

Planning For Urban Pollinators

A Best Practices guide to conserving native bees in cities



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A BEST PRACTICES GUIDE TO CONSERVING NATIVE BEES IN CITIES

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This project is part of an initiative to increase public awareness on the state of Native Bees, and provide resources and tools for urban communities to coexist with and support Native Bee populations.

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INTRODUCTION

This best practices guide is intended to inform people working to conserve habitat of native bees in urban settings. This may include individuals or organizations, and be a resource for community gardeners, private landowners, urban planners, and stakeholders working in environmental policy and strategy outcomes.

In the spring of 2012, EYA received funding from the Real Estate Foundation of BC to examine and report on the role of pollinators in cities, and how to support their populations in urban landscapes. Much reporting has been documented on the importance of pollinators to people and some excellent books exist on how to help bees. This report intends to avoid repeating other documents, yet provides a breadth of introductory information to fulfill the reader's understanding of our recommendations.

Cities implicate their own sets of "rules" due to different landscape features that can be examined under the lens of urban ecology, as well as the social constraints that make the abilities of community involvement and decision-making different from other focuses of conservation. This guide intends to take a practical approach to identify the specialized complications and benefits of promoting pollinator conservation in an urban environment, while still acknowledging general and highly useful tips and tools to plan for pollinators from other resources.

The focus of conservation in this report rests with native bee conservation initiatives. Although honeybees are included, this document is not intended to inform on the role of honeybees in cities, as honeybees are a non-native species of bee and require human management to survive. The logistical aspects of honeybee conservation involve social, political and environmental considerations outside the scope of this report.

During the spring and summer seasons of 2012 and 2013, EYA conducted a research project to examine how pollinator habitat enhancement impacts bee populations. The outcomes of this study are presented as a case study within the report. Methods for this are examined for this report in the index. Research was conducted in Vancouver, British Columbia and we hope that these findings may be used as a resource to other municipalities and cities and guide future bee habitat initiatives.

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WHY PLAN FOR POLLINATORS

Environmental Planning in cities is an important part of utilizing what landscapes provide for human needs and understanding the boundaries in which urban centers operate. As cities become more developed, the service of pollination is often not a priority for planners, as we do not consider there may be benefit from our investment in pollination in urban spaces, or believe there is adequate supply of pollinators for the requirements of pollination in these landscapes.

However, there has been a growing community in many cities around the world, making effort to bring food production literally into our backyards. The decline of the honeybee has earmarked the impact of their services to agriculture, and any interest in local food security and sustainability should consider the importance of pollinator conservation in urban settings. Community gardens, private backyards, and even urban farms are sprouting in urban areas, sometimes in very pollinator unfriendly landscapes. There are also environmental efforts underway to conserve native species. Conservation initiatives to reestablish native pollinators will contribute to protecting native plant communities in cities.

WHAT IS A POLLINATOR

Pollinators are classified as a group of organisms that perform the task of transferring pollen, the male reproductive plant material, from one plant to another. This act facilitates the sexual reproduction of plants, which is important for maintaining their genetic diversity to carry on plant generations for the following year, which they produce in the form of seeds, berries, and fruits. Pollinators worldwide are estimated to produce seeds for 60-70% of all flowering plants (19). Many animals perform this task including butterflies, birds, bats, flies, some wasps, and beetles. Above all, bees are responsible for the vast majority of animal pollination of plants.

WHY ARE BEES IMPORTANT POLLINATORS

All pollinators in the groups listed above eat nectar, and in doing so they pick up pollen inadvertently on their body, which is then transferred to the next flower that is visited. Bees, however, are the only group that actively collects pollen for food in specialized hairs on their body, making pollination by bees very effective and efficient. While many other pollinators specialize on certain flowering plants such as butterflies and hummingbirds, most bees are generalists, making them the most widespread group of pollinators. For these reasons, bees are the focus of pollinator conservation in this report, as their populations stand to make the greatest impact on pollination services. Approximately one third of the food crops we eat require a pollinator (6). On top of being vital to many of the food crops we produce, bees are important members of the ecosystems in which they live. Bees are often considered “keystone species”, meaning that they are a key indicator to the overall health of an ecosystem. Bees have a direct mutual relationship with plant populations, and they also occupy many niches. This

means that if there is high biodiversity and abundance of bees, that we can predict that there will be high biodiversity and abundance of other organisms within that ecotype.



WHAT IS A BEE

Bees are in the hymenoptera family, with their closest relatives being wasps and ants. Bees are insects, and often characterized by their two sets of wings and hair-like fuzz on their bodies called setae. There are over 20,000 species of bees worldwide (6), with approximately 450 species in British Columbia, Canada. Bees are a very diverse group, varying physically in size by many orders of magnitude, a range of colours, and many unique and specialized body features (19). Bees have developed a myriad of nesting options and specialized homemaking abilities. Different species of bees have a variety of lifespans. The social behaviour of bees fit anywhere on the spectrum of eusocial (the highest order of social behavior in organisms) like the honeybee, to solitary lives like many ground nesting bees.

Honeybees vs Native bees

Honeybees are the most commonly recognized bee and more highly researched and understood than all other bees. In North America, the honeybee is *Apis mellifera*, originally from Europe and brought over by settlers. Honeybees need human management to survive, and live in beehives called “Supers” of which there are multiple styles used by beekeepers. Honeybees are the only bees in North America that can produce honey for human use and consumption. A healthy colony may contain as many as 50,000 bees at one time. Other bee colonies in North America reach nowhere near these numbers, and Honeybees often outnumber other bee species in locally surrounding areas where they are managed. .



Native bees are bee species that have lived and evolved in North America naturally without human introduction. In North America, there are approximately 4000 species of native bees. The majority of these bees live solitary lives, and although all bees have the ability to sting, the majority of native bees have less propensity to sting than the honeybee. Native bees do not live in “supers” or “hive boxes”, but rather occupy nesting sites in materials they utilize in their surrounding natural environment

THE STATE OF BEES IN BRITISH COLUMBIA

British Columbia is home to approximately 450 species of bees, with 56 species found in the Vancouver area (22). Little is known about the status of many of BC’s native bee populations, although there are signs of some bees disappearing, while others appear to be increasing their populations (12). The Western Bumblebee is thought to once have been the most prominent species along the west coast of North America, yet is rarely seen today (25). Furthermore, less is known on the status of bee populations in city areas, with only one publication studying urban bee populations in Canada (22).

