Envisioning a Network for Pollinators
in South Seattle

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Master of Landscape Architecture

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Program Authorized to Offer Degree:
Department of Landscape Architecture

College of Built Environment

University of Washington

Abstract

Envisioning a Network for Pollinators in South Seattle

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Bees, butterflies, hummingbirds, moths and beetles that pollinate plants are responsible for bringing us almost every bite of food. They also sustain our ecosystems and produce most of the natural resources by helping plants reproduce.

Without these animals, our ecosystem will totally collapse. These pollinating creatures travel from plant to plant, flower to flower, carrying pollen on their bodies in an important interaction that enables the transfer of genetic material critical to the reproductive system of most flowering plants. These plants which provide us countless fruits, vegetables, and increase carbon sequestration for our living space. However, this nearly invisible ecosystem service is a precious resource that requires attention and protection and in disturbing evidence found around the globe, is increasingly in danger. Many pollinator populations are in decline and this decline is attributed most severely to a loss in nesting and feeding habitats. Environmental pollution, the misuse of chemicals pesticide, infectious disease, and changes in global climatic patterns are all contributing to shifting and shrinking the pollinator populations.

This pollinator network design responds to the issues of food shortages, climate change, urban biodiversity, and the desire to increase urban productive landscapes. Pollinators play an essential and indispensable role in urban agriculture and urban public spaces. As a result, this design thesis focuses on how to design a network for pollinators by means of connecting potential nodes, open spaces and a green belt in South Seattle, Washington. This network includes small-scale habitats, learning gardens, pollinator sanctuaries, community gardens and green infrastructure.

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First of all, I will like to give a big thank you to my thesis Committee Chair, Professor Jeff Hou and Committee Member Associate Professor Julie Johnson. I think their creativity, knowledge, guidance and passion all make this project possible to me. And they also give me a lot of the flexibility to develop my concept and idea during the design process. I really appreciate Jeff and Julie for sharing their critiques and enthusiasm for this design thesis. Under their instruction, they really made my two-year experience in graduate school much richer and also broaden my design horizon.

Then, I want to thank the Landscape Architecture Department for providing me such a wonderful learning experience during these two years. I learned a lot from the MLA program and it also triggers my passion and aspiration to put my efforts into landscape architecture design. My experiences from these wonderful design studios, it helped me make up my mind to work on my thesis topic.

I also want to thank my friends and my family who had always encouraged me and gave me the biggest support while I was pursuing my master degree at UW. Because of their support, I think I can totally focus on my school without any concern during these two years. I especially thank my mother and my sisters who continuously give me the emotional and technical support at any time.

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Abstract
Envisioning a Network for Pollinators

Fig. 0-1: The core concept of the pollinator network system

Bees, butterflies, hummingbirds, moths and beetles that pollinate plants are responsible for bringing us almost every bite of food. They also sustain our ecosystems and produce most of the natural resources by helping plants reproduce.

Without these animals, our ecosystem will totally collapse. These pollinating creatures travel from plant to plant, flower to flower, carrying pollen on their bodies in an important interaction that enables the transfer of genetic material critical to the reproductive system of most flowering plants. These plants which provide us countless fruits, vegetables, and increase carbon sequestration for our living space. However, this nearly invisible ecosystem service is a precious resource that requires attention and protection and in disturbing evidence found around the globe, is increasingly in danger. Many pollinator populations are in decline and this decline is attributed most severely to a loss in nesting and feeding habitats. Environmental pollution, the misuse of chemicals pesticide, infectious disease, and changes in global climatic patterns are all contributing to shifting and shrinking the pollinator populations.

This pollinator network design responds to the issues of food shortages, climate change, urban biodiversity, and the desire to increase urban productive landscapes. Pollinators play an essential and indispensable role in urban agriculture and urban public spaces. As a result, this design thesis focuses on how to design a network for pollinators by means of connecting potential nodes, open spaces and a green belt in South Seattle, Washington. This network includes small-scale habitats, learning gardens, pollinator sanctuaries, community gardens and green infrastructure.

Fig. 0-2: Rendering of design

This design thesis focuses on how to design a network for pollinators by means of connecting potential nodes, open spaces and a green belt in South Seattle, Washington. This network includes small-scale habitats, learning gardens, pollinator sanctuaries, community gardens and green infrastructure.

Introduction

Envisioning a Network for Pollinators

Fig. 1-1: The bird-eye view of Chief Sealth Trail

The Chief Sealth Trail is a multi-use recreational trail in the South Seattle area (WA). The total length of the trail itself is 3.7 miles long (6 km), which follows the Seattle City Light transmission line from South Dawson Street and Beacon Avenue South in Beacon Hill. And the extension work of the trail is planned northward to the Downtown area and southward to the city limits. The Trail was built and accomplished from the recycling of excavated soils and wasted concrete from the construction work of Link light rail along Martin Luther King Jr. Way in South Seattle. This trail is a precious comprehensive green belt cut through the Rainier Valley in South Seattle.

According to the site analysis, using the average pollinate and forage distance (a half mile) for pollinators to measure the coverage of the feeding and nesting sites in South Seattle and determine the potential pollinator habitats. We can tell there are many gaps between these scattered green spaces which include impermeable paving, parking lots, residential area or roadway. Thus, although there is a lot of open green space, green belts and parks in Seattle, their distribution is very fragmented and scattered. Besides, even though each node seems that it can provide food sources or micro habitats for pollinators, it cannot form a comprehensive corridor system. Therefore, I propose using The Chief Sealth Trail as the backbone, extending from the north to the south, and stretching east-westwards. The habitat typologies and the design proposal of hierarchical habitats, envisions the entire city to be the ideal home for pollinators anywhere and anytime.

Fig. 1-2: The concept map of the pollinator center
Base map: Google Earth, May, 2017

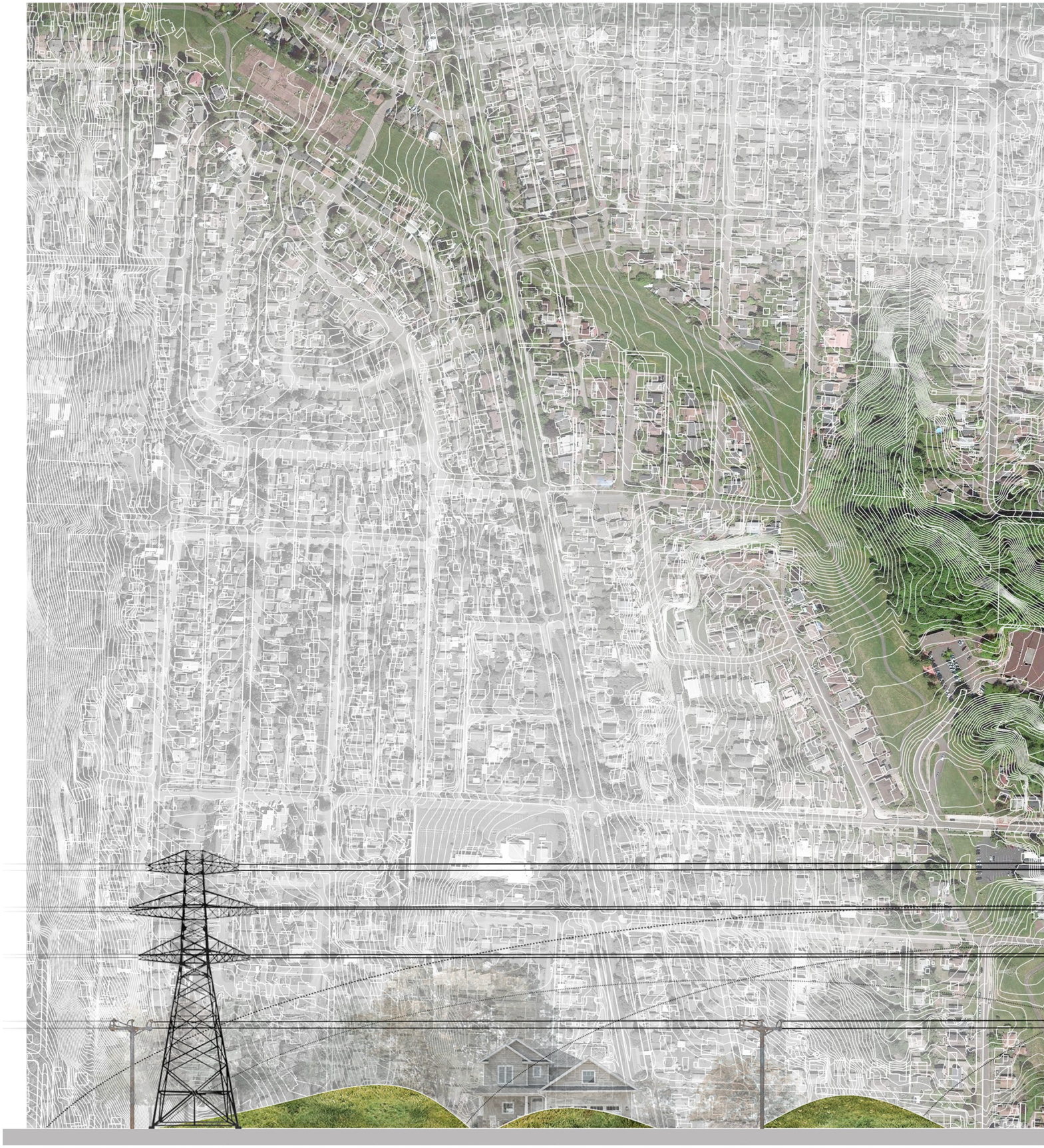
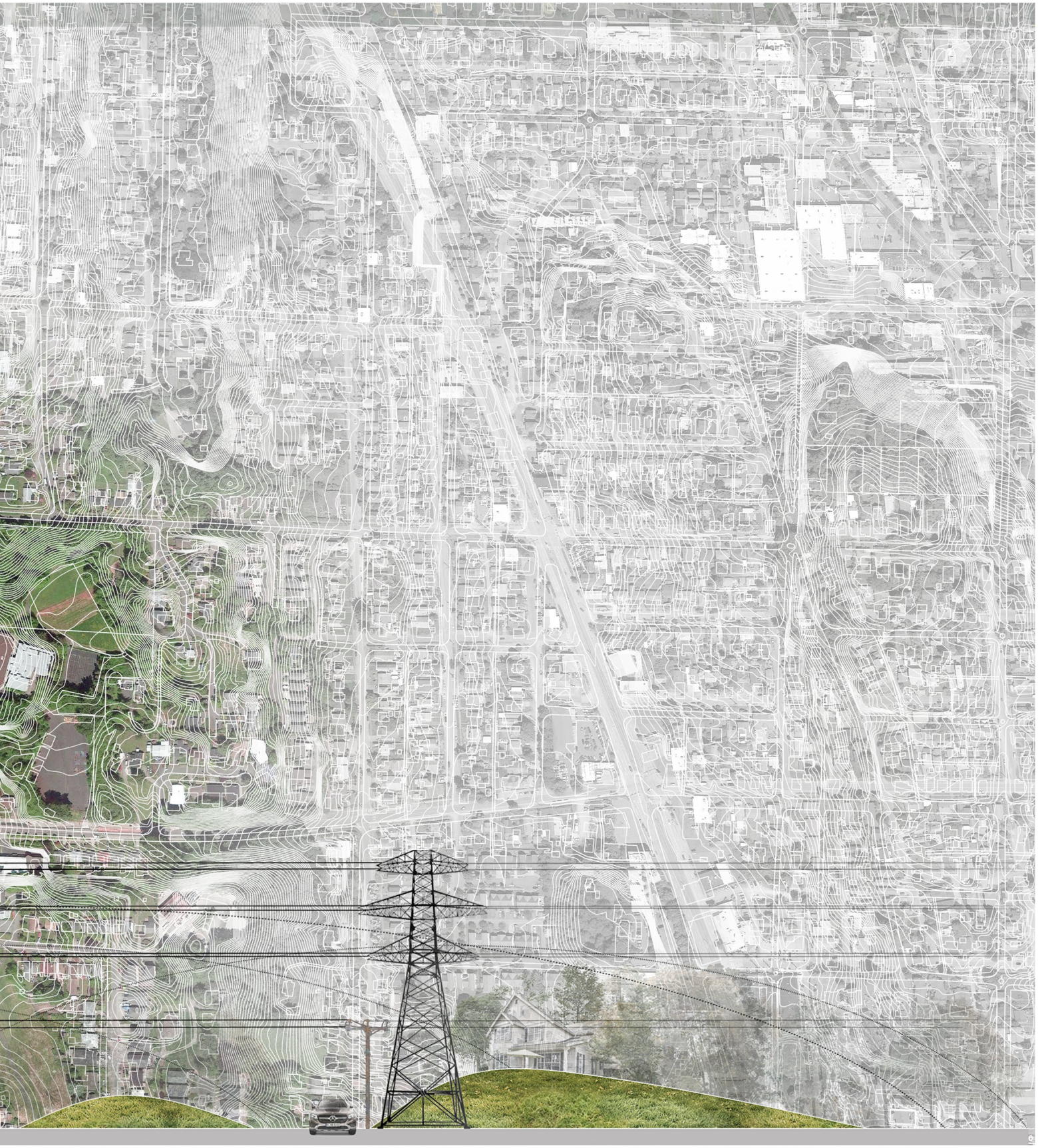


Fig. 1-3: The section and map of the design site
Base map: Google Earth, May, 2017



This plan and section represents the landform of the Chief Sealth Trail. The reason why I chose this site is because it has many advantages which could be utilized to promote the pollinator habitat. First, the trail itself is a connected series of green spaces for pollinators, which is good for keeping the biodiversity. Second, the turf along the trail is easy to maintain. People usually tend to choose that approach with low maintenance options when they need to support the pollinator habitat. Last but not least, some pollinators like bees actually need some bare spaces for nesting. The trail has a lot of the nesting sites for bees, especially ground nesting bees. Also, the trail is able to accommodate the artificial substrate for cavity nesting pollinators.

