Master Gardeners Association of BC

Thompson Shuswap Master Gardeners Association

2017 CITIZEN SCIENCE SUMMARY REPORT

WE GRATEFULLY ACKNOWLEDGE

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Big Little Science Centre

Thompson Rivers University Biology Department

Report written by: Aneka Battel

Acknowledgments

Thompson Shuswap Master Gardeners Association (TSMGA) gratefully acknowledges the TD Friends of the Environment and the City of Kamloops Social Planning Council for their grants that contributed to the success of the Citizen Science Project. Thanks to these grants TSMGA was able to integrate a number of activities throughout the summer that resulted in a highly engaged citizen science community, one that cares for the environment and advocates for pollinators.

Without our amazing Citizen Scientists who did all of the surveys (51 in total!), this project would never have taken place.

TSMGA is very grateful to the Thompson Rivers University biology department who gave us access to a beautiful lab. Accolades go to Dr. Lyn Baldwin, who was highly supportive of the Citizen Science Project. Although a plant biologist, Baldwin grew to love and admire the insect pollinators that interact with the plants that she studies.

Thank you to the Big Little Science Centre for their partnership, the cheerfulness and energy of Susan Hammond and Gord Stewart, and the astute conjuring of a field camp that would embrace TSMGA's pollinator agenda.

TSMGA is very appreciative of the TRU honours student, Aneka Battel's summer work with the Citizen Science Project. Her cheerful generosity and attention to detail moved this project forward.

Thank you to Master Gardener in Training, Jennifer Cook, who volunteered many hours to bring this report alive with her design work.

And finally, a huge thank you to Erin Udal, pollinator conservationist, and Lincoln Best, native bee taxonomist extraordinaire, who were so generous with their talent and knowledge.

Special thanks to all of our citizen scientists:

Charyle Badesso
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FORWARD

On a sunny weekend in early June, Thompson Shuswap Master Gardeners (TSMGA) held a two-day workshop at Thompson Rivers University (TRU) instructed by Erin Udal, a pollinator conservation specialist from Vancouver. Seventeen participants (ten were Master Gardeners) learned about citizen science, how to collect standardized data on bees and other pollinators, the basic biology of native and managed pollinators and how to identify features and habitat requirements of different bee families.

Originally, group surveys were to be held in the Natural Areas of the City of Kamloops and at the BC Wildlife Park. Unfortunately natural disasters transpired; beginning first with heavy rains and flooding followed by drought and wildfires throughout the southern interior. Kamloops Natural Areas Parks were closed to the public & Kamloops became an evacuation centre for the southern interior of BC.

Heavy smoke with the Air Quality Health Index measuring as high as 49 in August (anything over 10 is considered high risk) made pollinator surveys a challenge. Bees orient themselves to the sun to find their way home. Heavy smoke obscured the sun. And, of course, this also became a health issue for participants. Clear days were extremely windy. Small pollinators can't fly in wind.

TSMGA quickly adjusted its initial plan by conducting surveys in two managed parks, with surprising results (see following report). Despite the climatic conditions, Citizen Scientists were mostly successful in surveying their own gardens. As well, TRU student Aneka Battel, who also took part in Udal's training, surveyed and collected data in natural areas congruent to each of the participant's garden. Battel also carried out an audit of plants that pollinators visited in each of the participant's garden, flowering plants in the natural areas and in the two managed parks. Citizen Science participants counted 4,120 pollinators, although it is difficult to ascertain whether this was a true count of pollinator numbers because of less than ideal conditions for completing surveys.

In addition to the Citizen Science pollinator surveys, Master Gardeners partnered with the Big Little Science Centre (BLSC) in a First Nations Youth Camp for 17 children. Their focus was also pollination: providing an observation honeybee hive & activities; visiting the Butterfly Garden on McArthur Island twice; netting, observing & releasing pollinators; and observing floral and bee relationships. Each child built their own nesting box for cavity nesting bees.

Finally, 26 people attended a Master Gardener presentation on building nesting boxes for cavity nesting bees at the October "Friends of the Garden" meeting at Thompson Rivers University.

A quote from Dr. Lyn Baldwin summarizes the feelings of participants regarding this Citizen Science Project:

"For me, this project provided small moments of grace and affirmation during a summer filled with fire and anxiety. Not only did it give a sense of building community between myself and the other citizens, but it also taught me about the non-human inhabitants of my community. I found it deeply reassuring to observe bumblebees foraging on basil in my garden when I couldn't see across the smoky valley. The world was on fire, but life reaffirmed itself. There's an important synergy that develops when I consciously observe both plants and animals at the same time. Rather than focusing on just plants, I am inherently observing the connections that exist between those bound in community. My garden is forever changed for me.

There is no shortage of environmental issues to worry about today—many of which I feel helpless to change. Monitoring the pollinators in my own yard gave me a chance to act—even if it was only in collecting data. Everyone recognizes that pollinators are important, yet few of us grant them much time. Within this project, our group paid attention to the pollinators of our home and it felt like ***we might save the world, one garden at a time."***

From qualitative interviews with Citizen Science participants, the following points became clear:

1. All participants want to learn more and delve deeper into the taxonomy of native bees. Master Gardeners felt that they did not have enough knowledge to lead future surveys on their own. To that end, in partnership with TRU Biological Sciences, TSMGA is organizing a 2 -day taxonomy course in April, 2018.

2. Participants also wanted much more field experience with knowledgeable people. This is difficult to achieve because of the expense of bringing people to Kamloops. However, one Master Gardener who has taken bee taxonomy courses in the past has offered to take future participants on observational walks in Peterson Creek Park.

3. Participants were not completely happy with the Environmental Youth Alliance booklet on Pollinator Identification and wanted something that was more Kamloops oriented. A small pocket brochure with photographs of bees that we would commonly see here is proposed. This brochure could be used as an educational tool for future surveys, presentations with the Big Little Science Centre, school presentations & for the general public. It will be an excellent resource along with TSMGA's *Gardening for Pollinators* brochure that has successfully been used in our city for educational purposes.

4. Participants felt that another survey under better conditions needs to be undertaken to gain a more accurate baseline for pollinator abundance and diversity for urban spaces in Kamloops.

5. Most importantly, all participants felt that the City of Kamloops needs to step up and take more interest in pollinators and do more to support them. Suggestions were: take the Citizen Science Project seriously & support it monetarily; plant more pollinator friendly plants within the city; plant pollinator corridors (pollinators need flyways throughout the city); enhance ground nesting sites & place managed nesting boxes for cavity nesting bees throughout the city; give incentives to citizens for pollinating friendly gardens (e.g. Lower taxes for people who put in pollinator gardens. Give away coupons for pollinator friendly plants); use signage to identity various pollinators; and most importantly – spread the message. Kamloops then would be a truly sustainable pollinator friendly city that advances local food security.