CITIES AS AREAS FOR CONSERVATION

Ecological conservation has classically viewed human-occupied areas as unnatural, and therefore cities were thought to be something inversely different to the word “nature” (21). As a result, the focus for habitat conservation and restoration efforts have attempted to limit the amount of human interaction with untouched landscapes, both sequestering humans away from biologically important areas, and classifying natural landscapes as distinctly un-human. The development of social and economic opportunities in cities has mostly been independent of local environmental conditions and therefore cities are thought of as separate landscapes from nature (5).

This “humans” vs “nature” approach to conservation has been shifting since around the 1980’s, where the study of urban ecology has attempted to examine cities from an ecological perspective. Literature has considered energy flows, populations and communities of wildlife in urban areas, even identifying cities as their own unique ecosystems unto themselves (21). While settlement patterns and human issues have significantly changed vegetation and ecosystems (5), we must not forget that most cities are founded in areas that were once very biologically productive zones like estuaries and floodplains (21).

More people live in cities each year, with urban areas growing annually by 2.5%. Cities rely on a massive influx of energy, food, and many natural resources from other places on the planet in order to sustain the dense populations of people that dwell in them. It is estimated that Greater Vancouver uses 7.7 million extra hectares beyond its municipal limits to fulfill the lifestyles of its inhabitants (21). As cities grow and densify, development inevitably follows. When natural ecosystems are redeveloped or destroyed, the natural services they once provided are lost, often needing to be replaced in some other manner or form, at increased costs. Cities often replace lost services that were provided for free by watersheds and forests such as water filtrations, soil erosion measures, or waste management facilities (21).

Humans have a responsibility to account for the spaces they occupy due to the economic and environmental impact that development and structural change ensues. Sustaining the needs of urban users will require strategic planning that allocates efficient and effective ways to incorporate living systems that we rely upon back into our neighbourhoods and living spaces.

THE ROLE OF BEES IN CITIES

Cities are areas of land that have been cultivated, manipulated, and architecturally redesigned for the benefit and use of human beings. Every city in its evolution was once natural landscape, having been manipulated over time and will continue to evolve in design and function. Fast-paced development has meant many organisms have disappeared from these settings, unable to perform their lively functions in this changed landscape. Other wildlife have survived, or even flourished in cities.

The most widely and economically relevant ecosystem service that pollinators provide to humans is their ability to pollinate our food crops. Although agricultural areas are not urban, their massive landscape changes may be more extensive than even that in cities. With the loss of natural pollinators from these areas, we have replaced their service with that of the human-managed honeybee. Cities may be more appropriate and provide more potential for some pollinator populations than in other human changed landscapes.

Pollinators are also responsible for 60-70% of flowering plant populations, (20) securing a vital ecological role in sustaining plant communities. Especially when considering native and endangered plants that face their own set of struggles to survive, pollination should be an unthreatened service to protect plants. As there is little sign of city growth

slowing or of changes to natural resource needs well beyond city limits (21), then planners, city governments and citizens must start to include natural conservation from within urban boundaries as a method of saving biodiversity of pollinators and incorporating pollinator conservation initiative into sustainable ecological management in cities.

Little is known about the populations of bees in urban areas, as there has been little attention paid to their function in cities. As urban agriculture has become important both socially and economically to urban communities, bees play a role in the function of businesses and organizational programs invested in urban food production. Pollinators are key shareholders in the effort to provide local food security in cities and seed saving efforts. As we explore new and innovative ways to green our cities, the service of pollination will go hand in hand in the success or failure of many of these efforts.

NATIVE BEE BASICS

THE HONEYBEE

See “Honeybees vs native bees” for general information on the honeybee. Honeybee colonies are extremely large compared to the average native bee colonies, and therefore require large landscapes of nectar and pollen producing plants in order to feed their hives. Approximate distances of honeybees flights varies in the literature, but some estimates are around 5km. Certainly they are capable foragers as they must be, and they do not die at the end of the flowering season unlike most native bees. They survive over winter inside their hive, living off of the honey they collected during summer months until the following spring. Although the Queen can live for years, the average life of a single honeybee is usually less than 2 months. Honeybees make their homes in artificially created “Supers” which are provided by beekeepers.

THE BUMBLEBEE

Bumblebees are physically the largest group of bees in BC, characterized by their large fuzzy bodies. They have a louder buzz than most bees, and can in fact perform a type of pollination affectionately named “Buzz pollination”. Bumblebees are the only group that can perform this specialized form of pollination simply because they are so large, making them important in the sexual reproduction of nightshade plants such as peppers, potatoes, eggplant, and tomatoes.

In the wild, most bumblebee species are successional dependent on nesting habitat, meaning that they rely on other creatures to build nests which bumblebees take over once they are abandoned. They cannot build nests solely by themselves. Bumblebees are known to nest in old rodent homes underground or in tall grass, and in birds nests. After honeybees, in North America bumblebees maintain the most social colonies, consisting of a reproductive Queen and workers. Bumblebees live for one season, and

the entire colony dies in the onset of fall, with newly mated queens burrowing underground for hibernation until the following spring.

THE WOOD NESTING BEES

This group includes bees in the family Megachilidae, characterized by large jaws and carrying pollen on the underside of their abdomen. The most popularly known bee in this group is the “Blue Orchard Mason Bee” as it has become a favourite to host bee houses in people’s backyards. Wood nesting bees also rely on other animals to help create nest habitat for them, namely insects who drill holes in wood. Megachilidae nest in long tubules and can be found in old wood holes, in reeds, and even fence posts and cracks in brick buildings. This group behaves in semi-solitary fashion, where many females may make nests close together in ideal locations, but they maintain and produce their own nest chambers as individuals. Most species in this group live for short periods within the growing season, laying all the eggs they can in the span of a few weeks to a couple of months before dying. Megachilidae often use other natural materials to protect their eggs from predators. Mason bees use mud, leafcutter bees use plant leaves and petals, while woolly carder bees (another non-native to BC) utilizes the ‘velvet-like’ hairs on certain plants to line their nests.

THE GROUND NESTING BEES

This is by far the largest and most diverse group of bees. Over 70% of native bees fall under this category, and thus have a multitude of specific habitat requirements. Ground nesters are categorized together because they occupy a similar nesting niche, and there are human-influenced impacts that can impact many of these species as a group. Ground nesting bees live semi-solitary to solitary lives, and most ground nests can appear to look like large ant holes to the untrained eye.