Fig. 1-4: The birds eye view of Chief Sealth Trail in Seattle
Image credit: Dicklyon

Fig. 1-5: The perspective of Chief Sealth Trail

Fig. 1-6: The power line towers on the trail

Fig. 1-7: The hills along the trail

Seattle is a very green city. There are a lot of green belts, corridors and parks which provide rich ecological resources within the urban area. And, there are nearly 100 p-patches and community gardens also making Seattle rich of productive landscapes. However, even South Seattle contains plenty of the potential habitats for pollinators and other living forms, each green space is pretty scattered and fragmented. The isolated patches also caused the species as well as the natural resources, ecological homogeneous without the diversity.

One of the critical reason I chose the Chief Sealth Trail is because the Trail crosses through the Rainer Valley, which means it could provide the enough green spaces. This linear habitat is able to string each patch together in South Seattle in order to create the matrix habitat. And this system can effectively increase the ecological interaction of the pollinators and heterogeneity of the species.

Thus, this pollinator network design is driven by three main questions. First of all, how can we enrich the pollinator habitats in the urban area and also create ecological heterogeneity for pollinator habitat? Second, what could be the potential strategies for the community to create the pollinator friendly habitats and how can they implement these design strategies in the living space? Last but not least, according to the green space analysis, how may we take the advantage of the linear habitat Chief Sealth Trail to achieve the network system?

The main goal of this thesis design is to create a guide book for the community to mimic, create and reproduce the potential nesting and breeding habitats in the community or even the city. Citizens and local community groups can use this book as guidelines to recreate the new design by themselves to support the pollinator habitats in South Seattle.

2

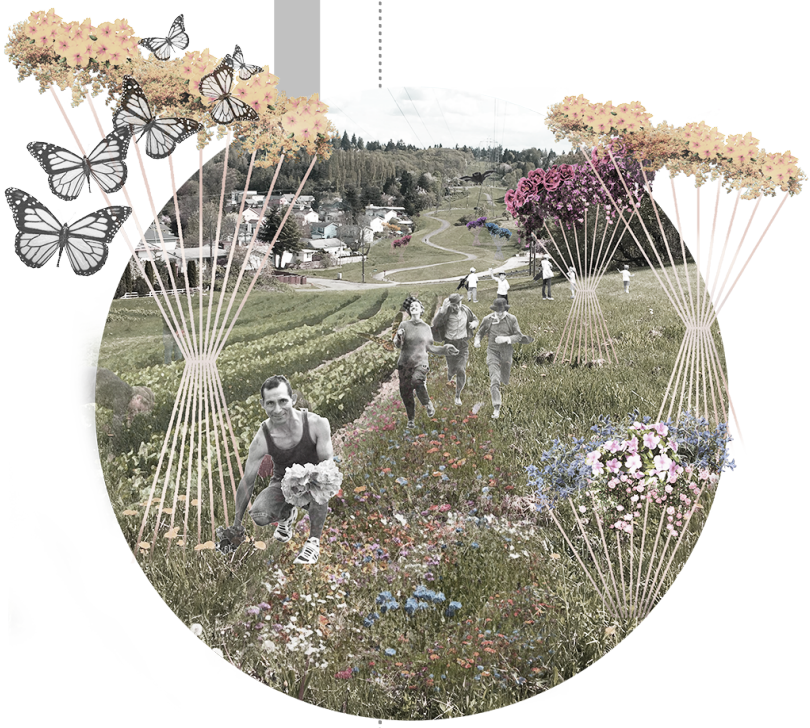
Learning Garden

Educate the public why essential about the pollinators and how to protect them.

Without the actions of pollinators, agricultural economies, our food supply, and surrounding landscapes would collapse.

https://www.fws.gov/pollinators/

1



Urban Farming

Planting food not only for humans but also pollinators.

3

Community Engagement

Community residents can share part of their front yard or garden as the pollinator habitats.

4

Pollinator Sanctuary

Create a core pollinator habitat habitat protected from human disturbance.

As the previous chapter mentioned, the total population of the pollinator around the world is facing and suffered a severely decreasing. Ultimately, the decline of the pollinators can not only have the environmental issue and also lead to the public health consequences. Losing crop pollination, ecological system collapsing and environmental issues are all the predictable severely result. As a result, we should start to protect and support their home and living conditions.

However, even though people all have the awareness of the agriculture is a good way of working with the pollinator habitat and crop pollination. Not that much of the people are aware of the horticulture is also another quality resource for the pollinator habitat. This design is trying to provide more options for people in the urban area to promote the pollinator habitats. Due to the issues, this design also gives a sense for the land managers and citizen who really concern about support and strive the pollinators.

Therefore, within the design concept and context, by means of the community engagement, urban agriculture, green infrastructures and environmental education, these are all the potential approach to achieve the goal of supporting the pollinator habitats.

Fig. 1-8: The diagram of the design guideline

2 Literature Review
Envisioning a Network for Pollinators

1. Patches, corridors and connectivity

In the article "Sustainable Large Parks: Ecological design or designer ecology? ", Lister proposed an important view point: "The potential for ecological design to create viable large parks is significant: it lies in the explicit recognition of resilience and adaptation as critical system parameters, and through this, in its ability to elucidate and reconcile the social, ecological, and economic imperatives necessary or long-term sustainability." (54) Obviously, large parks are an effective approach to keep the ecology diversity and it does make me think about the adaptation of shifting or diverging in ecosystems when we look back to this pollinator network design. Since the pollinators in South Seattle face critical issues such as serious human disturbance and habitats fragment, it is really important to consider the habitat as well as preserving the pollinator species in this design. Keeping the native plants for the pollinators to hide and increasing the number of habitats as much as possible are necessary.

There is a critical gap between the urban green space an surrounding wild nature in the site.

We use the swath as our strategy to stretch to the surrounding wild nature areas and create more potential urban green space.

Fig. 2-1: The ecological gap

On the other hand, I think this theory might not fit in and be utilized in all the circumstances and conditions. For instance, in some countries and cities, they don't really have enough space to design a large park, but there is still another strategy could also achieve this goal. To be more specific, there is another design process could also be the effective way called "stepping stone" patches of habitat. Since sometimes we don't have enough space to set the ecological preservation zone to preserve the whole and integral habitat in urban areas, stepping stone patches of habitat can be a good way to connect the small parks which are distributed in the city to form a green corridor and series of habitats. In this case, the design can utilize the elongated shape of the Chief Sealth Trail to create the ecological belt. Although the space of each habitat is not as big as rural environments, the pollinators can still enjoy the continuous physical environment in this limited zone.

Furthermore, in ***Corridor Ecology: the science and practice of linking landscapes for biodiversity conservation*** (Hilty.2006), Levery pointed that "Species that evolved in relatively continuous as opposed to naturally fragmented patches are less likely to be to adapt to human-included fragmentation and may require more natural corridors." (2006, 181). The clustered arrangement of stepping stone habitats is able to serve flexible and alternative routes for the species' interaction between the larger ecological patches. These corridors provide the ecological function of connectivity and continuity for the species and also solve the problem of the habitat fragmentation.

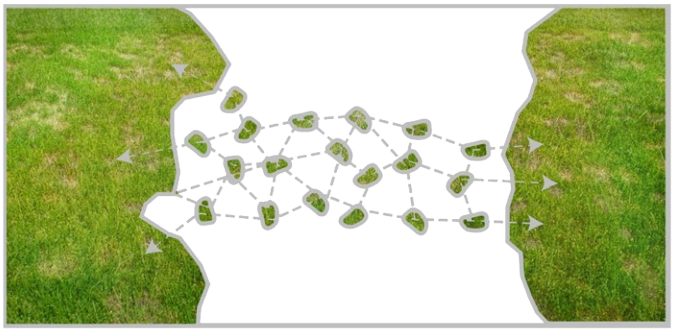


Fig2-2: Corridor and stepping stone habitats
The clustered arranged stepping stone habitats are able to serve flexible and alternative routes for the species' interaction between the larger ecological patches.

Fig2-3: Pollinator Pathway graphic identity
Image credit: Studio Matthews

Fig2-4: The community engagement on Columbia Street
Image credit: Pollinator Pathway

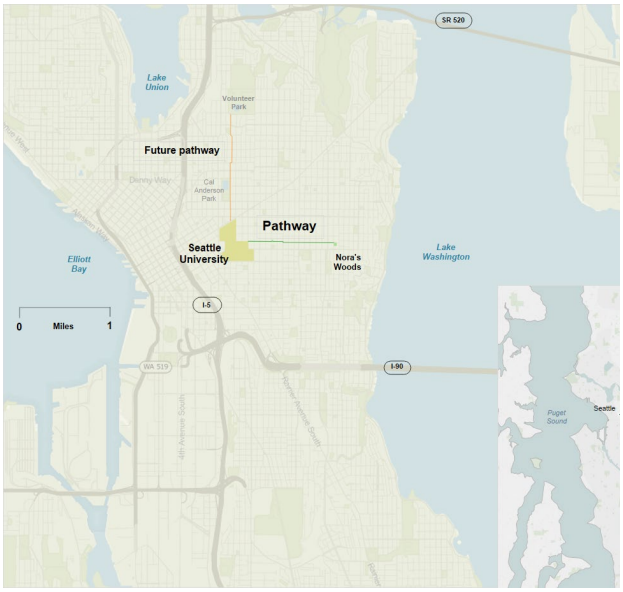


Fig2-5: The site of the project
Image credit: Dennis Bratland

2. Precedents

Three design precedents are discussed here, as they offer lessons for this project.

Precedent Study 1: Pollinator Pathway

What it is

The Pollinator Path is the Seattle based design project, which was founded by an artist, Sarah Bergmann, combined with the artistic sense and the ecological awareness of preserving the pollinator habitat. The first design site is located on east-west Columbia Street in Seattle.
(Pollinator Pathway, April, 2014)

How they did it

The concept of the pollinator pathway is creating a backbone in the existed isolated and fragmented green spaces to set up the system.

The first project they have done is located on Columbia Street to replant the 12-foot (3.7 m) grass strip between the street and sidewalk with the vegetation and flowers that could attract pollinators.

They also held an installation to present their design concept at Seattle Art Museum's Olympic Sculpture Park in 2012.
(Pollinator Pathway, April, 2014)

What is the inspiration

The concept of the habitat system intertwined with the city, farm land and wildland are able to increase the diversity and flexibility for the pollinator habitat.
It is important to reconnect the fragmented habitats from the urban, suburban and rural area to maximize the benefit of the ecosystem in the South Seattle.
As the network system, we should review the pollinator habitat system from the large and long-term perspective and leverage the scale of the system when we operate the design.

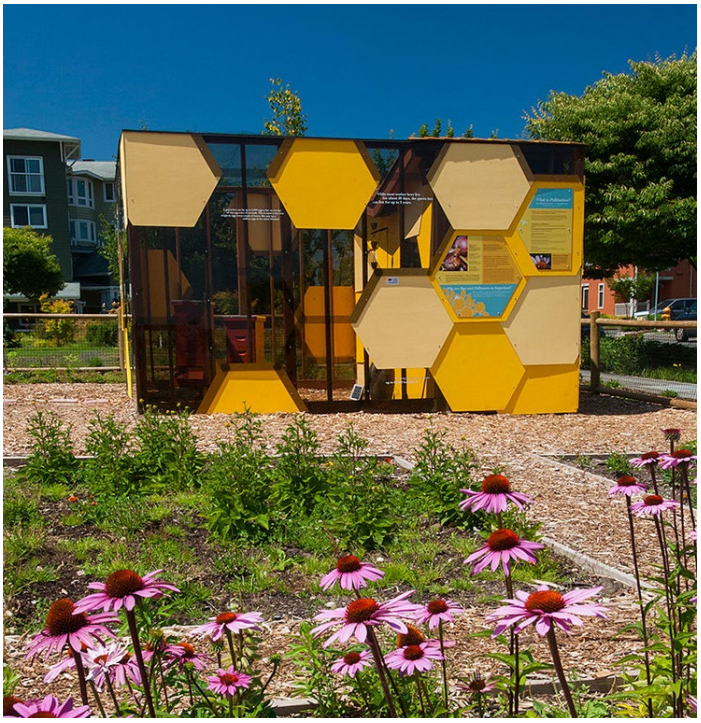


Fig2-6: The enclosure structure and beehives
Image credit: West Seattle Garden Tour

Fig2-9: Children are able to observe the hive closely
Image credit: West Seattle Bee Garden

Fig2-7 (Upper) + Fig2-8 (Bottom) : The beekeepers harvesting the honey
Both images credit: West Seattle Bee Garden

Precedent Study 2: West Seattle Bee Garden

What it is
The West Seattle Bee Garden (WSBG) is the volunteer based educational space that aims to teach the local residents about the importance of the pollinators which began in 2012. This bee garden is part of the existing Commons Park P-Patch. Besides, they also provide tours for visitors to closely observe the bee hives and further understand the pollinator habitat.
(West Seattle Bee Garden)

How they did it
This bee garden was built by the effort of nine months of community meeting and volunteer dedication.