Elaine Sedgman

Thompson Shuswap Master Gardeners
Citizen Science Project Co-ordinator

SUMMARY OF SURVEY METHODS

In order to determine factors impacting pollinators in Kamloops, BC, citizen scientists surveyed gardens, non-cultivated areas, and city parks for pollinator abundance, flowering plants, and possible nesting sites. Each citizen scientist attended a two-day training session led by Erin Udal, pollinator conservationist, which included learning the basic biology of native and managed pollinators in field and laboratory settings. The primary focus of the training session was for participants to learn how to identify pollinators to one of seven pollinator "guilds". These guilds included: bumble bees, hairy belly bees, mining bees, honey bees, wasps, flies, and other (butterflies, beetles, any insect that may transfer pollen).

Each survey lasted a duration of 20 minutes with the goal of recording as many pollinators on open flowers as possible. The individual surveys took place in the first two weeks of June, July, August, and September. To account for the influence of weather on survey results, we asked citizen scientists to survey, as much as possible, only when the following conditions were met: air temperature between 15°C and 35 °C, wind speed under 5km/h, and minimal cloud cover (on scale from 0-5, with 5 being total overcast). Wind speeds above 5 km/h can inhibit flight for certain types of pollinators and heavy cloud cover or smoke influence pollinator orientation by obscuring the sun. In addition to recording pollinator guild abundance, each citizen scientist was also asked to record the dominant plants flowering at the time of the survey and any potential nesting habitats observed, as well as the weather conditions during the survey.

Two city parks (Riverside Park and McArthur Island Park Butterfly and Xeriscape Gardens) were surveyed once for pollinator abundance by groups of citizen scientists. Riverside Park was surveyed on July 15, 2017, with 10 citizen scientist participating in the survey. McArthur Island was surveyed on July 29, 2017, with 9 citizen scientists participating. Each participant was allocated a discrete area for their survey and surveys followed the same protocol outlined above.

Pollinator guild abundance in non-cultivated, natural areas were surveyed by Aneka Battel, a Thompson Rivers University research student, as part of her undergraduate Honors Thesis. In order to compare pollinator abundance in non-cultivated natural areas with the home gardens of the citizen scientists, each home garden was paired with a nearby uncultivated natural area. Natural areas were surveyed for 20 minutes within a standard area of 17 m x 40 m (the typical lot size found in downtown Kamloops) to be as comparable as possible with cultivated home gardens.

In addition to pollinator surveys, a complete inventory of all flowering plant genera was conducted for each natural, non-cultivated and cultivated survey site. Garden inventories were completed in the company of the citizen scientist; non-cultivated natural area surveys were completed by Aneka Battel with field crew (C. Reith and A. Hajdasz) assistance.

SUMMARY OF FINDINGS

Summing across group, citizen scientist and student surveys, this project resulted in the observation of 4,120 pollinators within Kamloops from June-September of 2017. However, pollinator abundance varied between survey months and between habitats (cultivated gardens versus non-cultivated natural areas).

Individual Survey Results

Table 1. Summary of cultivated garden survey effort from June-September 2017, including number of surveys conducted during each month, total number of pollinators observed, and average temperature, cloud cover, and wind speed during surveys.

Survey Month	Number of Surveys completed	Average number of pollinators observed (per survey)	Average weather conditions
June	11	23	22°C, cloud cover 2, wind speed 10km/h
July	13	49	27°C, smoke, wind speed 7km/h
August	13	75	26°C, smoke, wind speed 5km/h
September	13	51	23°C, cloud cover 2, wind speed 13km/h

Table 2. Summary of non-cultivated area survey effort from June-September 2017, including number of surveys conducted during each month, total number of pollinators observed, and average temperature, cloud cover, and wind speed during each survey.

Survey Month	Number of Surveys completed	Average number of pollinators observed (per survey)	Average weather conditions
June	11	21	24°C, cloud cover 2, wind speed 12km/h
July	11	22	28°C, smoke, wind speed 6km/h
August	11	9	23°C, smoke, wind speed 6km/h
September	11	28	30°C, cloud cover 0, wind speed 5km/h

During garden surveys, the number of pollinators observed per survey steadily increased from June to August, followed by a reduction in September (Figure 1). Factors that could have influenced pollinator abundance include: suitability of available floral resources, weather conditions (including increased air temperatures), as well as increased observation skills of participants. It is unlikely that survey effort influenced the results as the number of surveys remained relatively constant throughout the summer (Figure 1). However, it should be noted that the abundance of pollinators in garden surveys peaked just as the abundance of pollinators dramatically declined in uncultivated natural area surveys (Figure 2). The synchrony of the increase in pollinator abundance in cultivated area with the decrease in pollinator abundance found in non-cultivated areas suggests that certain pollinators could be using gardens as refuges, especially in August when seasonal drought limits the abundance of native species flowering in natural areas.

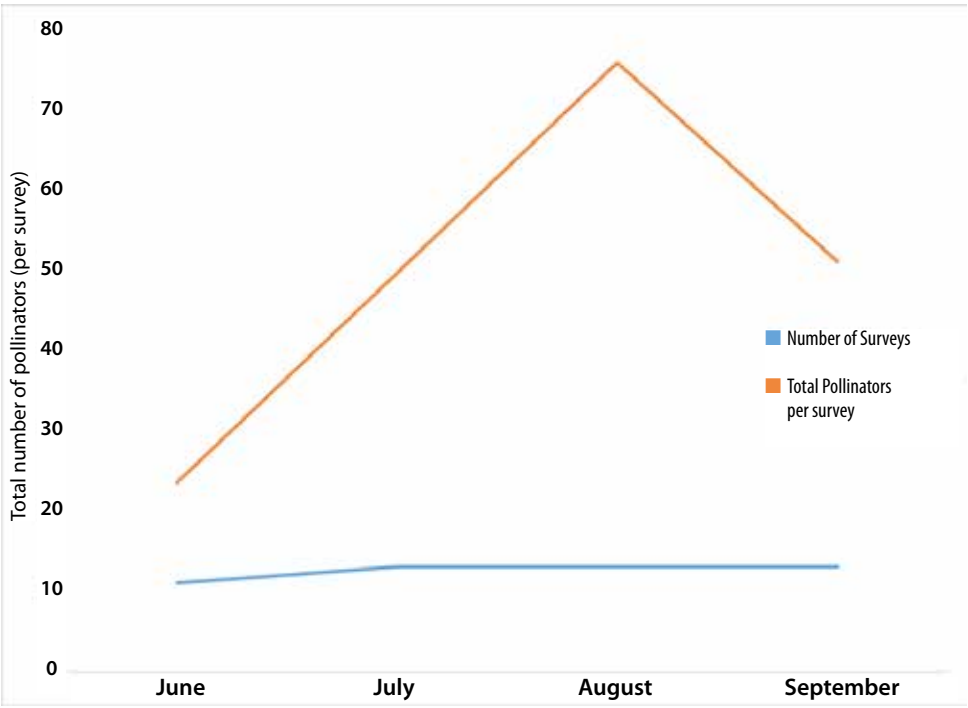


Figure 1. Number of surveys conducted and total pollinator abundance per survey in gardens in June, July, August, and September 2017.

