifolium	13.0	5.3	1.0	4.0	5.8
Stachys officianalis	12.0	16.3	19.6		16.0
Scabious japonica	12.0	2.4	5.3		6.6
Verbena bonariensis	11.0	19.2	33.6	33.3	24.3
Erysimum Bowles Mauve	9.3	10.0	46.1	14.1	19.9
Campanula perscifolia	9.3	4.4	4.7	3.0	5.4
Verbascum sixteen candle	9.0				9.0
Buphthalmum	8.0				8.0
Calendula oopsy daisy	8.0				8.0
Pulmonaria	8.0	8.3	5.1		7.2
Geranium macrorrhizum	8.0	6.2	14.4		9.5
Lavandula little lottie	6.7				6.7
Solidago canadensis	6.7	2.0	12.0		6.9
Geranium cantabridgense	6.0	10.0	13.6		9.9
Ageratum	5.3				5.3
Anemone hupehensis	4.0				4.0
Eupatorium	3.0	28.4	36.0		22.5
Digitalis	2.0	9.8	12.0	6.0	7.4
Thymus vulgare	2.0				2.0
Forget me not	2.0		1.8		1.9
Leucanthemum vulgare	2.0	0.8	2.5		1.8
Sweet William	1.0		6.7		3.8
Red Campion	0.0	0.0	0.0	0.0	0.0
Borage (over-wintered)			22.6	22.8	22.7
Knautea arvensis			30.0	14.0	22.0
Lavandula augustifolia			26.4	14.0	20.2
Campanula harebell			23.5	4.0	13.8
Monarda didyma pink			15.8	7.0	11.4
Aster amellus			10.3		10.3
campanula carpatica		10.0			10.0
Centaurea nigra			10.0		10.0
Doronimum caucausicum			13.3	2.0	7.7
Teasel		5.0	9.0		7.0
Lavandula stoechas		5.3	12.9	2.0	6.7
Kniphofia			4.0		4.0
Monarda didyma red			4.0	4.0	4.0
Calendula			5.1	2.0	3.6
Centaurea dealbata		3.4			3.4
Erysimum Winter joy			1.4	4.0	2.7
Cheiranthus cheirii		4.4	1.5	2.0	2.7
Verbascum phoeniceum			3.2	2.0	2.6
Papaver orientale		1.0	2.0	4.0	2.3
Clary sage			2.0		2.0
Centranthus rubra			1.6	1.0	1.3

Rating value = average bees per week x weeks of flowering

Appendix 2

Rosybee species sightings

	Bees	42	common name	Last seer	Plant attracting		Lepidoptera	27	
1	Andrena	flavipes	yellow legged mining	2017	Anthemis	1	Butterfly	Large white	2017
2	Andrena	fucata	painted mining	2017	Nepeta musinii	2	Butterfly	Small white	2017
3	Andrena	cineraria	ashy mining	2017	Anthemis	3	Butterfly	Painted lady	2017
4	Andrena	chrysosceles	hawthorn mining	2017	Hawthorn	4	Butterfly	Small tortoiseshell	2017
5	Andrena	haemorrhoa	orange tailed mining	2017	Rudbeckia	5	Butterfly	Peacock	2017
6	Andrena	scotica	chocolate mining bee	2017	Stachys sylvaticum	6	Butterfly	Comma	2017
7	Andrena	wilkella	wilke's mining	2017	mahonia	7	Butterfly	Small skipper	2017
8	Anthidium	manicaturm	wool carder	2017	Stachys byzantina, sta	8	Butterfly	Brimstone	2017
9	Anthophora	plumipes	hairy footed flower	2017	Pulmonaria	9	Butterfly	Green viened white	2017
10	Anthophora	quadrimaculata	four-banded flower	2017	Stachys byzantina, sta	10	Butterfly	Common blue	2017
11	Apis	mellifera		2017	Numerous	11	Butterfly	Red admiral	2017
12	Bombus	lucorum	white tailed	2017	Numerous	12	Butterfly	Gatekeeper	2017
13	Bombus	terrestris	buff tailed	2017	Numerous	13	Butterfly	Meadow brown	2017
14	Bombus	hortorum	garden	2017	Numerous	14	Butterfly	Small heath	2017
15	Bombus	ruderatus	large garden	2017	Numerous	15	Butterfly	Ringlet	2017
16	Bombus	lapidarius	red tailed	2017	Numerous	16	Butterfly	Marbled white	2017
17	Bombus	hypnorum	tree	2017	Numerous	17	Moth day	Clouded border	2017
18	Bombus	pratorum	early	2017	Numerous	18	Moth day	Burnet	2017
19	Bombus	pascuorum	common carder	2017	Numerous	19	Moth day	Scarlet tiger	2017
20	Bombus	ruderarius	red shanked carder	2017	Numerous	20	Moth day	Red underwing	2017
21	Bombus	rupestris	red tailed cuckoo	2017	Knautea macedonica	21	Moth day	Yellow underwing	2017
22	Bombus	vestalis	vestal/southern cuckoo	2017	Numerous	22	Moth day	Hummingbird hawkmoth	2017
23	Bombus	campestris	Field cuckoo	2017	Numerous	23	Moth day	Mint moths	2017
24	Chelostoma	campanularum	small scissor bee	2017	campanula	24	Moth night	Secaceous hebrew	2017
25	Colletes	hederae	ivy mining	2017	Ivy	25	Moth night	Feathered thorn	2017
26	Colletes	similis		2017	anthemis	26	Moth night	Pale november	2017
27	Colletes	daviesanus		2017	Helenium	27	Moth night	Green brindled crescent	2017
28	Halictus	rubindicus	orange legged furrow	2017		28			
29	Halictus	tumulorum	bronze furrow	2017	Anthemis	29			
30	Hylaeus	communis	common yellow face	2017		30			
31	Hylaeus	confusus	white jawed yellow face	2017	Campanula	31			
32	Hylaeus	dilatatus	chald yellow face	2017					
33	Lasioglossum	calceatum	common furrow	2017	Helenium, eupatorium				
34	Lasioglossum	albipes		2017	Erysimum bowles mauve, helenium				
35	lasioglossum	smeathmanellum		2017	campanula				
36	Megachile	centuncularis		2017	Scabious				
37	Megachile	versicolor		2017	Geraniums, knapwee				
38	Megachile	willughbiella	wollughby's	2017					
39	Nomada	panzeri		2017	Valerian				
40	Nomada	goodeniana	goodens nomad	2017	Geranium				
41	Osmia	bicornis	red mason	2017	Nepeta musinii				
42	Osmia	caerulescens	blue mason	2017	nepeta musinii				

Appendix 3

About Rosi and the nursery

Having been a passionate plantswoman and gardener all my life, in 2010 my husband and I became beekeepers. Naturally, we did a bit of reading about bees and quickly became aware that they appeared to be under threat that they are an essential part of our eco-system and so their health is important stuff.

Well, the horticulturalist in me wanted to know which plants to grow to help the bees. I found lists but not much guidance or many suppliers. So, we have decided to set up our own supply as well as a site for trialing plants to see which the bees seem to like best. That was the beginning of the research we are now publishing.

The nursery has been trading since 2012 and is a source of both plants and advice to meet the growing interest in bees from both gardeners and landowners. The business trades mainly through the website and we sell our plants in trays of 6 or 10 to encourage planting in blocks because that's what the bees prefer.

We pride ourselves on only selling plants that we believe will help gardeners to maximize the support they can give to bees.