Within the garden, it demonstrates the beehives within the special and beautiful enclosure design. These enclosure bee hives enable the visitors to observe the bee habitat closely and clearly. And there are numerous educational signs attached to the structures to play an educational function.
(West Seattle Bee Garden)

What is the inspiration
As the educational garden and demonstration bee center, West Seattle Bee Garden is a really good precedent for the public to access the pollinator in the close distance.

WSBG usually holds many events in the garden like the Western Seattle Bee Festival, which has becomes one of the most popular bee events in the community. These events also provide the opportunity for the public to learn about the pollinators.
Last but not least, WSBG provides an outdoor classroom and is open to the public, which enables people to better understand the pollinators and bees.

Fig2-10 (Top) + Fig2-11 (Middle) + Fig2-12 (Bottom): The Ginza honeybee garden.
Image credit: Yuchia Jan

Fig2-13: Flight range of the Ginza honeybees.
Image credit: Nippon.com

Precedent Study 3: Ginza Honey Bee Project

What it is
The Ginza Honey Bee Project is a nonprofit rooftop bee hive farm in the core area of Tokyo city in Japan form 2006. Ginza, as a luxury commercial district, seems hard to put it together with pollinator habitat. However, the location in between the Imperial Palace Garden (which is relatively free of agrochemicals) and Hibiya Park (which provides the large open green space in Tokyo) is making Ginza an ideal area for the beekeeping.
(Nippon.com, May, 2016)

How they did it
The Ginza Honey Bee Project aims to restore honey production, and leverage the public awareness of the relationship between bees, nature and community. This project connects 25 buildings in Ginza to implement the hives for the honey bees on the rooftop to keep 300,000 bees and now they produce almost 450 kilos of honey per year.

They use the honey to make high value-added commodities such as honey cake, the honey cocktail and chocolates. These products are sold in the department stores in Ginza for running and continuing the project.
And the Farm Aid Ginza event also supports the local organic agriculture, and the local street tree planting, and roof gardening in order to restore the bee habitats.
(Nippon.com, May, 2016)

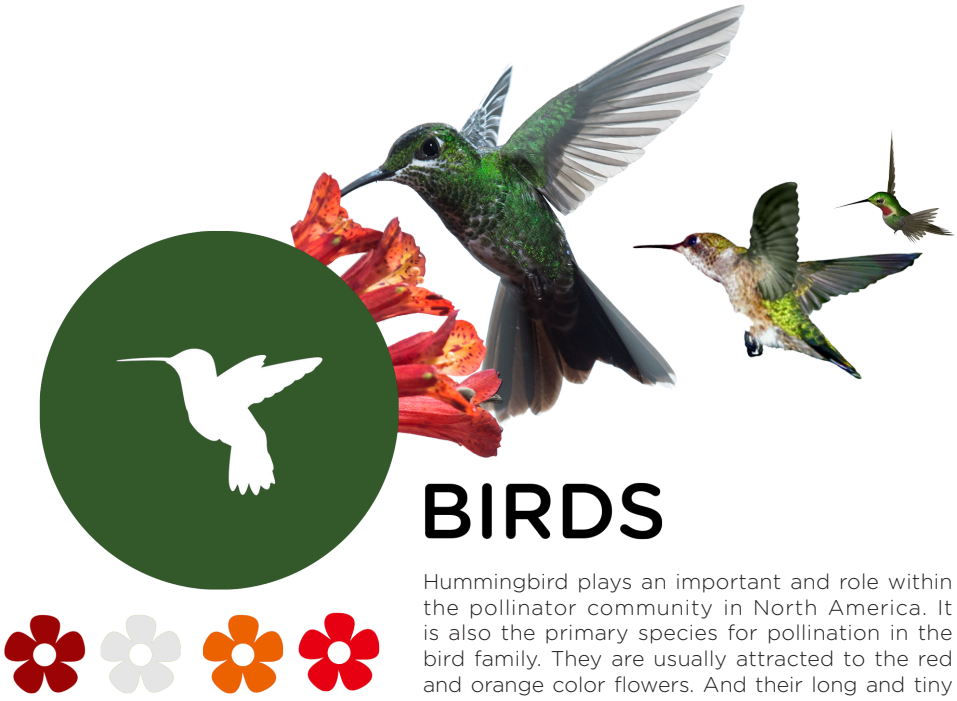
What is the inspiration
From this project, we can see the potential and flexibility of creating micro habitat even in the crowded and compacted urban area.
Furthermore, this large volunteer base project collaborates with local businesses, commerce and residents, so that everyone can consciously open their own roofs or private spaces to make the effort for the urban ecology and pollinator habitat in the city.

3. The Category of Pollinators

There are several pollinators to consider for pollinating plants, which are introduced here.

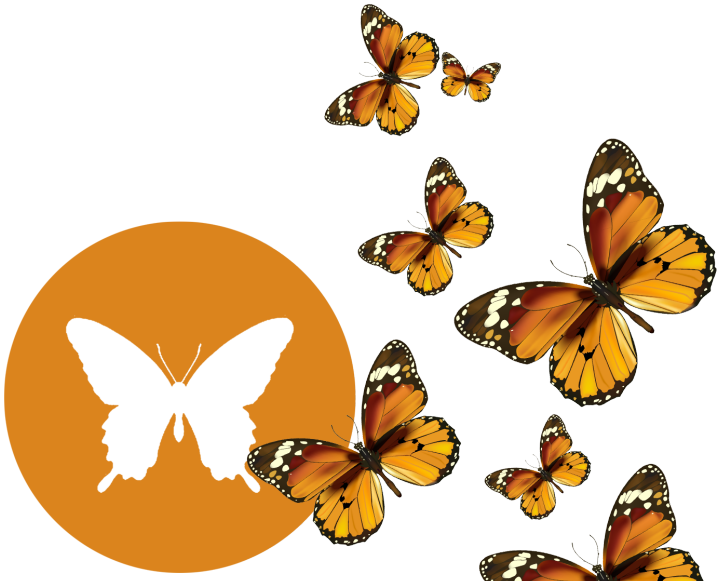
BEES

Bees are the most well-known and popular pollinators in the people daily agricultural systems around the North America. There are a lot of the crops, including cucumber, kiwi, broccoli, and cabbage that rely on the bee for pollinating.
(Pollinator Partnership : http://pollinator.org/)



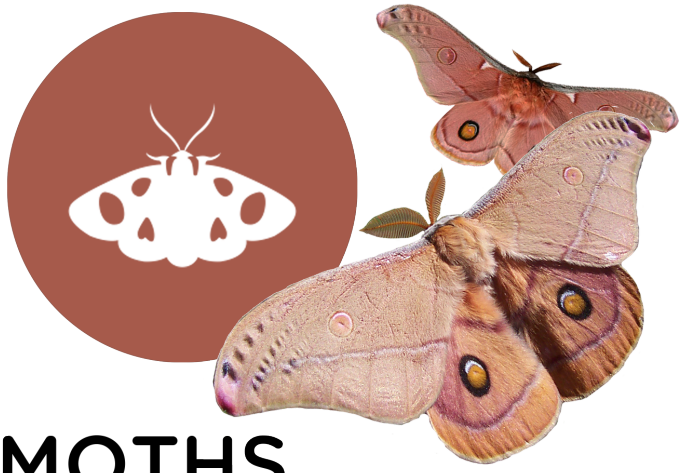
BIRDS

Hummingbird plays an important and role within the pollinator community in North America. It is also the primary species for pollination in the bird family. They are usually attracted to the red and orange color flowers. And their long and tiny beaks enable them to draw the nectar from the flowers easily.
(Pollinator Partnership : http://pollinator.org/)



BUTTERFLIES

Another popular and diverse group within the pollinator family is the butterflies. Countless trees, vegetation, flowers and crops have the tight relationship with them. These lovely creatures are really eye-catching pollinators in our garden, and they are also attracted to the colorful flowers.
(Pollinator Partnership : http://pollinator.org/)



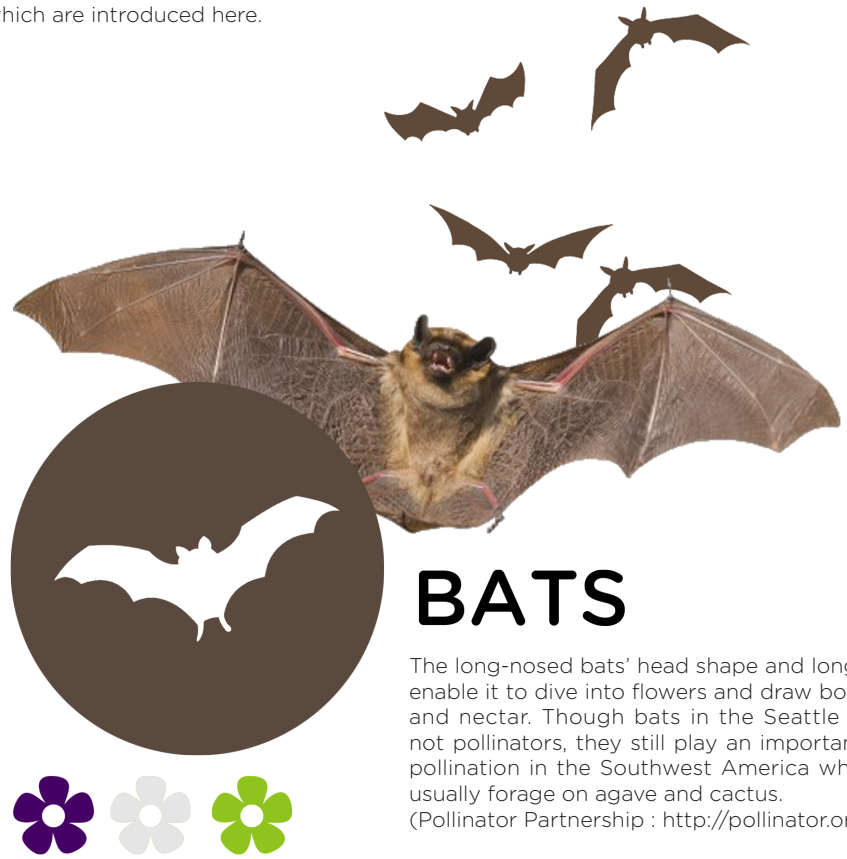
MOTHS

Moths are primary the nocturnal pollinators. Even though they usually look not as beautiful as the butterflies, they do play an important role in pollination as well. Since they usually pollinate at night, they are attracted to vegetation which has a strong flavor and smell.
(Pollinator Partnership : http://pollinator.org/)

Fig 2-14: The Category of Pollinators and attracted colors

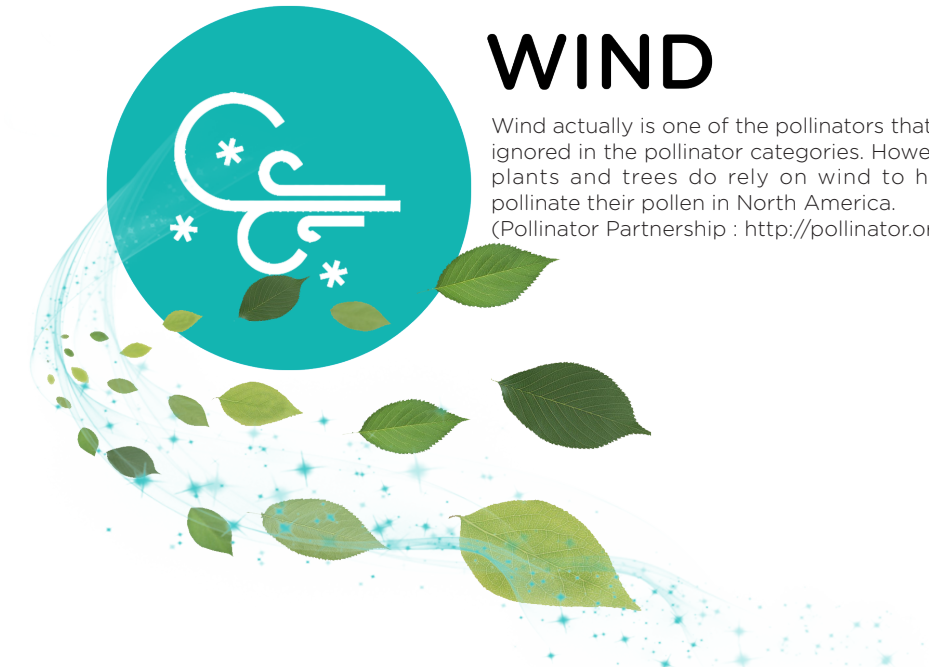
3. The Category of Pollinators

There are several pollinators to consider for pollinating plants, which are introduced here.