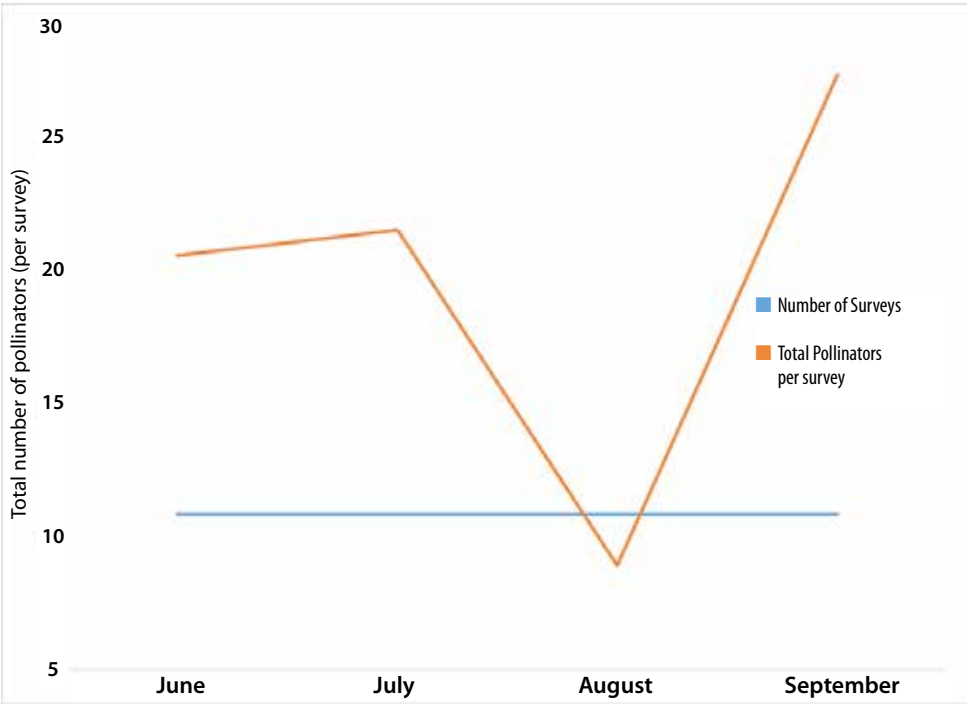


Figure 2. Number of surveys conducted and total pollinator abundance per survey in non-cultivated areas in June, July, August, and September 2017.

Furthermore, the results of this project also strongly indicate that the seasonal abundance of individual pollinator guilds in Kamloops varies by season and habitat (cultivated versus non-cultivated). In cultivated areas, the abundance of bumble bees, honey bees, and mining bees (as measured by the number of individuals observed per survey) make up the majority of pollinators observed and the remaining four guild types (hairy belly bees, flies, wasps, and other) each make up less than 12% of pollinators observed each month (Figure 3). In addition, the abundance of honey bees, mining bees and bumble bees (as measured by the number of individuals observed per survey) jumped dramatically in August in cultivated areas while the other four guilds did not (Figure 4).

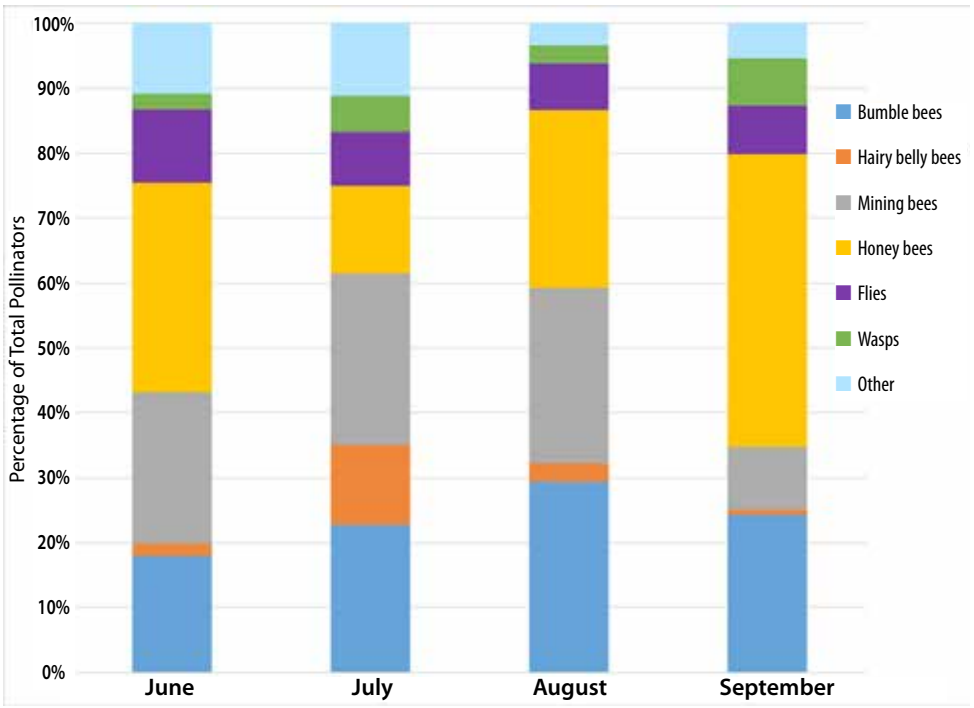


Figure 3. Pollinator guild composition from garden surveys in June, July, August, and September.