CREATING A POLLINATORS PARADISE

City landscapes have many aspects that may deter people from considering them places to conserve native bees. However, there are aspects about cities that mutually benefit bees and humans to cohabitate. Bees require what we love to keep in abundance - flowers! Cities have the ability to provide abundant forage for bees, and our mutually beneficial appreciation for flowering plants makes cities suitable for bee habitat. We need to start making pollinator - appropriate plant choices. While our current gardening practices do little to support nesting sites for bees, there are alternatives and nesting enhancements we can add to existing spaces to support certain groups of bees.

Bees are mighty hard workers, but rain, temperature, and wind can severely limit their abilities to pollinate, especially in the early spring and summer –critical time for establishing new nests. Enhancing nesting sites that limit weather conditions can boost bee survival.

CORRIDORS

Where green space does exist in cities, it is often isolated from similar patches. This essentially traps the wildlife living there from moving between locations. Movement between natural landscapes can be important for wildlife to find new food resources, to interact with others of their species, and to be able to leave areas that have become unsuitable or crowded.

We can design our cities to have natural corridors for bees by connecting suitable habitat patches to one another by planting pollinator friendly gardens between them. This will decrease the distances of “urban desert” that needs to be crossed before a pollinator can reach their next oasis. If we can design cities so that natural habitat connects to one another this will affect not only bee populations but also other beneficial wildlife such as butterflies and birds.

PESTICIDES IN CITIES

Pesticides are toxic chemicals used to kill unwanted organisms. While pesticides can be used to protect property, the reality is that most pesticides used in cities in private backyards are applied only for cosmetic reasons. Compared to agricultural settings, some Canadian cities may actually contain higher pesticide levels than agricultural areas due to misuse and over application (8).

Insecticides can harm bees as they are designed to kill insects. However, a particular class of pesticides have been linked to the deaths of honeybees called Neonicotinoids. These pesticides attack the nervous system of bees and their accumulative effects can disrupt bees ability to find food, confuse memory and communication, and suppress bee immune systems making them more vulnerable to diseases. Pesticide use in cities can be greatly reduced by homeowners by consulting alternative gardening practices.

Recommendation: Ask garden stores to ban the use of pesticides on their products.

Recommendation: talk to your local schools, universities, parks boards, daycares, and other public institutions about their landscaping policies and ask them to refrain from using pesticides.

Recommendation: Petition municipalities to adopt integrated pest management policies for City Operations.

Recommendation: Campaign neighbourhoods or local areas to refrain from using chemicals on private lawns or in gardens.

Recommendations: Promote proper use of pesticides and indicate their serious health side effects caused by misuse. Always read labels when using pesticides and do not exceed application amounts.

CARS AND BEES

Like the automobile's relationship with most wildlife, cars and bees do not mix well. Traffic can be killer for bees trying to fly across streets as has been personally observed. Cars may be limiting bees beyond the roadways, as new research has suggested that diesel pollution can interrupt floral odors that bees need to track where flowers are located (14).

Recommendation: Installing larger gardens away from heavy traffic areas may reduce pollution that disrupts bee foraging. Look to side streets, rooftops, or larger parks as areas that may have less car pollution.

URBAN GARDENING PRACTICES

Avoid mid- summer mowing: Bumblebees live in areas with tall grass, and mowing will destroy their habitat. It does not help to leave the grass until late in the summer and then decide to mow as is the practice with some municipal landscaping policies. As most bumblebees live until late summer, mid-summer mowing will simply destroy nests that were established in the spring when habitat appeared ideal for bees.

Convert your lawns: When we do leave green space in cities we tend to turn it into lawns. With our fascination for them, lawns now consume the largest managed land space by humans in North America. Considering our extensive cultivation of other crops, this is an incredible feat. North American culture is so devoted to lawns, that some cities even hold bylaws that require residents to mow their private lawns or face fines, including the City of Vancouver (Untidy premises bylaw – City of Vancouver). Unfortunately the ecological function of lawns is little to no use for wildlife, including pollinators.

Constant mowing disallows nesting habitat for bumblebees. Even ground nesters are not found in lawns, as this unnatural bed of grass is a foreign landscape to burrow into. Lawns may further be unsuitable to ground nesting bees due to inadequate water drainage and overwatering, chemical use on lawns, or unsuitable soil substrates.

Recommendation: Turn your lawn into wildlife habitat by converting it to native shrubs and perennials.

Recommendation: NO MOW AREAS OF CITIES - if its not a safety hazard, avoid the cost and manpower of mowing. You will be sparing precious habitat for native bumblebees and many other beneficial insects.

Tilling: Often a practice to aerate the soil and break up weeds in spring or fall. This practice destroys the nests of 70% of native bees. Although it may be necessary for some food crops, it is a trade off to losing your local pollinators.

Recommendation: Community gardens and backyard gardeners should section areas of NO DISTURBANCE.

Mulching: Much like tilling, mulching essentially buries the homes of ground nesting bees. While a new layer may not seem like much to the gardener, even small amounts may be trapping ground nesters from reestablishing their tunnels. Bees will search in vain to find their nests after they return to an area that was mulched while the bee was on a forage flight.

Recommendation: Avoid mulching if you can, and like recommended for tilling, establishing NO DISTURBANCE areas will offer the same benefit to a garden.

Plant Hedgerows: The landscape design of cities can often create wind tunnels (5) which makes flying more difficult for pollinators. By planting living walls of shrubs you will be creating wind barriers. It is an added benefit if you can select native flowering plants that will serve as bee food for hedgerows as you will get double the benefit.

Create heat traps: Bees are dependant on temperature to be able to fly. When it is too cold out, they cannot produce the energy to look for food, even when it is readily available, which occurs frequently in the springtime. However, even within small areas, the local temperature can vary greatly in urban environments depending on where the sun is hitting and the surrounding materials. Asphalt and glass on buildings can used to your advantage. If there is adequate sunlight and little wind, materials such as these can create warmer local conditions surrounding green space. Bees will benefit from being able to nest and forage in cooler climates.

Recommendation: Utilize the materials you have to work with. Find local hot spots, and create habitat that traps heat.

Making Flower choices: Although cities tend to boast high abundance of beautiful flowers, it doesn't always translate well with the bees. People's backyard gardens can be full of colourful and exotic displays, but this is all smoke and mirrors to the bees. Bees are only interested in the nectar and pollen reward that flowers have to offer. People habitually plant horticultural plants, many of which are difficult for a bee to access the base of for nectar or the flowers are so unnaturally shaped that the bees cannot effectively gather their nectar. Horticultural flowers that are in highly managed areas of Vancouver turn up the lowest biodiversity and number of bees (22). Some flowers that turn up low visits from bees includes Tulips and Petunias.