BATS

The long-nosed bats' head shape and long tongue enable it to dive into flowers and draw both pollen and nectar. Though bats in the Seattle area are not pollinators, they still play an important role in pollination in the Southwest America where they usually forage on agave and cactus.
(Pollinator Partnership : http://pollinator.org/)



WIND

Wind actually is one of the pollinators that is always ignored in the pollinator categories. However, many plants and trees do rely on wind to help them pollinate their pollen in North America.
(Pollinator Partnership : http://pollinator.org/)

BEETLES

The plants and flowers which beetles pollinated tend to be big, with the obvious sexual organs exposed. Beetles do play a role in the pollinator community. However, sometimes their bad behavior like damaging the plants and leaving the mess after they visited does make people not really welcome them in the garden.
(Pollinator Partnership : http://pollinator.org/)

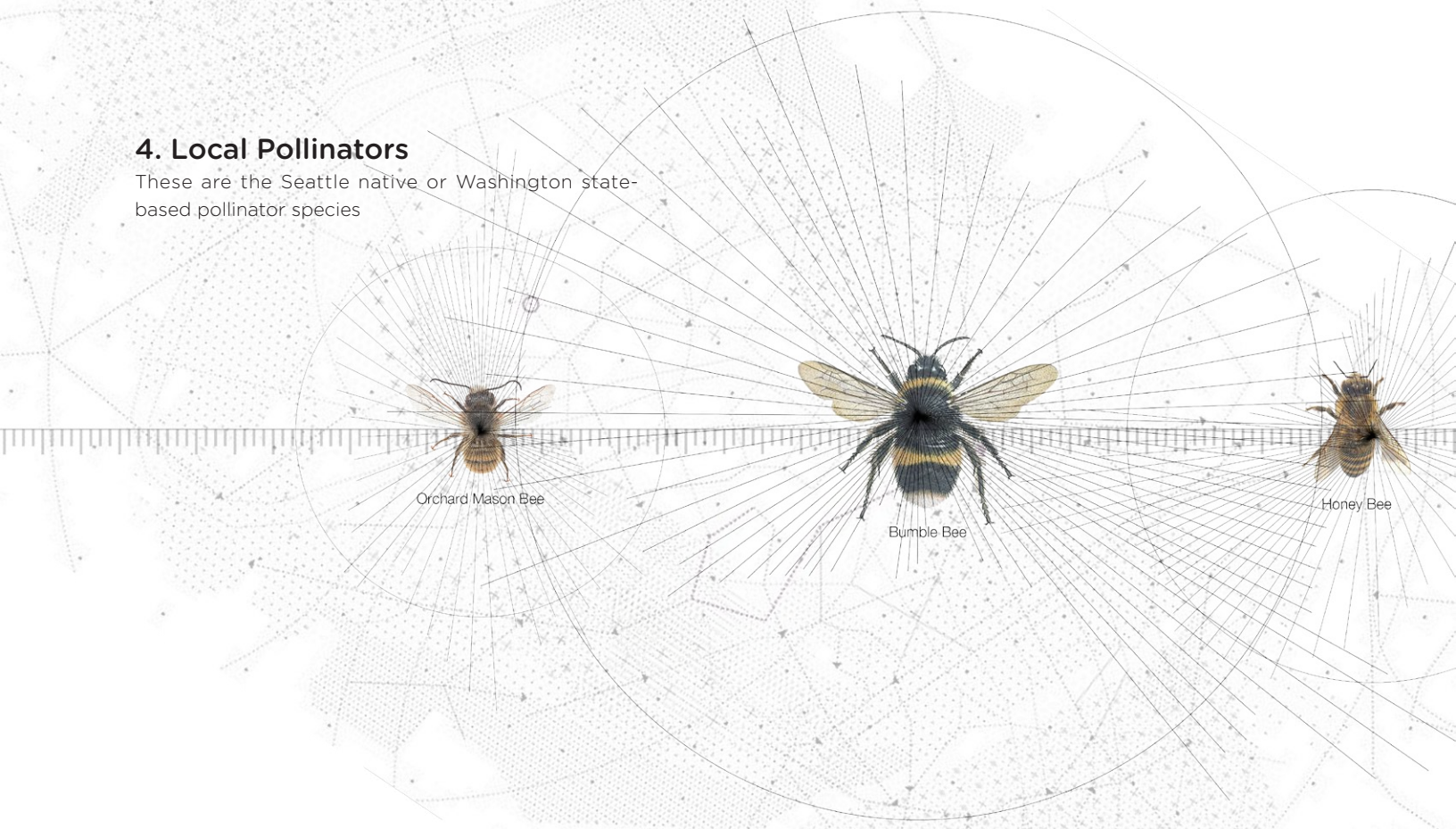
FLIES

It might be hard for people to welcome flies in their garden for pollination. Flies seemnot as attractive as the bees, butterflies and hummingbirds, yet, actually, numerous fly species are generalist pollinators , and so are the good helpers in pollination.
(Pollinator Partnership : http://pollinator.org/)

Fig 2-15: The Category of Pollinators and attracted colors

4. Local Pollinators

These are the Seattle native or Washington state-based pollinator species



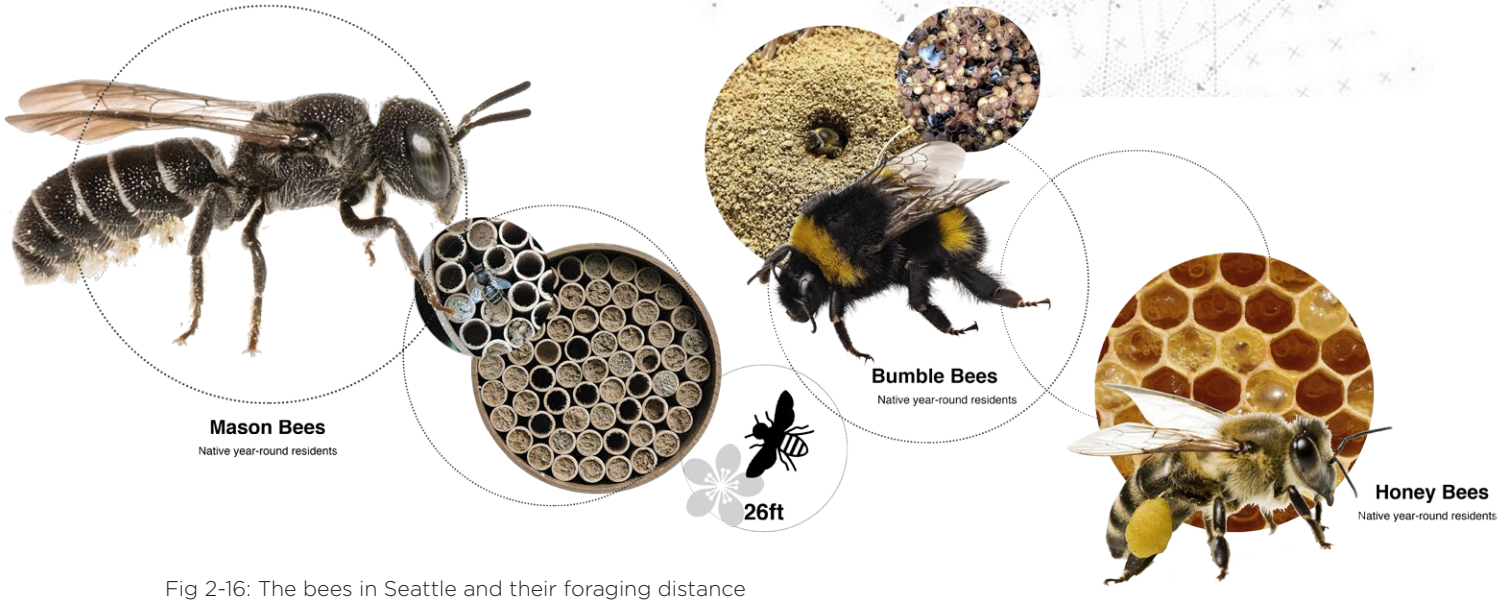
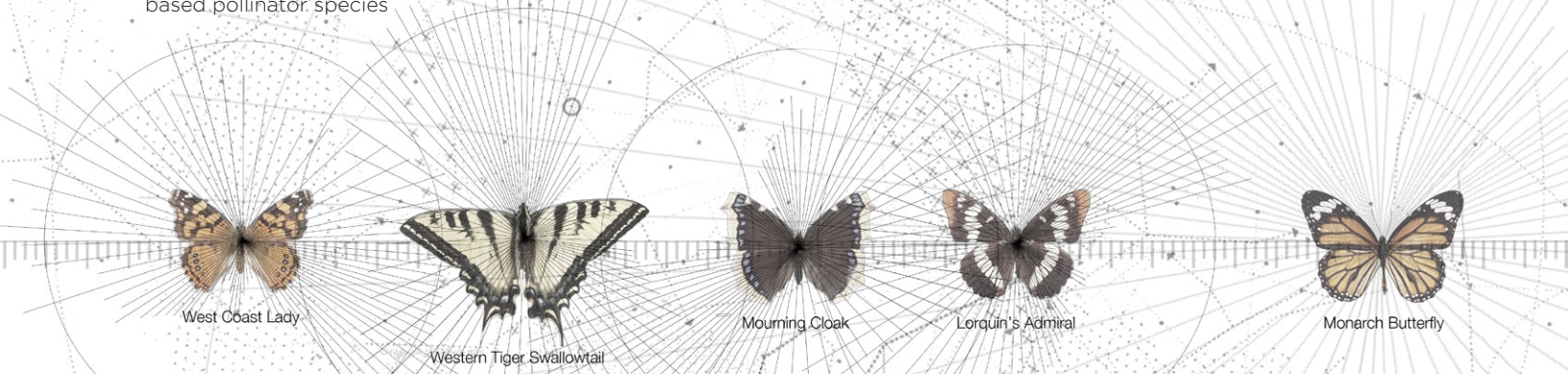


Fig 2-16: The bees in Seattle and their foraging distance

The foraging distance for honey bee is rangs from 1-4 miles but is able to go up to 12 miles, although the Mason-bee species are only able to fly few hundred feet. And both the Mason-bee and bumblebee are the ground-nesting species.
(Buzz About Bees)