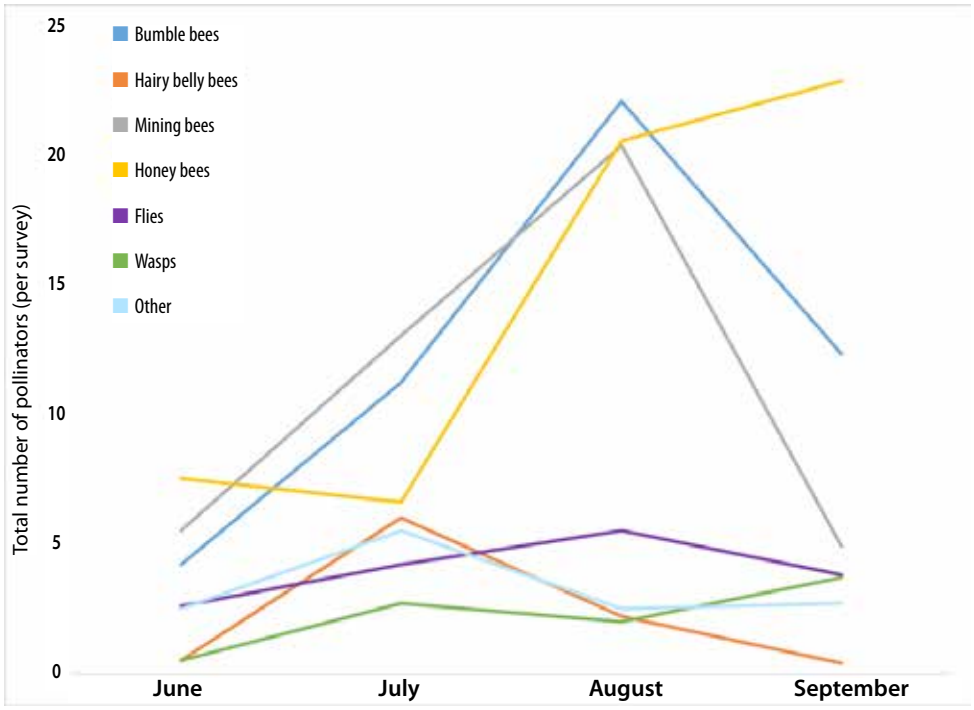


Figure 4. Total number of pollinators per survey belonging to each pollinator guild from garden surveys in June, July, August, and September.

In comparison, the abundance and seasonal occurrence of pollinator abundance in non-cultivated areas in Kamloops was very different than that observed in cultivated gardens. First, mining bees and wasps were the most abundant guilds (as measured by the number of individuals observed per survey, Figure 5). Within these surveys, hairy belly bees and bumble bees had the lowest abundance, each totaling less than 9% of the pollinators observed per survey. Seasonally the abundance of all guilds (except bumble bees and flies) exhibited a dramatic decline in August before rebounding in September (except bumble bees and wasps, Figure 6). In particular, the September abundance of honey bees far exceeded that observed earlier in the year in non-cultivated, natural areas. Honey bees in non-cultivated areas appeared to be foraging primarily on rabbit brush, (Chrysothamnus nauseosus) that was in abundant flower during September (A. Battel, pers. comm.).

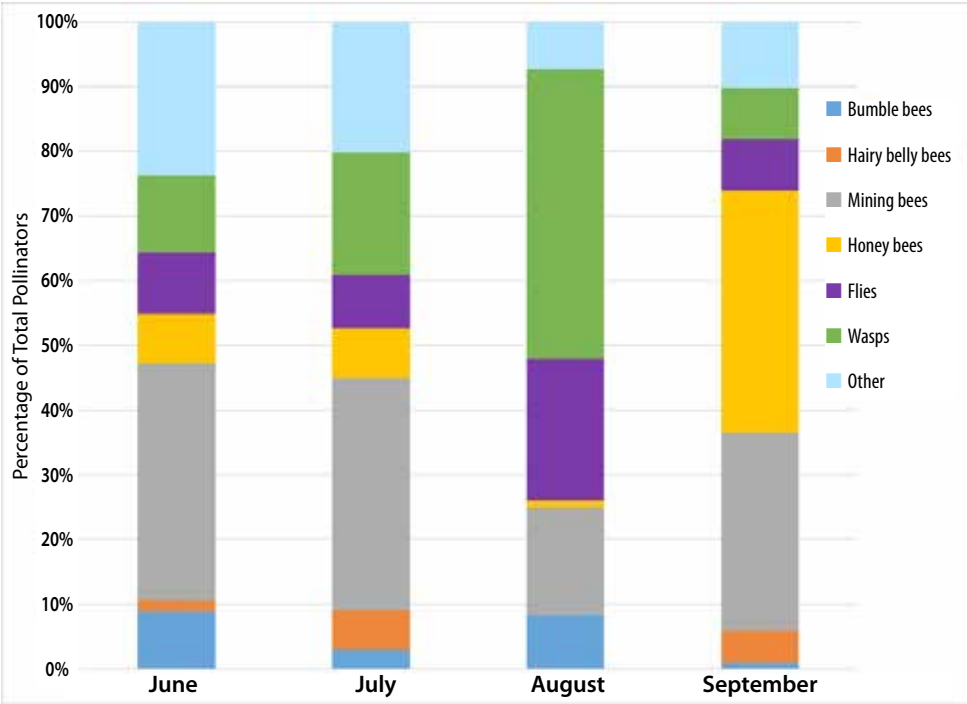


Figure 5. Pollinator guild composition from non-cultivated surveys in June, July, August, and September.

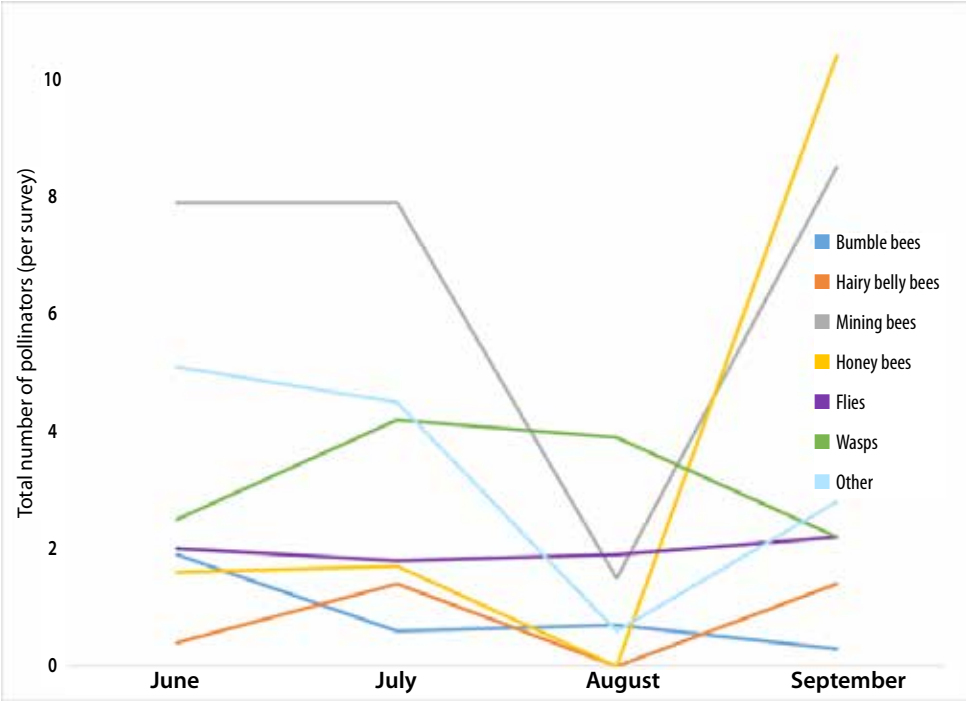
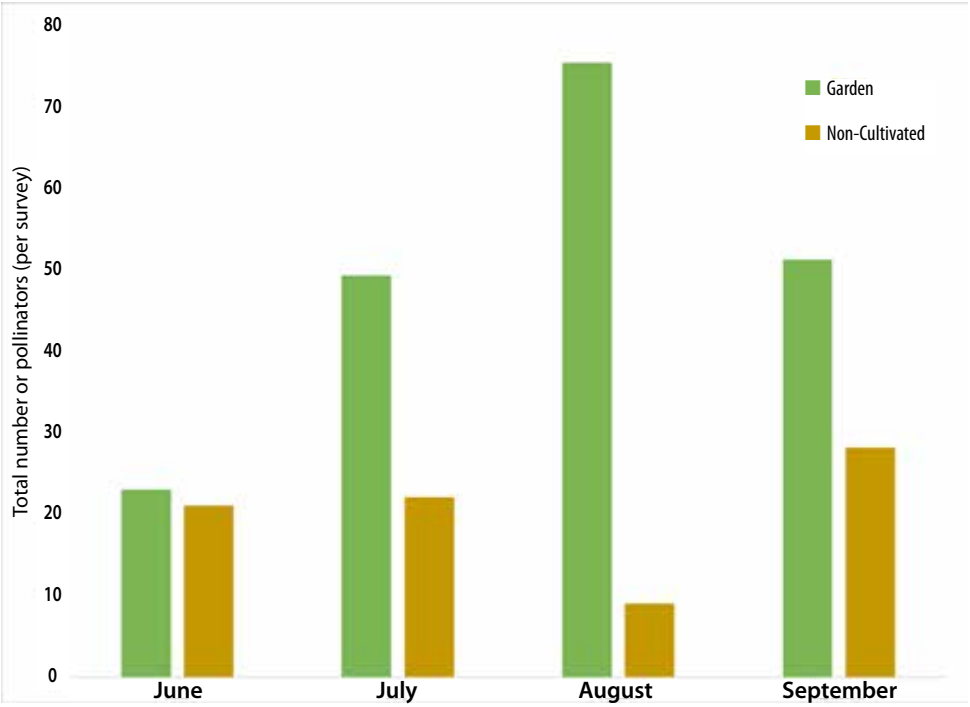