From personal observation and communication with citizen scientists, time and again we observe that when given the choice, bees often choose native plants in the vicinity. Food from cultivated flowers may be unrecognized, a poor health choice, or simply difficult to access.

Weeds and Bees: Humans and bees may both like flowers, but we seem to be attracted to opposite types. Weeds are extremely important to maintaining bee populations in cities. Many weeds such as dandelion, clover, and buttercup have been found to maintain forage for bees for long periods of time as has been personally recorded, and are an important source of food for native bees in spring (22).



Recommendation: Keep lawns unkempt. Lawn “weeds” are often great sources of nectar and pollen for bees in springtime.

Habitat size: To have any attraction to bees, habitat enhancements should be at a minimum one square meter (17). If your focus is in very small spaces such as balconies, try to provide as much flowers in the space as possible. By planning enhancements in areas located near natural habitat, you are strategically attaching you new pollinator garden to a network of existing habitat and increasing the integrity of an already existing beneficial space for pollinators.

LANDSCAPE DESIGN

Bees need to eat from the time they emerge until they die. Different species of bees come and go through the entire bloom season, with some lasting the entire time. This means that to support a diversity of bees, we must provide food for all types throughout the spring, summer and into early fall (17). Bees range in size greatly, and some shapes and sizes of flowers support different bees. Small bees prefer open shaped flowers where nectar and pollen is easily accessible. Bumblebees and honeybees are often able to tackle elaborately shaped flower, such as flowers found in the pea family. Although most bees are general feeders (they take what they can get), some species prefer different colours of flowers. Bees are also more attracted to larger congregations of one type of plant. This is because bees search for one type of flower at a time, and

Key Points:

- Select plants that will overlap in bloom times from spring - fall
- Provide a range of flower size, shape and colours.
- Plant in clumps
- Choose native plants

when one plant is grouped together it is more attractive because their efforts will be more efficient if the plant is all in one place (17). This is sometimes a compromise when designing a plot as we often like to spread colours out in our gardens. It is important to take note of the biologically historical context of where you are planting. Native plants are

always a best choice for natural ecosystems, and by providing native plants as forage for bees, you are ensuring healthy food that will bloom at the appropriate time needed for local bees.

PLANT CALCULATOR

Calculate the costs based on how much space you have available by filling in the grey cells. These calculations are based on 2013 general nursery plant costs. This does not include labour, soil or any other material costs you may want to consider when designing your pollinator habitat.

I have		
7	x	7 = 45
W (feet)	L (feet)	Square feet
I want my garden to have (recommended 40% shrubs, 60% perennials w/ seed dispersed throughout; 100%)		
50%	50%	0%
Shrubs	Perennials	Seed
I should plant this number of		
4	7	-
Shrubs	Perennials	Seed
Cost		
\$ 31.80	\$ 37.41	\$ -
Shrubs	Perennials	Seed
Total Cost		\$ 69.21

To use this calculator online, visit
www.nectartrail.com - *Plant a Bee Garden*



SOUTH WESTERN BC PLANT SELECTION GUIDE

Plant	Latin	Season	Native plant	supports high bee biodiversity	high nectar/pollen source	Other comments and planting notes
Willow	Salix sp.	Feb - Mar	✓	✓	✓	early nectar source of bees in springtime
Threadleaf phacelia	Phacelia linearis	Mar-May				
Heather	Erica sp.	Mar-May				early nectar source of bees in springtime, long bloom
Salal	Gaultheria shallon	Mar-June	✓			long bloom, good cover crop
Columbine	Aquilegia formosa	April-May	✓			Preferred by bumblebees
Oregon Grape	Mahonia nervosa	April-May	✓		✓	
Baldhip Rose	Rosa gymnocarpa	April-May	✓	✓		
Salmonberry	Rubus spectabilis	April-May	✓			
Saskatoon berry	Amelanchier alnifolia	April - June				
Lavender		April - June				
Lily of the Valley	Convallaria majalis	May				
Coastal Strawberry	Fragaria chilosensis	May	✓			great ground cover, food for birds
Western Snowberry	Symphoricarpos occidentalis	May-June	✓		✓	supports birds, butterfly larvae
Red Huckleberry	Vaccinium parvifolium	May – June				
Elderberry	Sambucus racemosa	May - June				
Sea Blush	Plectritis congesta	May – June				
Camus	Camassia leichtlinii	May-June	✓			
Red Flowering Currant	ribes sanguineum	May-June	✓			supports hummingbirds as well
Lupin	Lupinus polyphylus	May- July	✓			
Nootka Rose	Rosa nutkana	May-July	✓	✓		
Ocean Spray	Holodiscus discolor	June- July	✓		✓	hardy once established, high pollen load
Snowberry	Symphoricarpos albus	June - July				
Penstemon	Penstemon sp.	June-July				
Yarrow	Achillea millefolium	June-July	✓		✓	High bee attractant for smaller species, easy to seed
California lilac	Ceanothus "Victoria"	June-July	✓	✓	✓	
Fireweed	Chamerion angustifolium	June - Aug				
Sea holly	Eryngium maritimum	June-Aug				
Ox-eyed Sunflower	Heliopsis helianthoides	June-Aug	✓		✓	aggressive spreader, long bloom period
Bee balm	Monarda didyma	June-Aug			✓	
Black Eyed Susan	Rudbeckia fulgida "Goldsturm"	June-Aug	✓		✓	long bloom time
Purple Coneflower	Echinacea purpurea	June-Aug			✓	long bloom time; supports butterflies, birds
Foxglove	Digitalis purpurea	June-Sept		✓		blooms in second year, difficult to transplant, very high biodiversity supporter
Russian sage	Perovskia atriplicifolia	June-Sept				great for bumblebees
Showy Sunflower	Helianthus laetiflorus	June-Sept	✓	✓		aggressive spreader
Common Harebell	Campanula rotundifolia	June-Sept				great for bumblebees
Stonecrop	Sedum sp.	July - Sept				
Korean Mint	Agastache rugosa	July - Sept				
Douglas Aster	Aster subspicatus	Aug – Sept				
Common Sunflower	Helianthus annuus	Aug-Sept	✓	✓		
Goldenrod	Solidago canadensis	Aug-Sept	✓			supports species late in summer, aggressive
Grey Goldenrod	Solidago nemoralis	Aug-Sept	✓			supports not just bees but also other pollinators: bats, not aggressive

URBAN NESTING HABITAT

Cities provide little nesting habitat for bees and available nesting habitat may be the limiting factor to bee populations in urban areas (6, 18, 22). Ground nesters especially have a difficult time finding suitable nesting locations (23) because so little undisturbed, natural soils are left in cities.