4. Local Pollinators

These are the Seattle native or Washington state-based pollinator species



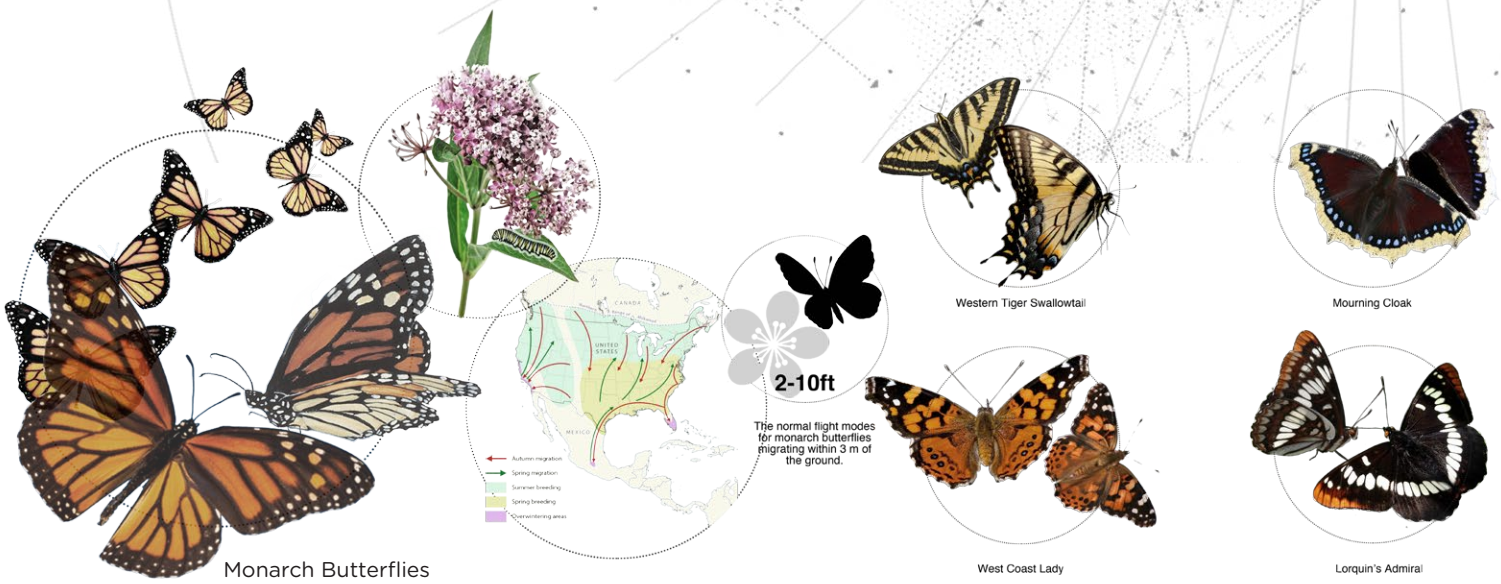
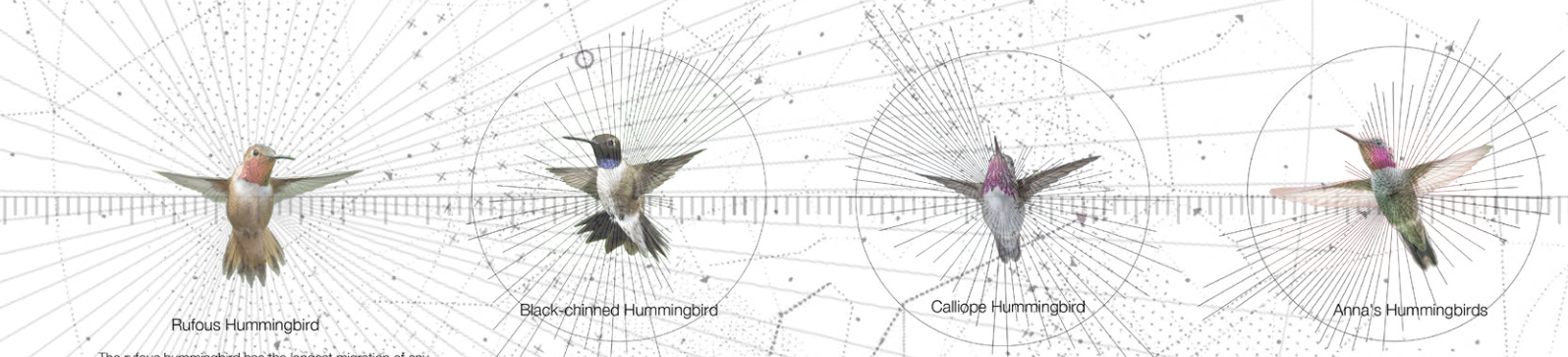


Fig 2-17: The butterflies in Seattle and their foraging distance

The average foraging distance for the butterflies is 0.5 - 2 miles. Around 88% of the butterflies fly further than 3 miles. Only 5 % of the migratory butterflies like Monarch Butterflies will fly over 18 miles from the boundaries of their nesting site or habitat. (North American Butterfly Association)

4. Local Pollinators

These are the Seattle native or Washington state-based pollinator species



The rufous hummingbird has the longest migration of any hummingbird species. These hummers fly more than 3,000 miles from their nesting grounds in Alaska and Canada to their winter habitat in Mexico.

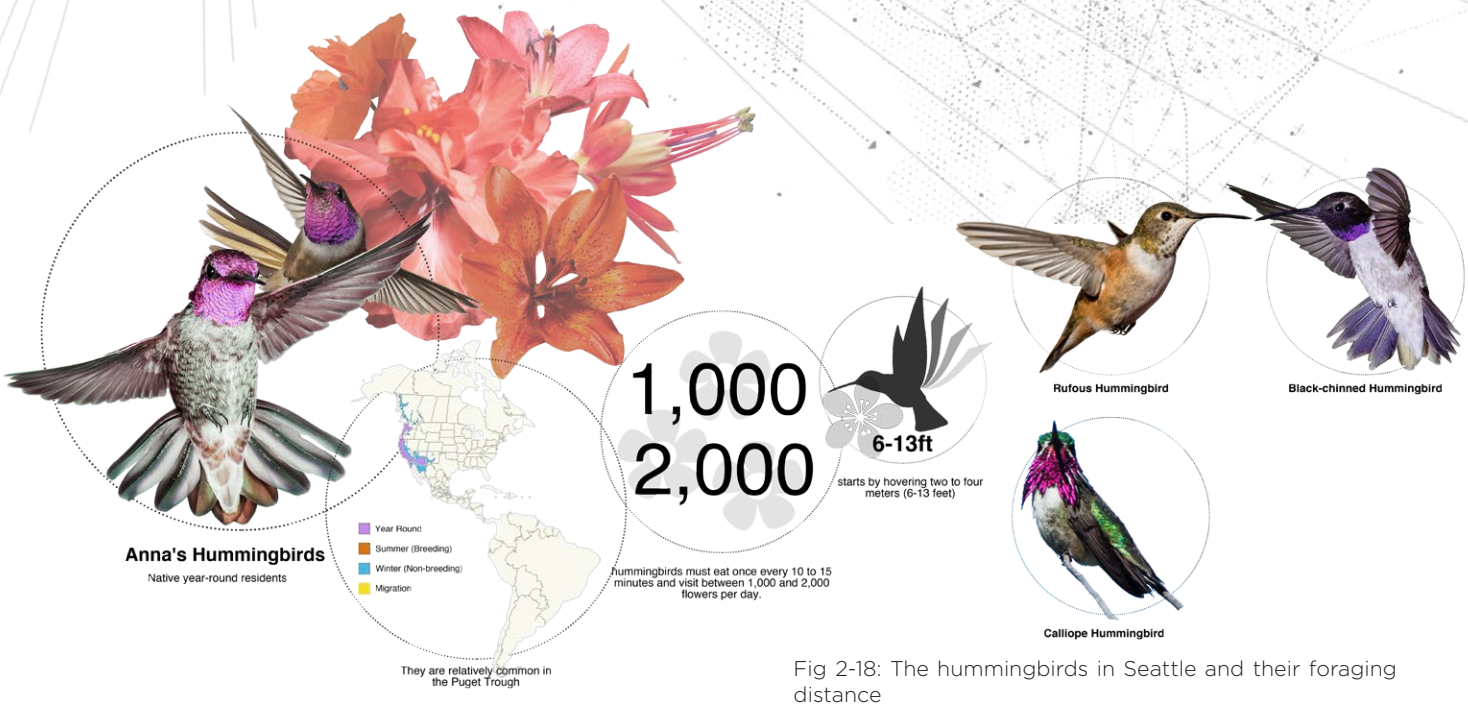


Fig 2-18: The hummingbirds in Seattle and their foraging distance

The foraging distance for the hummingbirds typically spans 0.5 mile or less. The male hummingbirds don't need to take responsibility for nesting so they can also leave the site anytime. In Seattle, Anna's Hummingbird and Rufous Hummingbird are two migratory species.
(Birds of North America)

5. Hazards

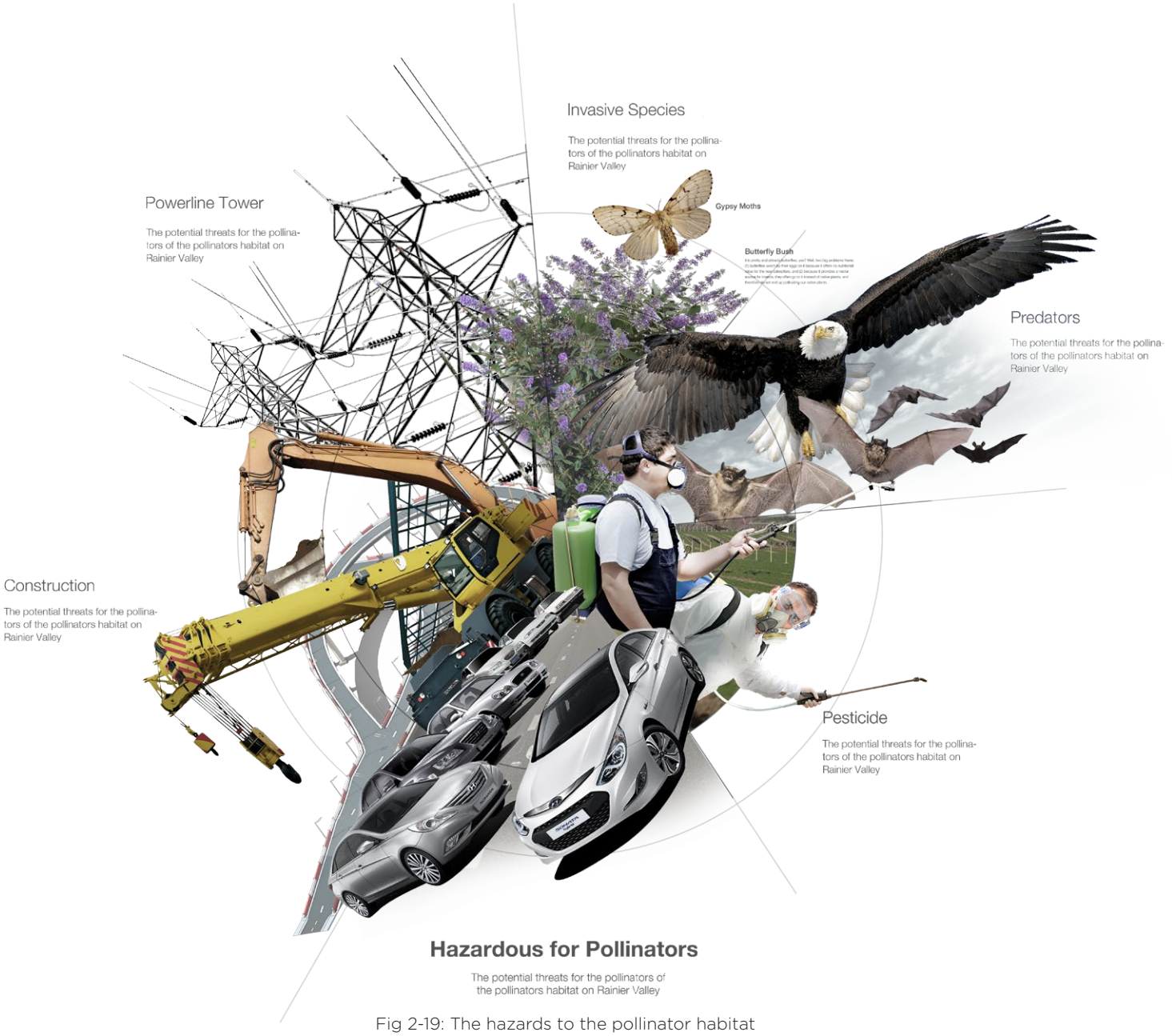


Fig 2-19: The hazards to the pollinator habitat

These potential threats might cause the pollinator difficult to nest and rest in South Seattle site. Pesticide are the primary reason for pollinator population decline. (United States Environmental Protection Agency)