Figure 6. Total number of pollinators per survey belonging to each pollinator guild from non-cultivated surveys in June, July, August, and September.

Not only did the natural and cultivated surveys indicate important differences in pollinator guild abundance and seasonal variation, but the total abundance of pollinators differed. In each month, total number of pollinators observed per survey was greater in cultivated gardens than non-cultivated areas (Figure 7), although the only months that had statistically significant differences were July (paired t-test, p=0.037) and August (paired t-test, p=0.049). Based on the seasonal trends observed in different pollinator guilds in cultivated and non-cultivated areas, it is very possible that the increase in pollinator abundance in gardens was largely driven by the large increase in bumble bees, mining bees, and honey bees in gardens at this time (Figure 4).

Figure 7. Comparison of total number of pollinators per survey in gardens vs non-cultivated areas in June, July, August, and September.



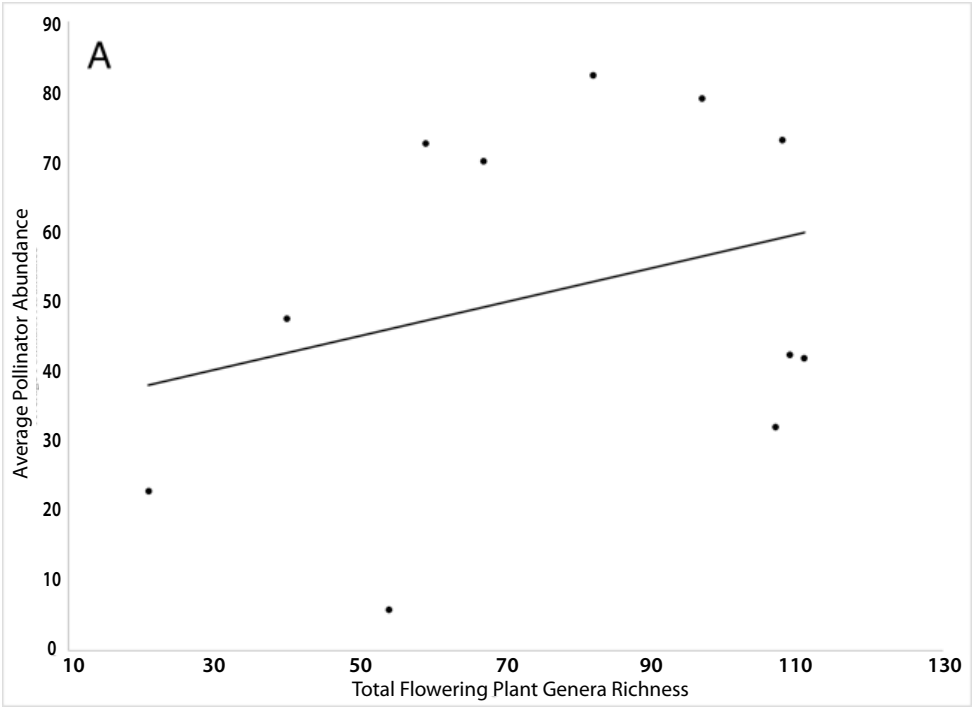
Although these result suggest an important role for gardens in maintaining pollinator diversity within the city of Kamloops, this project also makes clear that cultivated gardens are supporting certain guilds of pollinators (honey bees, bumble bees, and mining bees) more than others. Many bee species, as well as other pollinators, are known specialists that require specific host plants (1). Certainly, in this project, there was a relationship between the number of flowering plant genera at each site and average abundance of pollinators observed in cultivated gardens (Figure 8A) but not in non-cultivated, natural areas (Figure 8B). A similar study done in 2016 in Vancouver parks by the Environmental Youth Alliance yielded results that coincide with the data analyzed from garden surveys. They also found that a higher richness of flowering plants resulted in higher pollinator abundance (2).