Providing Artificial nesting sites for Native Bees:

There are many helpful guides and designs to provide man-made nesting habitat for native bees and this report does not intend to replicate these but recommends looking at:

Online:

[Nests for Native Bees - the Xerces Society](#)

Book:

Attracting Native Pollinators: Protecting North America's Bees and Butterflies - The Xerces Society, published 2011

Bumblebees: Although there are many models of outdoor nest boxes for bumblebees, we do not know of any with good survival rates. Bumblebee queens will search for weeks in the spring to find the nest she will use to build her colony, utilizing small cave-like crevices. In a natural environment bumblebees will nest in abandoned mouse holes either below ground or in tall grass, and sometimes in birds nests. Bumblebees have been reported to also nest in stacked wood piles, plastic tubing, and exposed insulation in urban environments.

Do not expect bumblebee queens to find an artificial nest box, but rather you may wish to introduce her to one. Consider placing bumblebee boxes away from areas where moisture may linger on cooler days. Be aware of placement visibility as the public is less knowledgeable of these types of nest boxes- Bumblebees are territorial and will sting if their nests are disturbed once the colony is established. Use signage if placed in publicly accessible areas.

Wood Nesting Bees: There are many helpful guides and designs for wood nesting bee houses, specifically the Blue Orchard Mason Bee. Other wood nesting bees will also use wood nest boxes. This report recommends looking at:

[Beediverse](#)

[Mason Bee Homes](#)

For information on managing nest homes check out:

[The Environmental Youth Alliance](#)



BUMBLEBEE ENTRANCE ON A CONSTRUCTION SITE

[The David Suzuki Foundation](#)

Recommendation: Do not use chemically treated wood to build the nesting holes of your mason bee house. These chemicals are designed to make wood resistant to insects, including bees.

Recommendation: Although durable to weather, refrain from using cedar for mason bee houses. Cedar wood naturally repels insects and we have found these types of homes are often rejected by mason bees.

Ground Nesting Bees: Many ground nesting bees use different soil substrates to nest underground. In general, hard packed, sandy clay-like soils are preferred. However, trails that are heavily used by people or other wildlife are not used by native bees frequently and you should consider walking paths as “degraded habitat”. High ground that will not be waterlogged is important when choosing to set aside habitat for ground nesters. The entrances to ground nesting bee homes often appear similar to ant holes and often are covered, sprayed or destroyed in backyards as a preventative measure to ants.

SITE SELECTION

While habitat enhancement efforts can benefit pollinators greatly, it is important to consider what we are replacing when we choose to develop green space. Be sensitive to the ecological benefits that may already be serving a purpose to pollinators or other wildlife and leave good habitat alone. Find areas in cities that can be enhanced and are on the periphery of natural habitat. The following urban habitat “types” were selected from *City of Surprises*, 1997. See reference (7).

Empty lots: Empty lots can be suitable places for bee habitat, but constantly face the threat of development. However, lots that will be unoccupied for a few years can sometimes be options to consider habitat enhancements by approaching city landowners. As with similar agreements for community gardens, leases are sometimes available for 1, 5 or 10 year management. Partnering with groups that have common goals, such as gardeners, can increase your chances of success. In these in cases, consider the value of an enhancement and how your habitat design might be transported once development is inevitable.

Boulevards: Strips of greenspace along roadways and side streets are often maintained by municipalities, and often have bylaw or policies on the heights of allowable plants due to visibility for traffic or safety hazards. If boulevards are maintained by city crews they often do not have exposed soil or understory growth. These areas may be ideal for ground cover and small native plant conversions. They are ideal enhancement spaces from an ecological perspective because they often run in linear form, and have potential to provide urban corridor travel routes for pollinators.

Linear right-of-ways: Greenspace alongside streams or ditches. These types of spaces again can provide corridors for pollinators that go undisturbed by human activity. Often inclined topography such as these seem to attract many bees if forage opportunities are present. Sharply inclined green spaces are sometimes rare in cities, and these spaces are suspected to provide some useful nesting sites for ground nesting and bumblebees. These sites may be unsuitable habitat due to mid-summer mowing, heavy chemical runoff, or constant debris settlement on plants near busy roadways.

Railway corridors: Abandoned railway lines can provide habitat that runs along sections of the city that is away from traffic. Railway lines also serve as a type of urban corridor, however be mindful that herbicides or other measure may still be applied to unused railway lines to prevent destabilizing the tracks. The soil surrounding railways may also be contaminated with oil, grease, or other lubricants.

KEY POINTS:

Take note of landscape features that will impact temperature, wind, and rain.

Select sites that have access to surrounding habitat for bees so they are not isolated.

Avoid green space that is shaded by buildings or trees for large parts of the day, especially morning.



BEE ALLIES

Pollinators are an important part of bringing biodiversity and local food back into urban landscapes. Creativity and resourceful use of space is needed in order to successfully enhance habitat for pollinators in city landscapes. Municipalities must start to include pollinators in their environmental targets and campaigns. Community groups that share interest in environmental conservation, gardening, and food production can form alliances to bring forward initiatives that will enhance urban bee habitat. Especially in urban settings, pollinator education and native bee outreach initiatives should be part of campaigns as public opinion plays a large part in the successful establishment of projects for native bees. Some potential bee allies to consider include urban farmers, educational institutions, community Gardens, conservation organizations, local government such as parks and recreation, and private landowners.



BEE EDUCATION AND FACILITATION

The Environmental Youth Alliance is focused on urban projects and have experience working to promote public outreach initiatives with both honeybees and native bees. While many threats limit conservation efforts for bees in cities, one major obstacle to getting project approval and public involvement is the social ideologies people hold about bees. What has been learned, and a few tips are as follows:

Simply put, ignorance regarding the lifestyles of bees and their threat to humans is a constant battle that anyone working in bee outreach will tell you.

Colony Collapse Disorder (CCD), a term referred to the unexplained disappearance of tens of thousands of honeybee colonies reported by their beekeepers in the past 15 years (23), has been one topic that has been in the news and which most of the public is familiar with. Ironically and although terribly devastating, the loss of honeybees has helped to sway public opinion of bees. The threat of losing bees' valuable service of pollination has been highlighted in mainstream media more than any conservationist can dream of getting across to the general public in the last number of years. Even when speaking about other pollinators, it is important to be knowledgeable of the most up-to-date research, public policies, and reports regarding CCD. It is a jumping off point to connect with audiences, while being sure to demonstrate the difference between this phenomenon and the points you would like to highlight if you are speaking about native bees or other pollinators. Identifying CCD also prevents confusion to audiences who may hold on to "facts" they have heard which you can speak to before moving on.