6. Supportive plant species

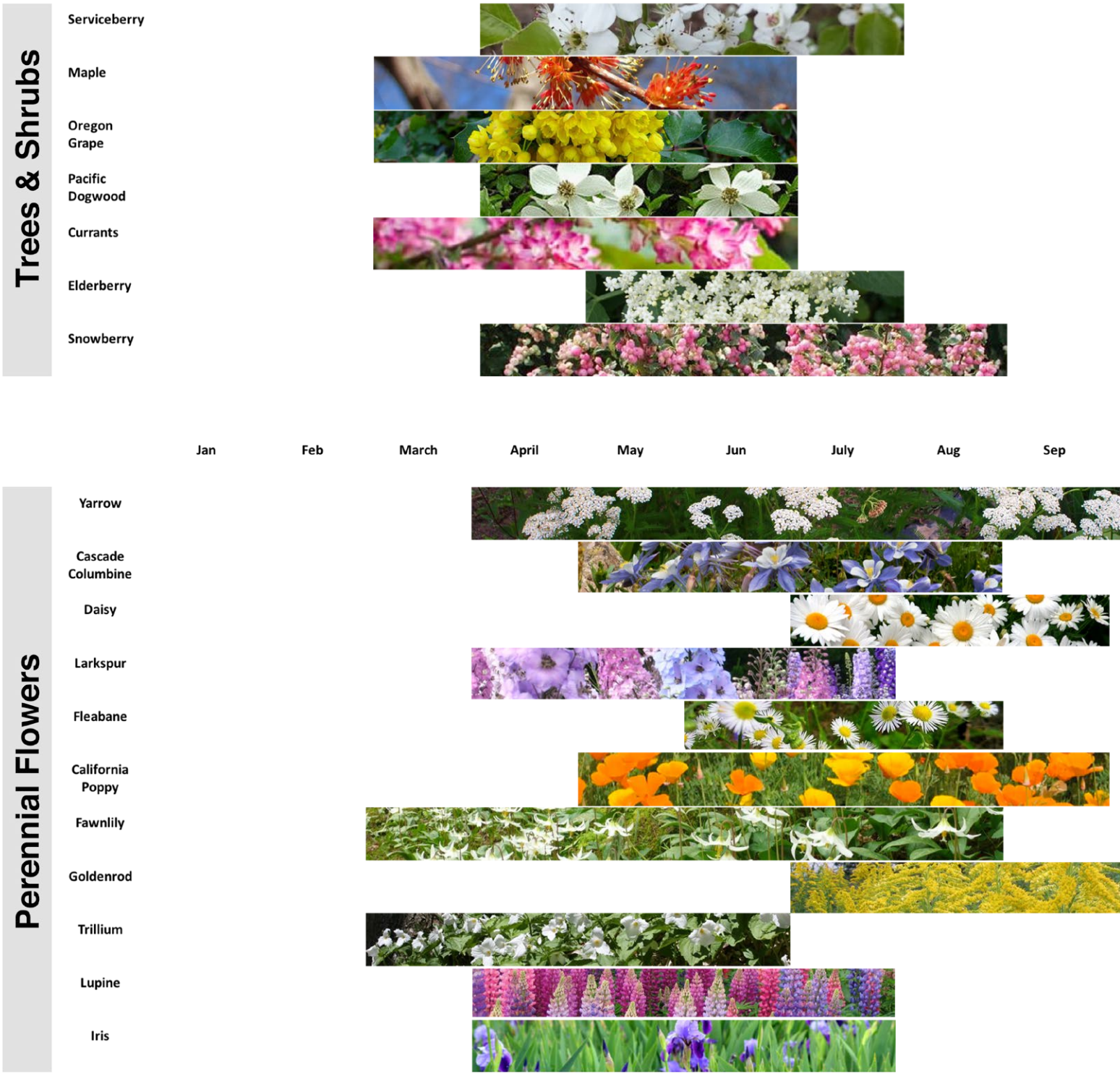


Fig 2-20: The blooming seasons of pollinator food-source plant species (Pollinator Partnership)

Flower definitely the most important component within the pollinator habitats. Keeping the blooming season as long as possible will be good to make sure these creatures have enough food resources around the year. Also, different pollinators will be attracted by different colors of the flowers. As a result, keeping the species diversity is also critical to create a pollinator friendly garden.

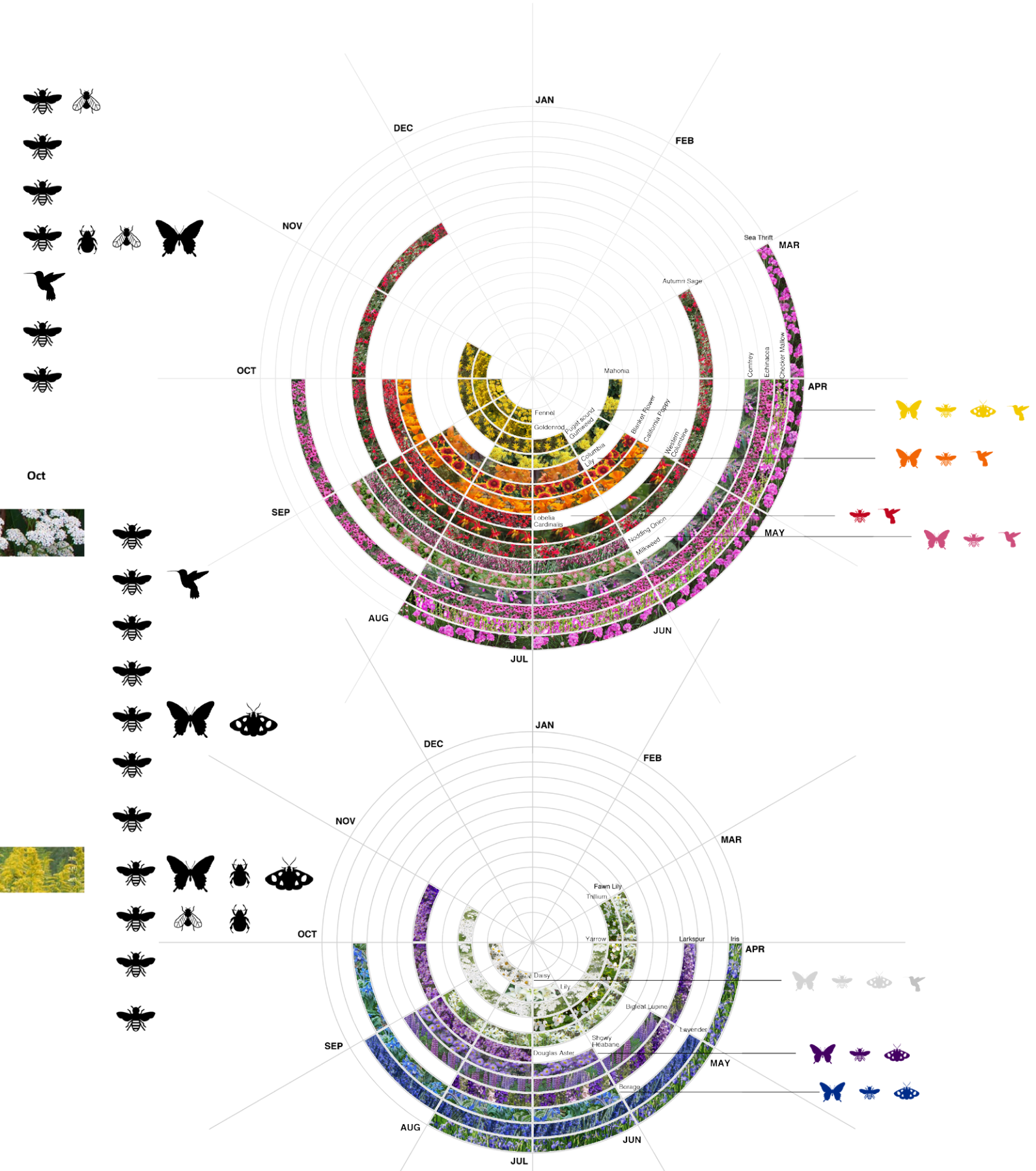


Fig 2-21: The colors and blooming seasons of pollinator food-source plant species (Pollinator Partnership)

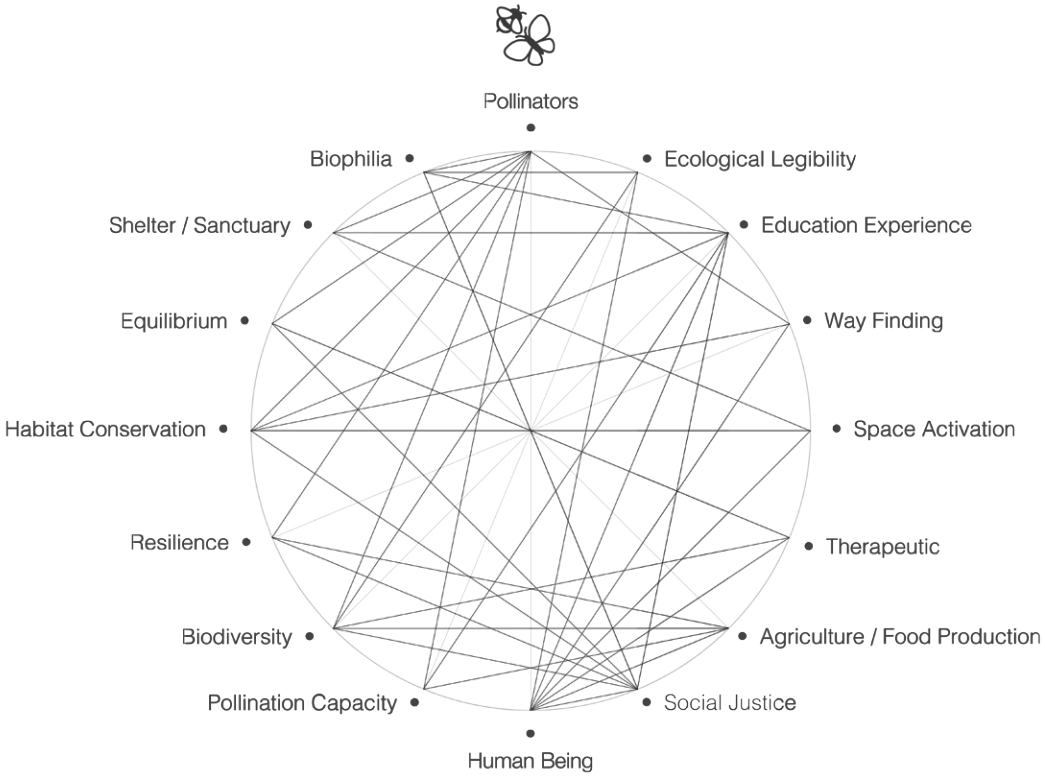


Fig. 2-22: The network relationship between people and pollinator

7. Human relationships with nature

The concept of this pollinator network system is a bidirectional design, not only benefit humans and public health, but also improving the pollinators' number and ecological diversity. The diagram above is indicating the indispensable relationship between the pollinators and human beings. The principles of this design are aiming to increase the consciousness of biophilia, ecological legibility, biodiversity, and ecological equilibrium by improving pollinator habitat. This awareness and response builds from the inherent love of natural environment and other living creatures.

For humans, how can local communities start the process to support the pollinator habitat? What are the goals and advantages for people to protect these creatures and their homes? What are the design strategies that could be utilized in this network system? On the other hand, where are the ideal sites for pollinators to breed, pollinate and nest? How could pollinators produce the food and procreate without threatened by human activities? These questions explore the best way to respond these concerns by means of landscape architecture design.

We should focus on a long horizon for protecting the pollinator habitat and promoting the pollinator health. It could also provide more information about the choices when people want to support the pollinator habitats and set up a network system. The functions of nesting, habitats, wetland, wildlife crossing, education, productive landscape, wayfinding and infrastructure which are able to create the simultaneous benefits for people and pollinators.

1.Nesting:
The nesting site is critical for the pollinators to have a home. It provides the hiding places for pollinators to breed without disturbance.

2.Habitat:
A good pollinator habitat needs to provide enough food sources for pollinators as well as resting place for them while foraging.

3.Wetland:
Since Seattle is surrounded by the water, the wetland habitat or floating wetland could also be an ideal place for the pollinator habitat without the human disturbance.

4.Wildlife Crossing:
Since there are many migratory species in pollinator community, wildlife crossing features should help these pollinators safely migrate without the risk of being hit by the car.

5.Education:
Educating the public about the importance of the pollinator habitat and natural systems is necessary. By means of learning gardens or outdoor classrooms, people are able to better understand these lovely creatures.

6.Productive Landscape:
Crops and pollinators always have an indispensable relationship. This is important to generate the food for people and pollinator simultaneously through urban agriculture.

7.Infrastructure:
Green infrastructure could be the most flexible and accessible place in the community to create the microhabitats for pollinators.

8.Wayfinding:
The wayfinding function is not only for people to become aware of pollinator habitat, but also can be designed to attract pollinators to stay and rest.