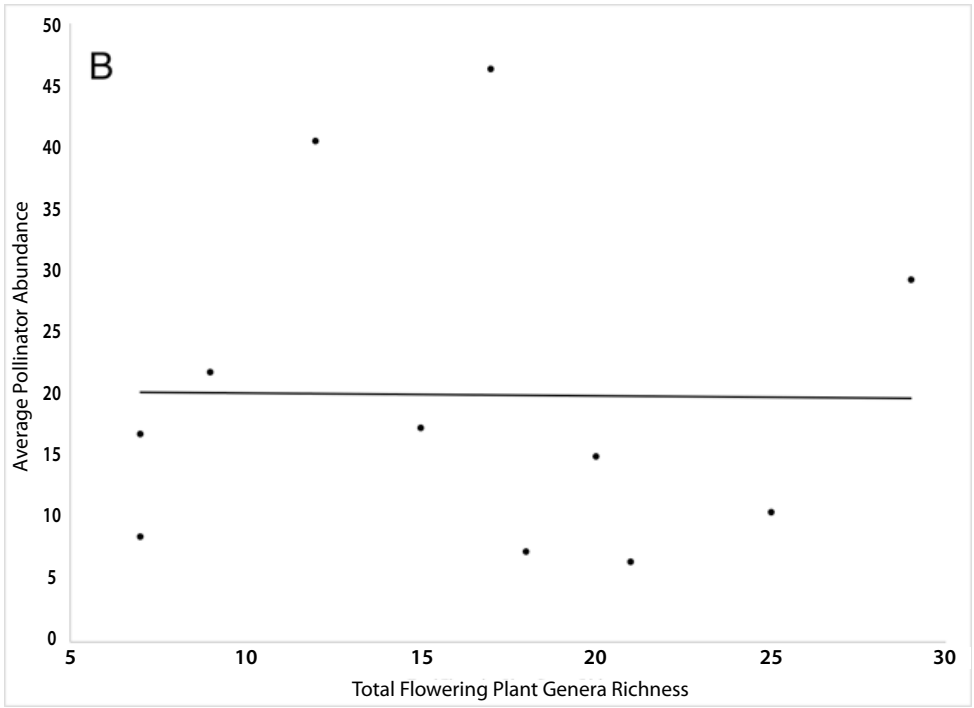
These results suggest that high flowering plant genera diversity is important in gardens for pollinator abundance. For example, the garden with the lowest diversity of flowering plant genera (21 genera) had an average pollinator abundance of 20.8 pollinators. The garden with the highest diversity of flowering plant genera (111 genera) had a much higher average pollinator abundance of 41.8 pollinators. Dominant flowering plant genera observed in gardens and non-cultivated natural areas are outlined in Table 3.

	Garden Dominant Flowering Plant Genera	Non-Cultivated Dominant Flowering Plant Genera
June	*Cotinus, Geranium, Rosa, Solanum, Delphinium, Campanula, Nepeta, Aquilegia, Tanacetum, Rubus, Philadelphus, Cerastium, Aster, Lobelia, Papaver, Lupinus, Lamium, Potentilla, Trifolium, Paeonia, Salvia, Tagetes, Antirrhinum, Achillea, Iris, Verbena, Lonicera, Tilia, Sedum, Spirea, Lavandula, Lappula, Taraxecum*	*Achillea, Heuchera, Astragalus, Tragopogon, Crepis, Delphinium, Rosa, Erigeron, Arnica, Eriogonum, Medicago, Sisymbrium, Lappula, Lithospermum, Descurainia, Linaria, Gaillardia, Melilotus, Silene, Calochortus, Opuntia, Grindelia, Cirsium, Monarda, Ipomoea*
July	*Nepeta, Citrus, Origanum, Leucanthemum, Campanula, Sedum, Solanum, Perovskia, Hosta, Antirrhinum, Weigela, Echinacea, Campsis, Iberis, Salvia, Papaver, Tilia, Cosmos, Hemerocallis, Cucurbita, Coridalys, Stachys, Heuchera, Coreopsis, Clematis, Alyssum, Alchemilla, Geranium, Rosa, Lythrum, Viola, Fragaria, Lavandula, Calendula, Lonicera, Petunia, Impatiens, Rudbeckia, Lobelia, Monarda, Helianthus, Eryngium, Borago, Potentilla, Trifolium, Alcea, Tagetes, Achillea, Verbena, Lamium, Gaillardia, Dianthus, Physalis, Spirea, Euphorbia, Calluna, Ajuga, Dicentra, Erigeron, Centaurea, Viola, Symphoricarpos, Linum, Tanacetum, Vinca, Phlox*	*Crepis, Calochortus, Eriogonum, Achillea, Erigeron, Medicago, Centaurea, Sisymbrium, Descurainia, Lappula, Astragalus, Chrysothamnus, Melilotus, Ipomoea, Cirsium, Grindelia, Linaria*
August	*Mentha, Solidago, Symphoricarpos, Hydrangea, Rudbeckia, Perovskia, Echinacea, Salvia, Lobelia, Ocimum, Cosmos, Heliopsis, Echinops, Geranium, Origanum, Nepeta, Hemerocallis, Rosa, Melissa, Anethum, Monarda, Helianthus, Tanacetum, Alcea, Tagetes, Liatris, Phlox, Coreopsis, Asclepias, Campanula, Alyssum, Vinca, Crocosmia, Lavandula, Solanum, Trifolium, Cucurbita, Lamium, Fragaria, Gaillardia, Antirrhinum, Verbena, Physalis, Centaurea, Zinnia, Calendula, Dianthus, Gazania, Eutrochium, Impatiens, Potentilla*	*Centaurea, Grindelia, Medicago, Chrysothamnus, Sisymbrium, Lactuca, Tragopogon, Centaurea, Solidago, Descurainia, Melilotus, Cirsium*
September	*Eupatorium, Mentha, Aster, Alyssum, Hydrangea, Origanum, Sedum, Helianthis, Perovskia, Symphoricarpos, Clematis, Antirrhinum, Echinacea, Ocimum, Rudbeckia, Achillea, Coreopsis, Gaillardia, Heliopsis, Cimicifuga, Geranium, Cosmos, Solanum, Monarda, Tagetes, Alcea, Delphinium, Veronica, Osteospermum, Lobelia, Gypsophila, Campanula, Nepeta, Phlox, Liatris, Indigofera, Crocosmia, Brassica, Cynara, Anemone, Myosotis, Thymus, Penstemon, Potentilla, Weigela, Mandevilla, Chrysothamnus, Fushia, Papaver, Calendula, Campanula*	*Chrysothamnus, Solidago, Grindelia, Medicago, Sisymbrium*

Table 3. Dominant flowering plant genera recorded during each month in gardens and non-cultivated natural areas.

Figure 8. Number of flowering plant genera recorded as compared to average pollinator abundance from June-September in cultivated gardens (A) and non-cultivated, natural sites (B).





In short, increasing the diversity of plants in cultivated gardens was correlated with increased pollinator abundance but the same was not true for non-cultivated natural areas. One explanation for this difference could be that non-cultivated natural areas in Kamloops are supporting more specialist than generalist pollinator species. For specialist pollinators, it is not the number but the specific identity of floral resources that matters (1). Although preliminary, these results suggest that protecting pollinator diversity within the city of Kamloops needs to be a multi-pronged approach that encourages the cultivation of pollinator-friendly gardens (preferably that include some native, pollinator-host plants) as well as the ongoing protection and enhancement of the city's natural areas that already support important pollinator host plants. Certainly, the results of the group surveys indicate that the public gardens of Kamloops support different pollinator guild abundances (see next section).