Identify the elephant in the room: bees can sting. It is important to not side step this fact or ignore the natural progression of this topic into conversation when facilitating, especially in intimate settings. You will be more successful in reassuring people of stings as a health threat when *you* introduce the topic and allow people to share personal beliefs or stories of their experience with bees. Most people do have a personal experience with stings, and normalizing this fact diffuses it from being a scary topic, or one that there is something to hide from. People also tend to trust what you have to say following a discussion about bee stings, and listen more tentatively to ideas regarding conservation once their bee ideologies have been identified and gently reexamined. This is recommended for any age group, do not be afraid to speak to children about their experiences. Children often hold the greatest reactions to what they have been previously told, and you can be an advocate for alleviating fears. Speaking to bee sting safety around children will educate them, and alleviate health concerns to adults also listening.

As in any environmental campaign, the “why should I care” notion is ever-present to certain members of the public. A strategy to tackle this easily is to identify how an environmental loss impacts a person directly. With bees, it is most easily done by presenting people with a connection to their food (This can be especially effective if people are listening to you while eating their lunch). While this may seem obvious, it is your hitting home point. Just as strongly as people hold an experience of being stung, they can immediately identify food as an elemental daily need in their lives. The importance of pollinators to food crops is one of many points you may wish to highlight, but you will gain attention from this point directly.

Public outreach with bees often means moving people across an entire ideological pendulum, from a dislike for bees, to a neutral state, and then to concern for their wellbeing and motivation to protect bees. You will never “win over” everyone, but it is a mistake not to include public education and outreach components when planning urban conservation projects and initiatives.

KEY POINTS:

- Don't ignore people's biases and experiences
- Be capable of speaking about mainstream knowledge
- Connect the target audience to something personal: food!



A Case Study: Findings of Bee Biodiversity and Abundance in urban areas of Vancouver, BC.

Goal

The Environmental Youth Alliance conducted a survey of bees that live in urban spaces in Vancouver, BC. We wanted to know the impact that planting pollinator habitat would have to bee populations.

Sampling Methods

Sites were assessed in 2012 before any enhancement took place, and again in 2013, after a pollinator garden was established. Four sites were selected to conduct surveys: a golf course, an urban farm, a semi-natural park, and an empty lot that was subsequently converted into a community orchard. All sites had small scale honeybees hives managed in the surrounding areas (known beekeepers keeping <5 hives). The sizes of these spaces were unequal, however search efforts within these sites were relatively the same. It is difficult to suggest a general search area as surveys were opportunistic to whatever flowers were in bloom, but 100 meters² is an estimated approximation.



POLLINATOR ASSESSMENT SQUAD VOLUNTEERS JESSICA UDAL, KRISTEN MATHIAS, AND JESSICA LEUNG.

Biodiversity surveys were conducted every two weeks from June-September in 2012, and May-August in 2013. The timing was different between years because plants bloomed slightly earlier the second year and we wanted to capture pollinator activity based on their natural lifecycle. Data was gathered in 10 minute observation surveys and 10 minute netting surveys. Bee specimens were categorized at Simon Fraser University.

Bee observation data was grouped according to bee guilds. Guilds are assemblages of bees based on their taxonomic, physiological and life history characteristics. Guild organization allows bee diversity to be examined based a bee's *function* in the environment. For example: all bumblebees (guild bumblebee) serve similar purposes in the environment (pollinate similar types of flowers) and utilize similar resources (nest in leaf/grass litter) so can best serve as a measure of their presence at a site by grouping all individuals together. Pollinator guilds were broken down to:

- 🐝 Honeybees
- 🐝 Bumblebees
- 🐝 Ground Nesting Bees
- 🐝 Wood Nesting Bees

- 🐝 Flies
- 🐝 Wasps

We compared the biodiversity and abundance of bees caught in 2012 to the bees caught in 2013. We also examined the evenness of bee guilds observed across both years to examine what flowers supported the greatest variety of bees groups.

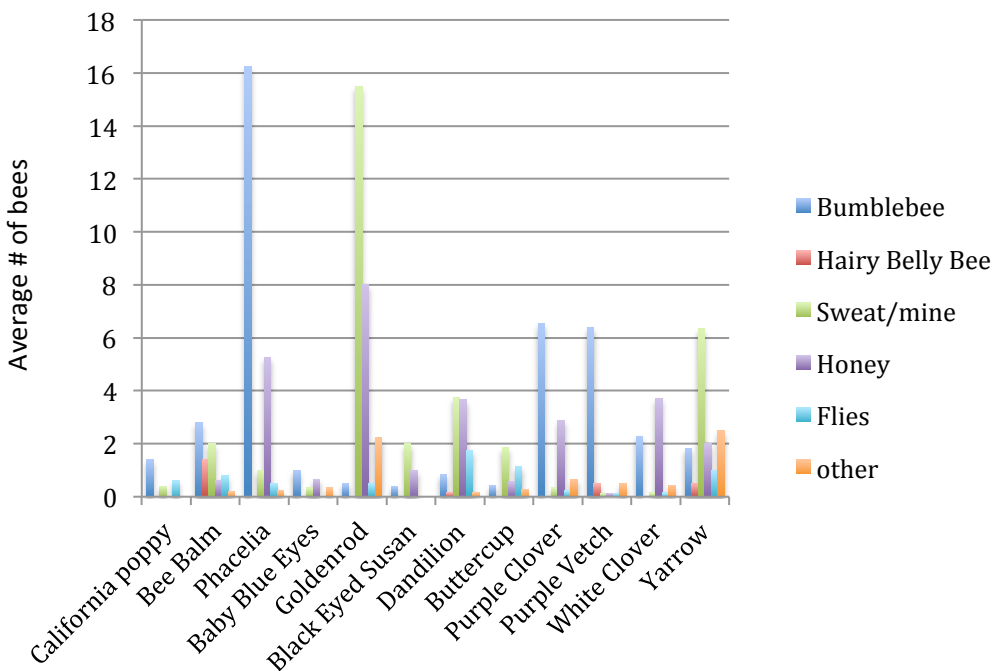
Habitat enhancement efforts

All sites received a pollinator habitat enhancement in 2012. Only floral resources were added to sites, although Fraserview Golf Course had previously established bee boxes for wood nesting bees. All enhancements were provisioned with 1-2' potted native plants (selected from the Plant Selection Guide given in this report) from Linnaea Nursery, N.A.T.S. Nursery, and Cedar Rim Nursery located in Langley, British Columbia. Seed was selected from Applewood's Bee Feed Mix.