8. Principles for pollinator habitat

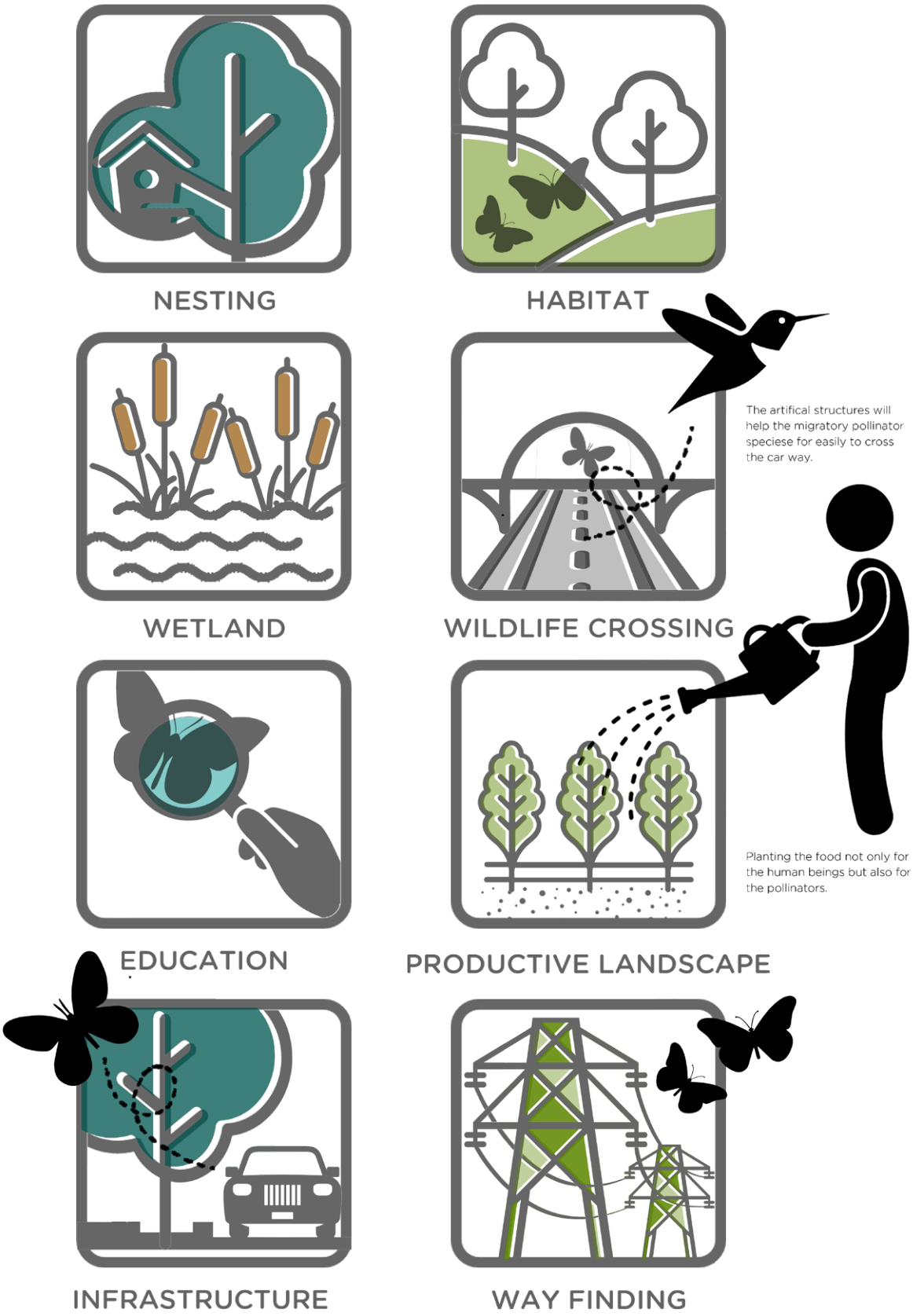
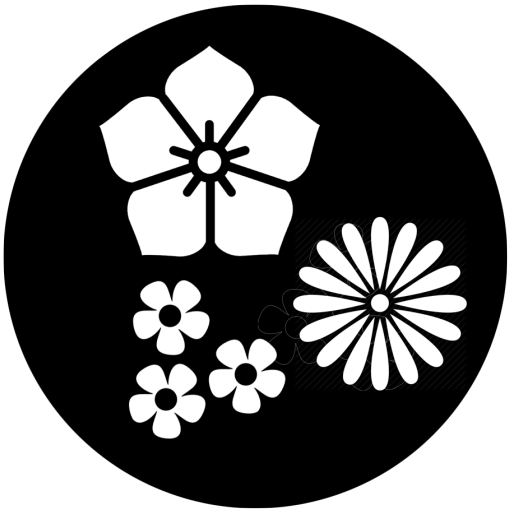


Fig. 2-23: The eight categories of the design principles

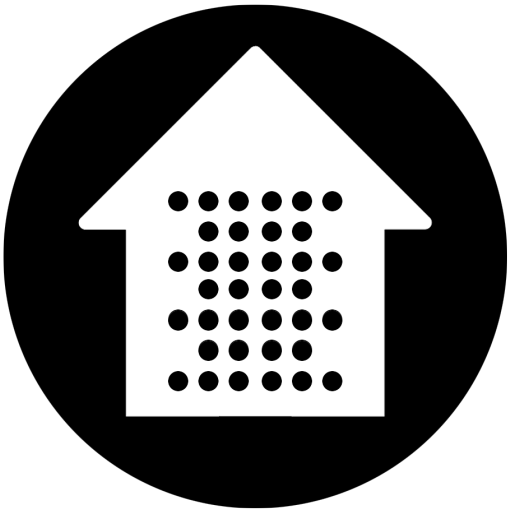
1



Increase Flower Diversity

- Support native vegetation and flowers, trees and shrubs that bloom all season.
- Rest areas near the garden or farm can be ideal sites for pollinator gardens.
- Plant wildflower or native plants along boulevard or corridors.
- Highlight the pollinator habitats and gardens with obvious signages.

2

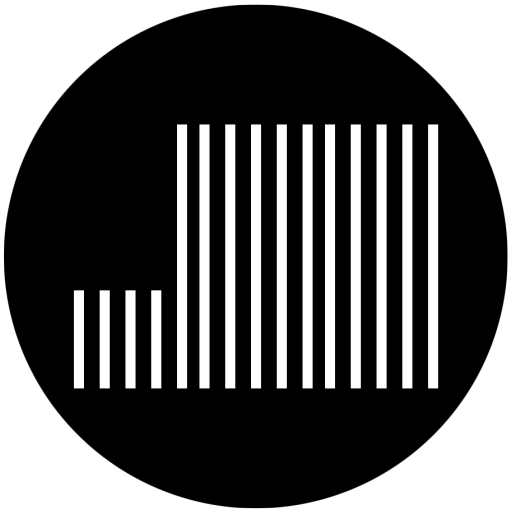


Provide Nest Sites

- Keep woody shrubs with pithy stems for pollinator nesting.
- Preserve trees that provide pollen, nectar and shelter for pollinators.
- Provide access to bare and soil surface for ground nesting.
- Retain some branches or logs for nesting substrate.
- Add some artificial substrate nesting sites like nesting blocks or bee box.

Fig. 2-24: Guide for pollinator habitat restoration and maintenance

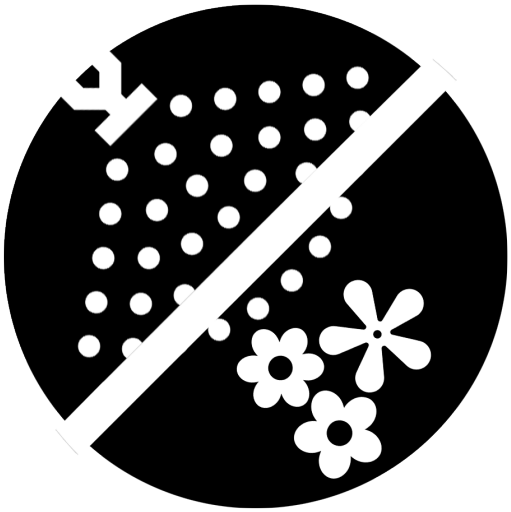
3



Reduce Impact of Mowing

• Keep and protect the woody shrubs with pithy stems on order to provide the pollinator nesting habitats.

4



Avoid Herbicides and Insecticides

• Minimize herbicide application to increas floral resources as much as possible.

• Minimize pesticide use beside pollinator habitats.

(Source: Pollinator Partnership:www.pollinator.org/ngm.htm)

3 Site Analysis
Envisioning a Network for Pollinators

Fig. 3-1: The envision concept of the network system

The concept of this network design is taking the advantage of the Chief Sealth Trail as the backbone of the entire pollinator network system. Through the green infrastructures and ecological facilities to connect the surrounding green belts, nods and parks.

Then, the goal of completing the full coverage of the pollinator habitat will be achieved. Within these series of analysis diagrams, each circle represents the half-mile radius forage circle for the pollinators, which also means the habitat distance for nesting and breeding. South Seattle currently has many green spaces, parks and corridors. These habitats are really scattered and separated. There are many ecological gaps in between cause the habitat discontinuity. Thus, in order to fill-up these "gaps", the design for the network system creates stepping stone habitats. Once the coverage is able to cover the entire South Seattle, this network system can provide a rich and diverse living habitat for pollinators.

All the trees, shrubs, turfs, or even the stems of the plants could be nesting sites for the pollinators. Also, surrounding open green spaces could be the ideal anchor to continue this network system and green corridor, such as the Cheasty Boulevard, Beacon Food Forest, New Holly Power P-Patch Community Gardens. These community gardens and open green spaces are able to be the microhabitat providing food resources for the pollinators. Therefore, using the Chief Sealth Trail to link these sites is another goal to complete the pollinator network system.

After the network system is completed, it could provide the double benefits not only for the pollinators but also for humans. These open green spaces can effectively mitigate some heat island effect in the urban area, promote the public and pollinator health, offer ecological heterogeneity.

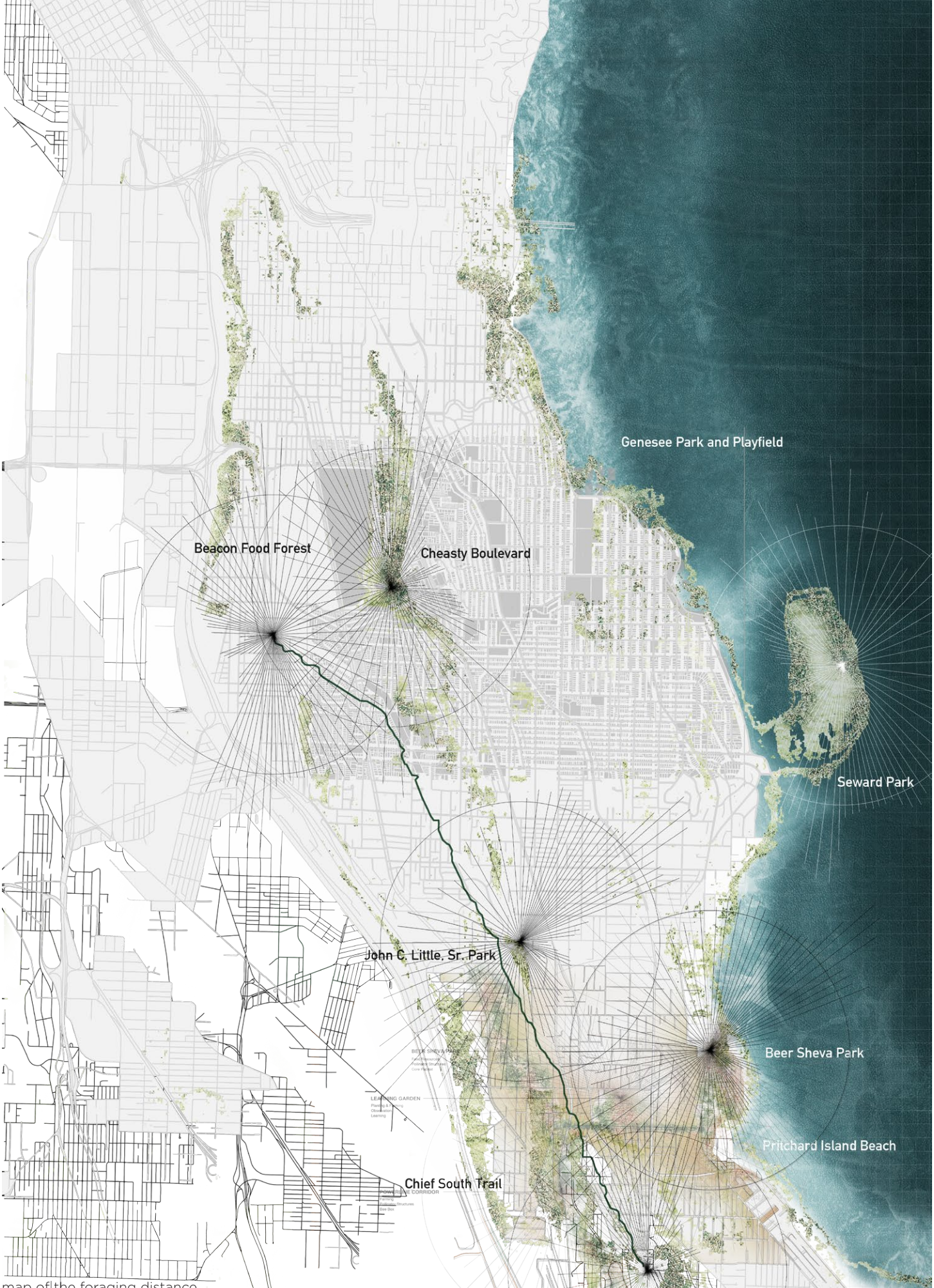
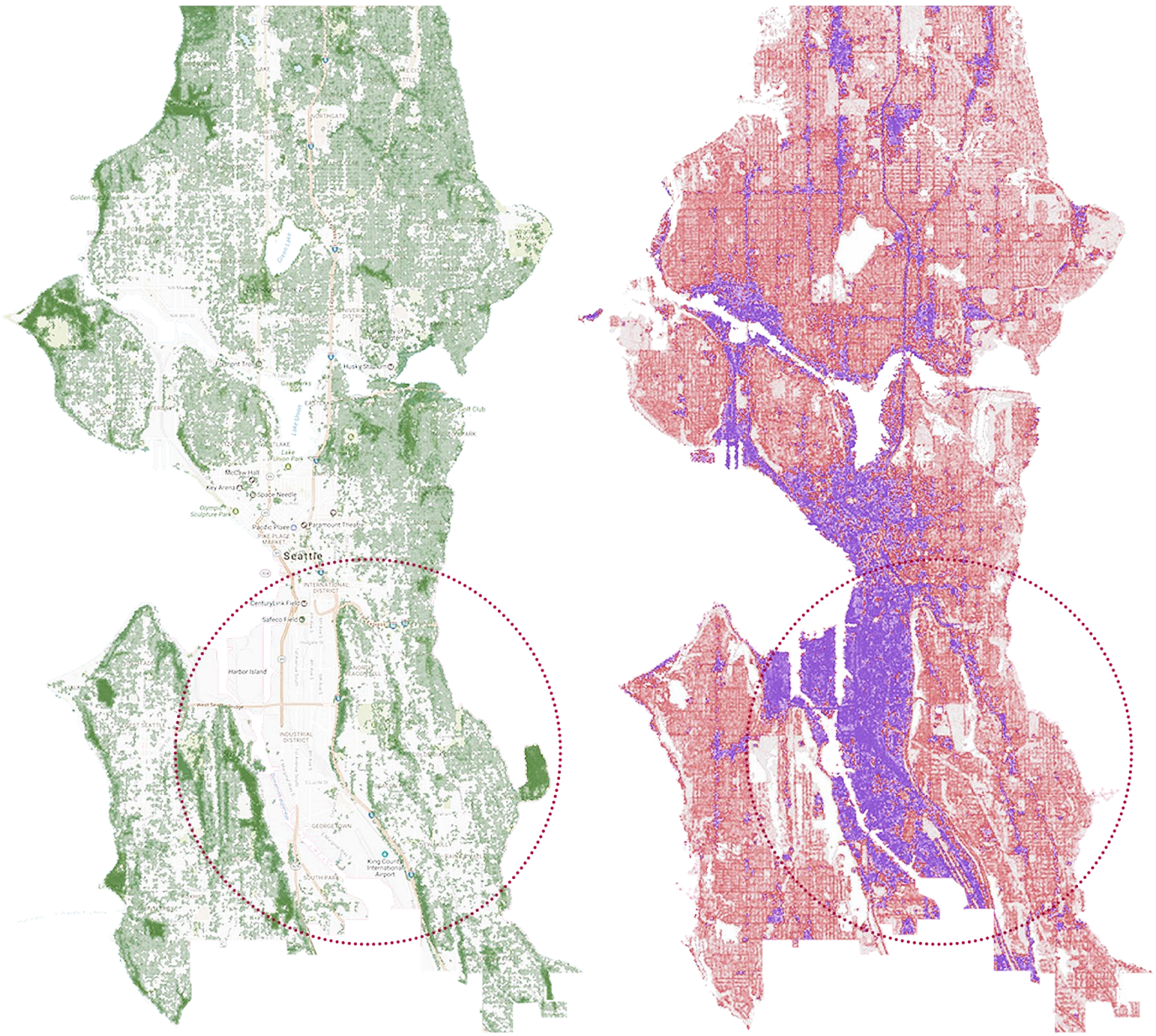