Group Survey Results

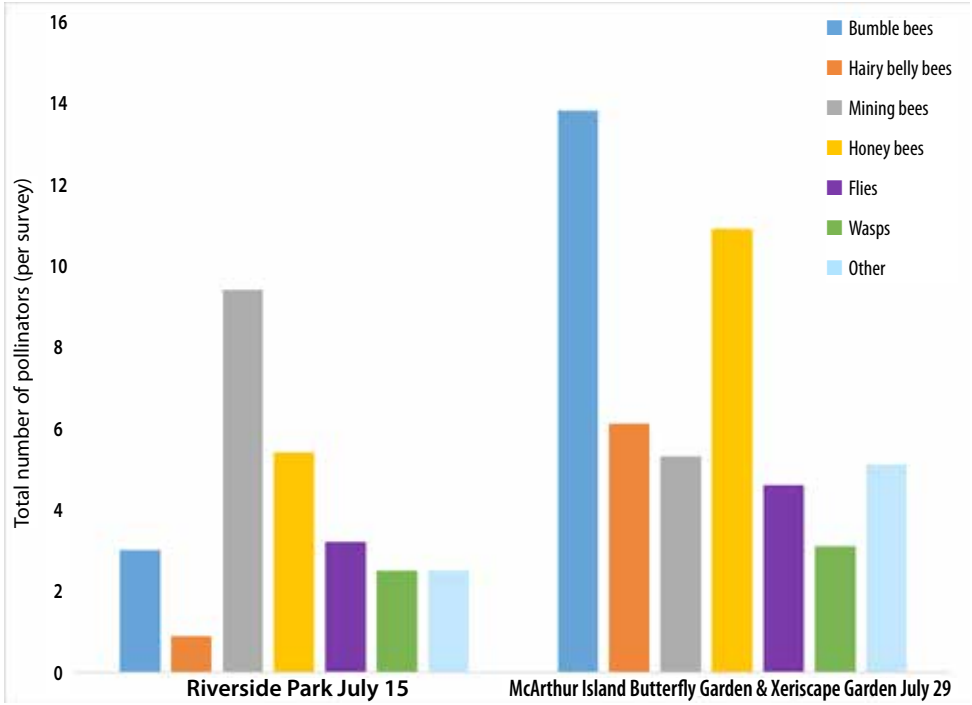
Of the two surveys conducted, McArthur Island Butterfly Garden & Xeriscape Garden had a higher total pollinator abundance per survey than Riverside Park (Table 4). The abundance of mining bees per survey, however, was lower in McArthur Island than in Riverside Park (Figure 10).

Survey Date & Time	Survey Location	Number of participants	Average number of pollinators observed (per participant)	Flowering plant genera richness (per survey)	Weather conditions
July 15, 2017 10:00AM	Riverside Park	10	27	3	25°C, cloud cover 1, wind speed 5km/h
July 29, 2017 10:00AM	McArthur Island Park Butterfly Garden & Xeriscape Garden	9	49	2	30°C, cloud cover 0, wind speed 0km/h

Table 4. Summary of group survey results from two group surveys: Riverside Park and McArthur Island Park Butterfly Garden and Xeriscape Garden. These results include number of surveys conducted during each group survey, total number of pollinators observed per survey, richness of genera listed by each participant during survey, and temperature, cloud cover, and wind temperature during each group survey.

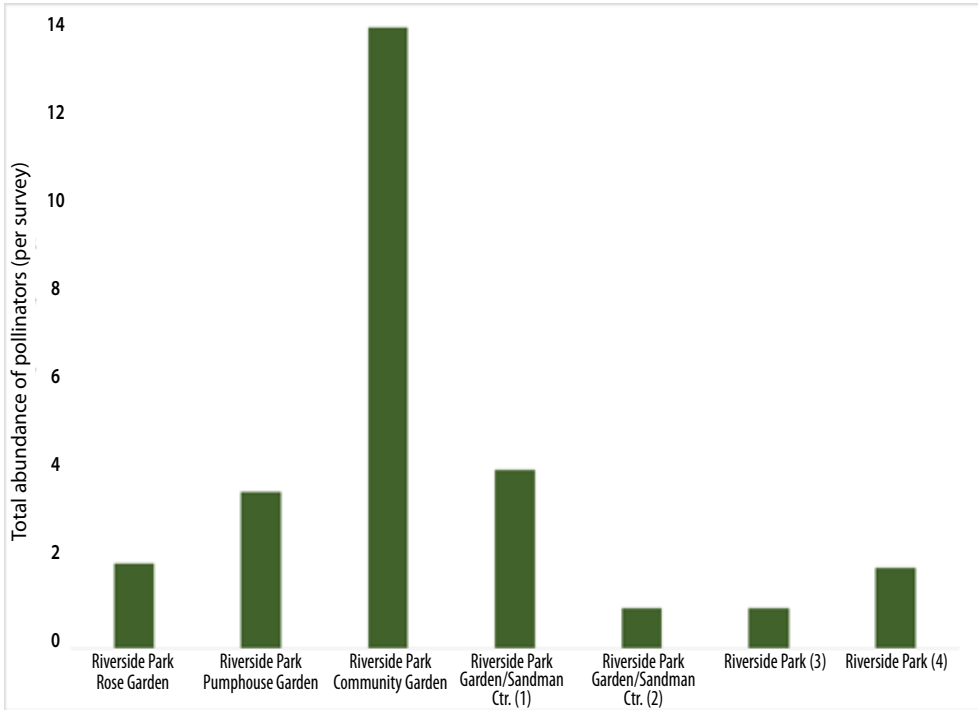
Figure 9. Map of two group survey spots: Riverside Park and McArthur Island Park Butterfly Garden and Xeriscape Garden in Kamloops, BC.

Figure 10. Total number of pollinators per survey belonging to each pollinator guild from group surveys conducted at Riverside Park and McArthur Island Butterfly Garden & Xeriscape Garden in the month of July.



Although Riverside Park contained a higher flowering plant genera richness per survey, this site exhibited a lower pollinator abundance per survey. This is likely due to the types of flowering plant genera found at Riverside Park. In particular, gardens within Riverside Park planted with *Petunia, Hemerocallis, Spirea*, and double-flowered *Rosa* supported relatively low pollinator abundance. In comparison, the community garden at Riverside Park had a higher pollinator abundance than the rest of the park (Figure 11). This may be because the community garden contained more pollinator-friendly flowering plant genera such as: *Cucurbita, Tagetes, Allium, Geranium, Origanum, Brassica, Fragaria, Anethum, Coriandrum, Helianthus, Cosmos, Borago and Solanum.*

Figure 11. Total pollinator abundance per survey observed at each survey area of Riverside Park group survey.