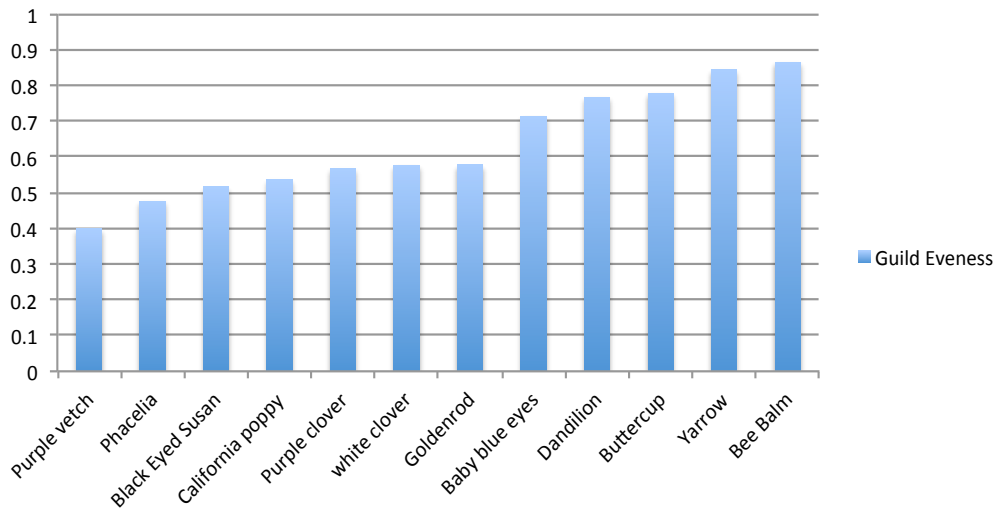
Plant Visit Observations

Pollinator visitation counts were conducted over two years at field sites, and only plants that we repeated observations three or more times were examined for pollinator preference. The majority of plant data collected was on “weedy” plants, as they had the highest numbers of observation periods. This is due to the fact that weeds are more common at most field sites. The following graph displays plants, and their average visitations from different bee guilds.

Average number of bee visits on flowers:



Guild Evenness in plant visits



1 = highest Evenness. Flower was visited by all guilds of bees the same amount,
 0= zero Evenness. Flower was visited discriminatorily by one guild more than all others.

Data Analysis:

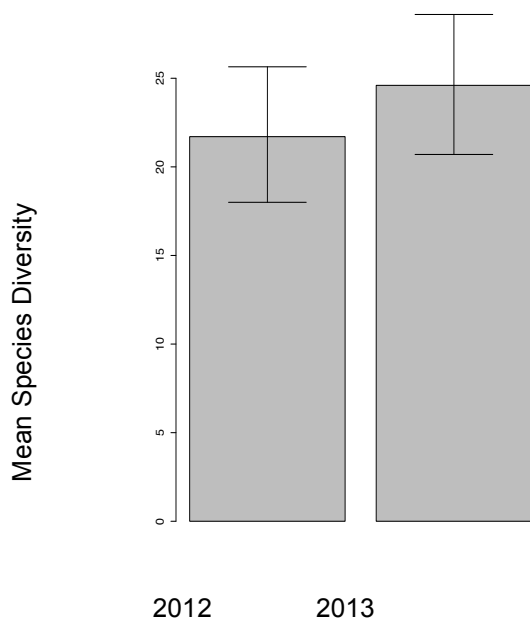
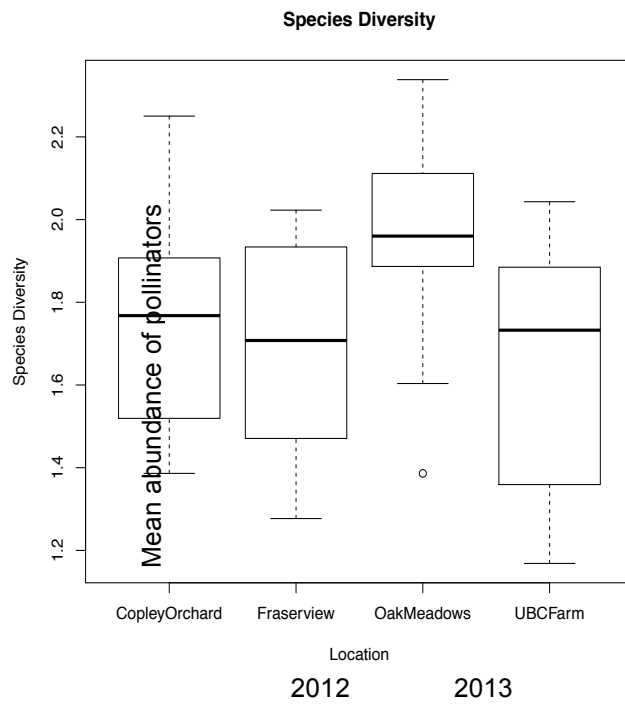
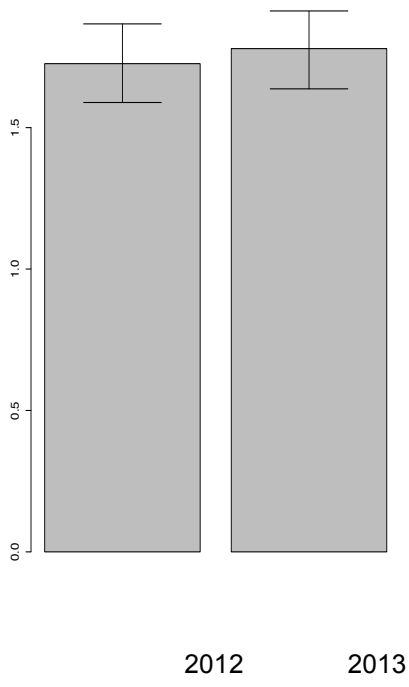
To identify the impact that garden enhancements have to pollinators, data was analyzed using R version 2.14.2 for Windows. Five response variables were considered in separate statistical analyses. These were species diversity, species evenness, guild diversity, guild evenness, and insect abundance. Diversity and evenness were assessed with the Shannon Weiner index.