▲ *Although pollinator abundance was very low in the rose garden, surveyors found a digger bee nesting site. One female had covered her tunnel entrance with a rose petal.*

In comparison, although McArthur Island Butterfly & Xeriscape Gardens contained fewer flowering plant genera than the areas surveyed at Riverside Park, the McArthur Island gardens contained many more pollinator-friendly plants: *Helianthus, Amaranthus, Tagetes, Campanula, Alcea, Limonium latifolia, Aster, Coreopsis, Scabiosa, Geranium, Borago, Circium, Echniacea, Asclepias, and Heliopsis.* Presence of these flowering plant genera helped support the higher abundance of pollinators observed at McArthur Island as compared to Riverside Park.

At Riverside Park, mining bees were the most abundant pollinators observed (35%), whereas at McArthur Island Park, bumble bees (28%) and honey bees (22%) made up the majority of total pollinators. The pollinator guilds with the lowest abundance also differed between the two parks (Riverside, hairy belly bees (3%); McArthur Island, wasps (6%, Figure 12).

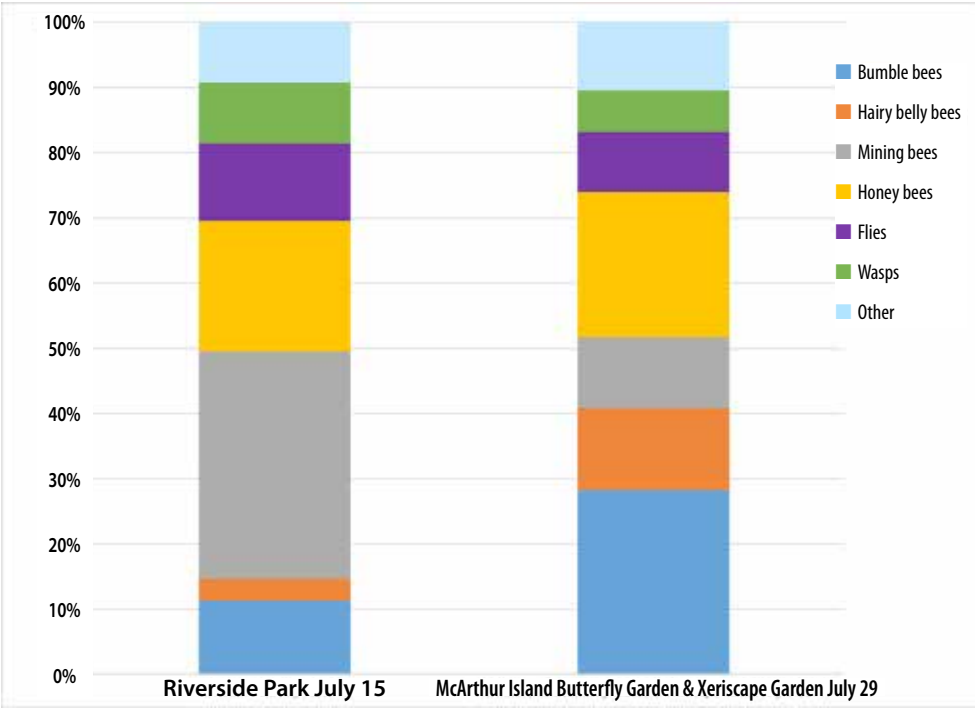


Figure 12. Pollinator guild composition from group surveys conducted at Riverside Park and McArthur Island Butterfly Garden & Xeriscape Garden in the month of July.

In all private gardens, natural area and city park surveys, hairy belly bees had extremely low abundance. Their total abundance per survey slightly peaked during July in garden and non-cultivated areas, although they made up no more than 12% of pollinators each month and made up no more than 13% of pollinators in the group surveys. Hairy belly bees are cavity nesting bees and are often limited by appropriate nesting sites, especially in urban areas. The abundance of this guild could be potentially increased if artificial nest boxes were installed in parks and gardens.

CONCLUSION

This project – which represents an important community collaboration between citizen scientists of the Thompson-Shuswap Master Gardeners, Thompson Rivers University, and Big Little Science Center – has provided important data regarding the abundance of pollinators in Kamloops during the summer of 2017.

A total of 4,120 pollinators were observed during 113 surveys. The data collected indicate that while flower-diverse, cultivated gardens may provide important habitat for pollinators (especially during August), these cultivated gardens likely support different pollinators than non-cultivated natural areas. Ultimately, supporting pollinator populations within the city of Kamloops will rely upon the following:

a. Continuing to promote (and plant) bee-friendly gardens throughout Kamloops.

b. Cultivating the awareness of native pollinator-host plants within cultivated areas.

c. Identifying and protecting existing populations of pollinator-host plants within existing natural areas.

d. Providing nesting sites for cavity nesting bees (hairy belly bees).

With the support of TD Bank, the City of Kamloops, and partners, we may be able to help protect pollinators by providing the public with knowledge and awareness about pollinators in Kamloops. Future plans include annual survey repeats and extending the survey period from May to September to further determine seasonal trends in pollinator guilds and abundance.

Literature Cited:

1. Aigner P. 2001. Optimality modeling and fitness trade-offs: when should plants become pollinator specialists?. Oikos 95:177-184

2. Wray J, Udal E. 2016. Citizen Science Monitoring Summary Report. Vancouver, BC: Environmental Youth Alliance. [accessed 2017 Feb 13]. http://eya.ca/wp-content/uploads/2016/09/Final_report.pdf

SURVEY SHEET

Pollinator Monitoring Survey

Summer 2017

Name: _____

Date: _____

Location: _____

WIND: _____ (km/h)

TEMP: _____ (ºC)

CLOUD COVER: _____ (scale 0 - 5. 0 = clear, 5 = full haze)

A pollinator monitoring event with Citizen Scientists in an opportunistic survey of the insects present at a given location, observed in a short time frame by a number of participants. The goal is to record as much accurate data as possible, within a 20 minute timeframe. The individual data will be totaled to assess what kinds of pollinators are supported by this location, and what is lacking. From this, the community can make decisions on what kind of flowers and nesting provision they may want to include in their green space plans on site.

SURVEY SPOT	
Bumblebees	
Hairy belly bees	
Mining bees	
Flies	
Wasps	
Others	

Pollinator photos taken? Yes ☐ No ☐

Designed by Erin Udal

Other Observations?

Nesting spots, local climate differences, landscape features, special sightings.

Plant Observations:

Types of plants. Common names OK, include shape and diameter of flower: may also include colour, smell, estimate of number of flowers in patch.

Designed by Erin Udal

Thank you to our Photographers

Aneka Battel

Cover – top right & centre left
Page 15
Page 17 left

Elaine Sedgman

Cover – top left & bottom
Page 4 both
Page 5 both
Page 7 both
Page 8 right
Page 17 right
Page 18 both

Erin Udal

Cover – centre right
Page 8 left

Sherry Bennett

Cover – centre right
Acknowledgments
Page 6

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