General Findings of bee diversity and abundance:

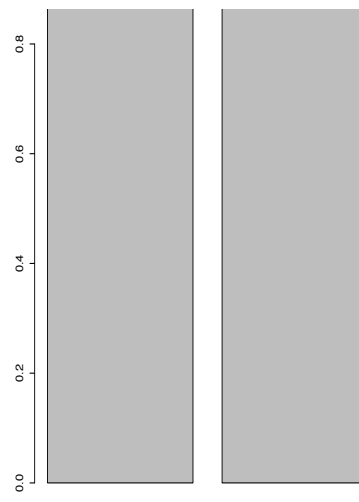
432 pollinators were collected over both years and captured 48 species; 31 bee species, 11 wasp species, 5 fly groups (not all flies were classified beyond genus). See *Summary of Bees found in Vancouver*.

Honeybees (*Apis mellifera*) were the most common bee, with 69 specimens collected. Bumblebees were the most frequently caught guild of bees, with the largest collection from species *Bombus flavifrons* (45 specimens).

We detected *no effect* of year on any of the response variables. Although the trend for mean pollinator abundance was suggestive of an increase following planting, this effect was not statistically significant ($p = 0.093$). Our measure for pollinator biodiversity, mean species diversity and mean species evenness was not significant between 2012 and 2013 ($p = 0.609$ and $p = 0.454$ respectively). Specimens were found in all guilds at all sites. Guild evenness was *not significantly changed* at any of the sites between years. There was also *no significant effect* in species diversity or species evenness within any of the sites between the years.



Species Diversity at sites both years



Conclusions:

We found no significant evidence to suggest that small-scale pollinator garden enhancements have an impact on pollinator biodiversity or abundance (including bees, flies and wasps). A slight trend increasing pollinator abundance after enhancements took place suggests that this study may have suggested more significance to pollinator habitat enhancements if more sites were included or documented for future years. One year is not a significant amount of time for small scale habitat enhancements to impact bee biodiversity and abundance. More time is necessary for gardens to become established.

Although not statistically significant, Oak Meadows Park (OMP) displayed the highest biodiversity and abundance of bees more than other sites. Oak Meadows Park is a 500m² park with semi-natural areas, and separated by Oak Street, Oak Meadows is directly west to VanDusen Gardens, which is one of Vancouver's largest human-managed gardens (approximate area of 2.8km² green space). The location of OMP is unique because although it is located in the center of Vancouver's urban housing district, Oak Meadows is part of a large fragment of habitat for bees and includes a high volume of floral resources west of its perimeter. Furthermore, the Western section of Oak Meadows Park is mandated by the City of Vancouver as a "naturalized park", resulting in infrequent mowing and hosting many native plants that were present before any additional enhancements including Lupine, Yarrow, Salal and Snowberry. Not only population size, but also guild and species diversity were both highest at Oak Meadows. This further demonstrates that larger habitat size creates the opportunity for varieties of floral and nesting resources, thus supporting higher biodiversity of bees.

Nesting habitat was not the focus of the enhancements, and because soils were disturbed during garden work, future years will provide more opportunity on for bees, especially undisturbed soils for ground nesters. The highest wood nesting bees were found at Fraserview Golf Course and Oak Meadows Park (9 specimens each). While Oak Meadows Park hosts naturalized material for wood nesting bees, Fraserview Golf Course has provided artificial nesting opportunities for this guild. Both natural and artificial nesting materials may benefit urban landscapes to host wood nesting bees.

Bumblebees were observed more frequently than other bee guilds. This may be because bumblebees have larger colonies per queen than other native bees, and therefore more individual bumblebees are foraging at the same time. Although mowing limits habitat opportunities for bumblebees at these sites, perhaps city rodent populations are providing adequate nesting opportunities for bumblebees. Further investigation into where bumblebees nest in urban settings is needed.

31 species of bees were found at 4 sites in urban and suburban spaces in Vancouver, BC. Although pollinator gardens showed no impact on bee populations after one year of establishment, more time may be necessary to observe the benefit of these types of enhancements in our green spaces. It is important to monitor our native pollinator populations in urban spaces so that we may observe trends in their population growth, and further understand how city landscapes can sponsor their existence.

Summary of Bees found in Vancouver, BC in 2012/2013:

Pollinator Species	Total Collected	2012	2013	% of Total
Agapostemon.texanus	4	3	1	1%
Ancistrocerus.sp.	5	2	3	1%
Andrena prunorum	1	0	1	0%
Andrena.sp.	3	2	1	1%
Andrena sp. 2	1	0	1	0%
Anthidium.manicatum	3	1	2	1%
Apis.mellifera	69	31	38	16%
Bombus californicus	4	0	4	1%
Bombus.flavifrons	45	17	28	10%
Bombus.melanopygus	8	5	3	2%
Bombus.mixtus	42	23	19	10%
Bombus.vosnesenskii	29	12	17	7%
Bombus. Genus	1	1	0	0%
Bombus.bifarius	3	3	0	1%
Coelioxys sp.	1	0	1	0%
Colletes sp.	2	0	2	0%
Crabronidae ectimnius	1	0	1	0%
Crabronidae.sp.	4	3	1	1%
Crabronidae sp. 1	3	0	3	1%
Crabronidae sp. 2	1	0	1	0%
Crabronidae tachyshex	1	0	1	0%
Diptera genus	42	16	26	10%
Dolichopodidae.sp.	2	1	1	0%
Eristalis.tenax	5	3	2	1%
Halictus.confusus	6	1	5	1%
Halictus.rubicundus	13	6	7	3%
Heriades.sp.	3	1	2	1%
Hylaeus.sp.	10	1	9	2%
Ichneumonidae. Genus	4	4	0	1%
Lasioglossum.sp.	19	4	15	4%
Lasioglossum.dialictus	14	14	0	3%
Megachile.sp.	7	3	4	2%
Megachile sp. 2	3	0	3	1%
Melissodes.microsticta	8	8	0	2%
Merodon equestris	1	0	1	0%
Nomada sp. 2	1	0	1	0%
Nomada sp. 3	1	0	1	0%
Nomada sp. 1	1	0	1	0%
Osmia.sp.	4	2	2	1%
Osmia sp. 2	1	0	1	0%
Osmia sp. 3	1	0	1	0%
Sphecodes.sp.	1	1	0	0%
Polistes. Genus	16	6	10	4%
Syrphidae. Genus	35	12	23	8%
Vespidae sp.1	1	0	1	0%
Vespidae sp. 2	1	0	1	0%
Villa sp.	1	0	1	0%
Totals	432	186	246	100.0%

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