Fig. 3-2: The map of the foraging distance



CANOPY COVERAGE

2001 : 28.71%

2014 : 16.15%

From these two maps, the green coverage distribution in South Seattle is relatively scattered. Especially, the canopy coverage in South Seattle is declining. And the other map shows that there are many impervious surfaces at that area as well. As a result, due to these two analyses, it seems the conditions for pollinator habitat need attention.

Fig. 3-3: The canopy coverage and impermeable pavement in Seattle
GIS map: Seattle.gov

Fig. 3-4. The ecological gap in South Seattle
GIS map: Seattle.gov

This map shows a more specific distance of the pollinator daily forage distance. Each circle represents the half mile which is the average forage distance of every species of local pollinator, including bees, hummingbirds, butterflies and moths. When using these circles to determine the habitat coverage in South Seattle, it is not difficult to see that there is quite a large gap between the Chief Sealth Trail and Seward Park. And also, there is a wide range of impervious paving in between. The gap will not only prevent pollinators effectively going to the pollination sites in South Seattle, but also undermines the ecological integrity of the area.

Site availability is a critical issue to improve biodiversity and habitat complexity. Therefore, creating the stepping stone habitats and green infrastructure will be a good way to continue the network system. Furthermore, these pollinator facilities and structures can also increase the green spaces in the South Seattle in order to maximize the habitat coverage for the pollinators.

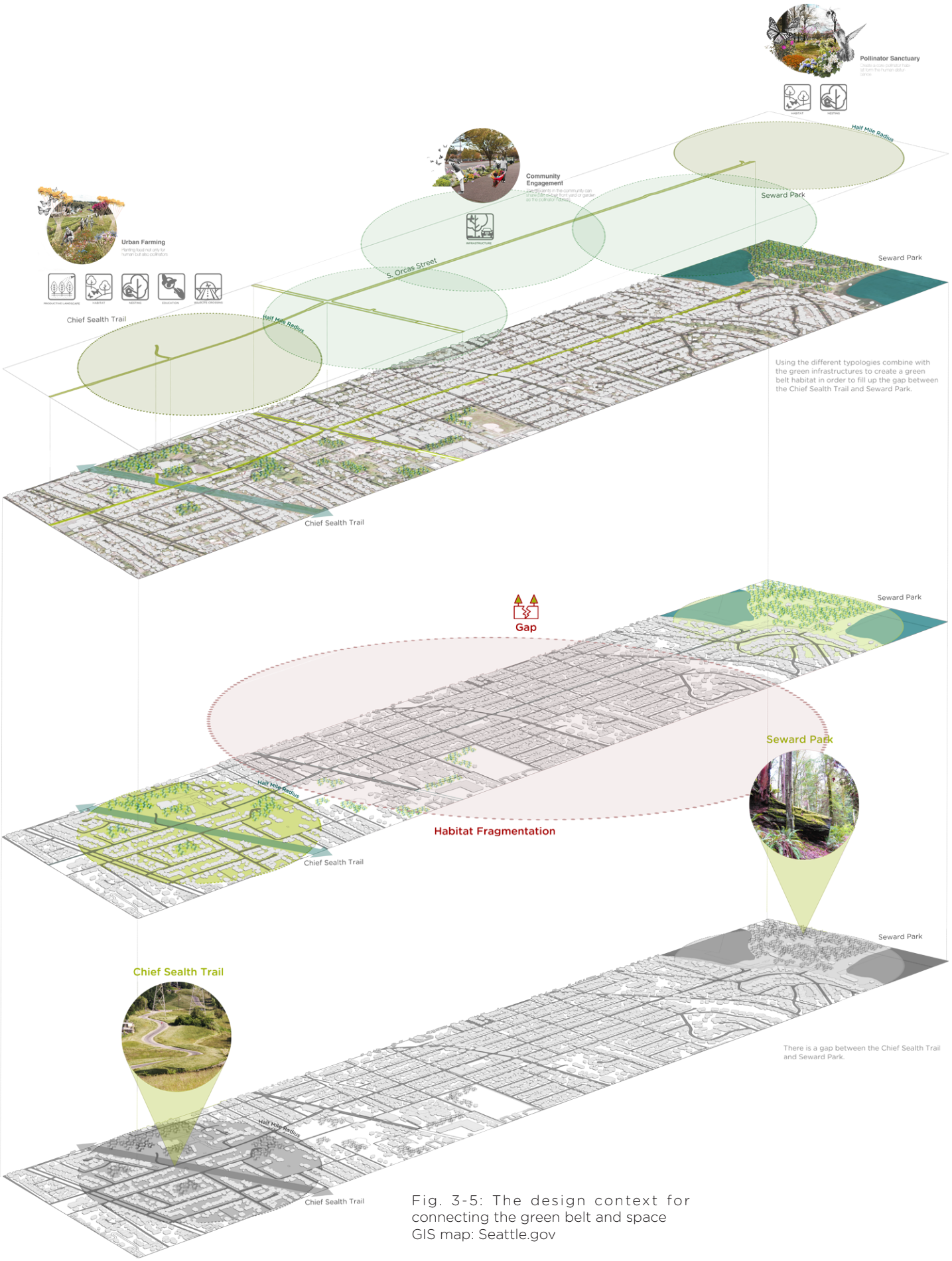


Fig. 3-5: The design context for connecting the green belt and space
GIS map: Seattle.gov

Fig. 3-6: The perspective of the Chief Sealth Trail

The Chief Sealth Trail is an ideal site to develop the pollinator connection not only because it is the longest green corridor in the South Seattle, but also contain several advantages for the pollinator habitat.

Usually, when people think about how to create a pollinator habitat, the first thing comes to their mind is planting a lot of flowers in the garden. However, more than 70% of the bee community and other pollinator species are ground-nesting species. The Chief Sealth Trail provides a wide range of bare space, which is good for the cavity or ground nesting pollinators to build their homes. Besides, the consecutive green belts have allowed the habitat to have continuity and ecological integrity. Last but not least, the hills along the trail also provide the shelter function, protecting the pollinators from being disturbed by human activities.

As a result, use this Trail as a backbone and extending around to Seward Park would help form a comprehensive network system in South Seattle.

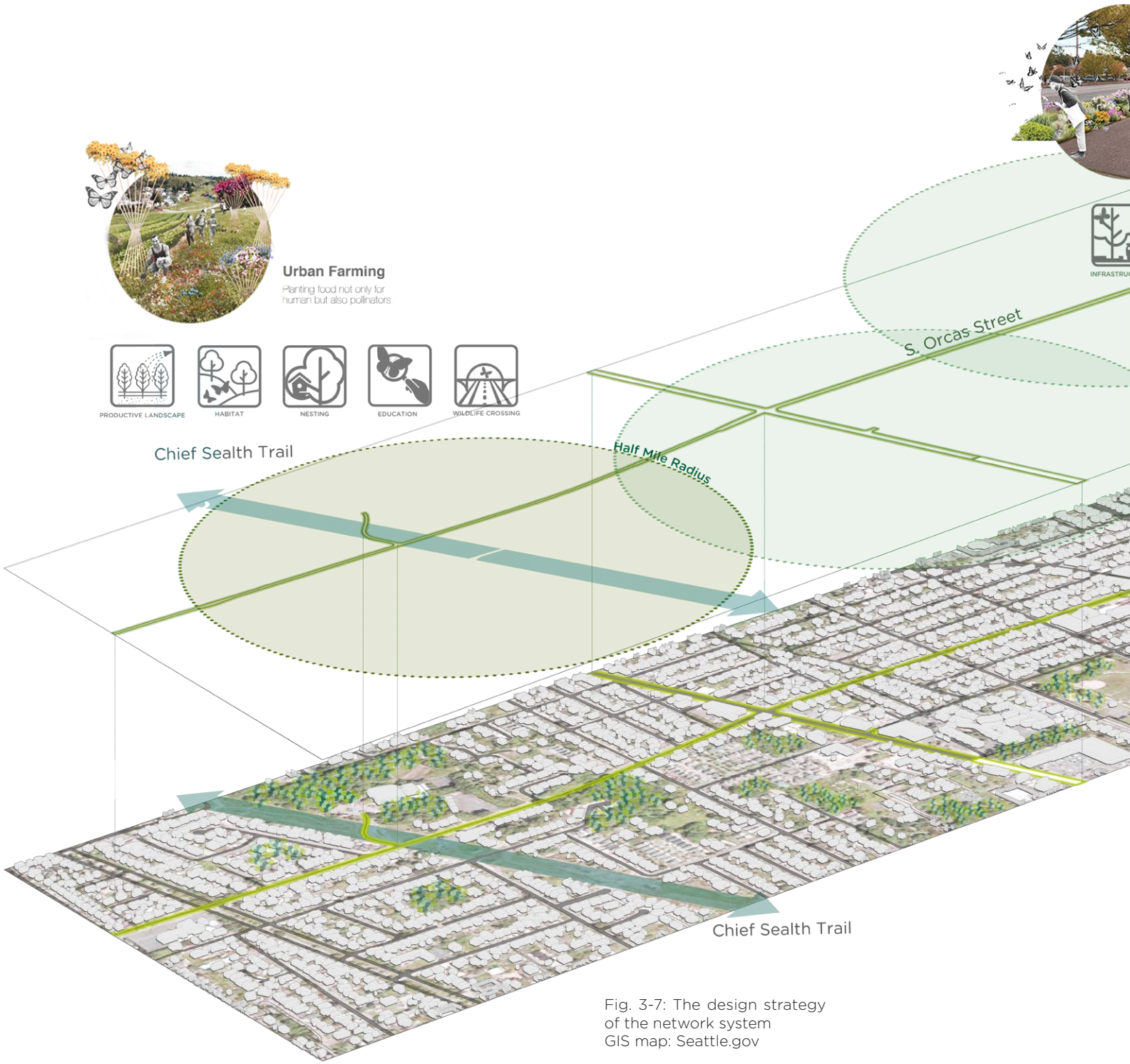
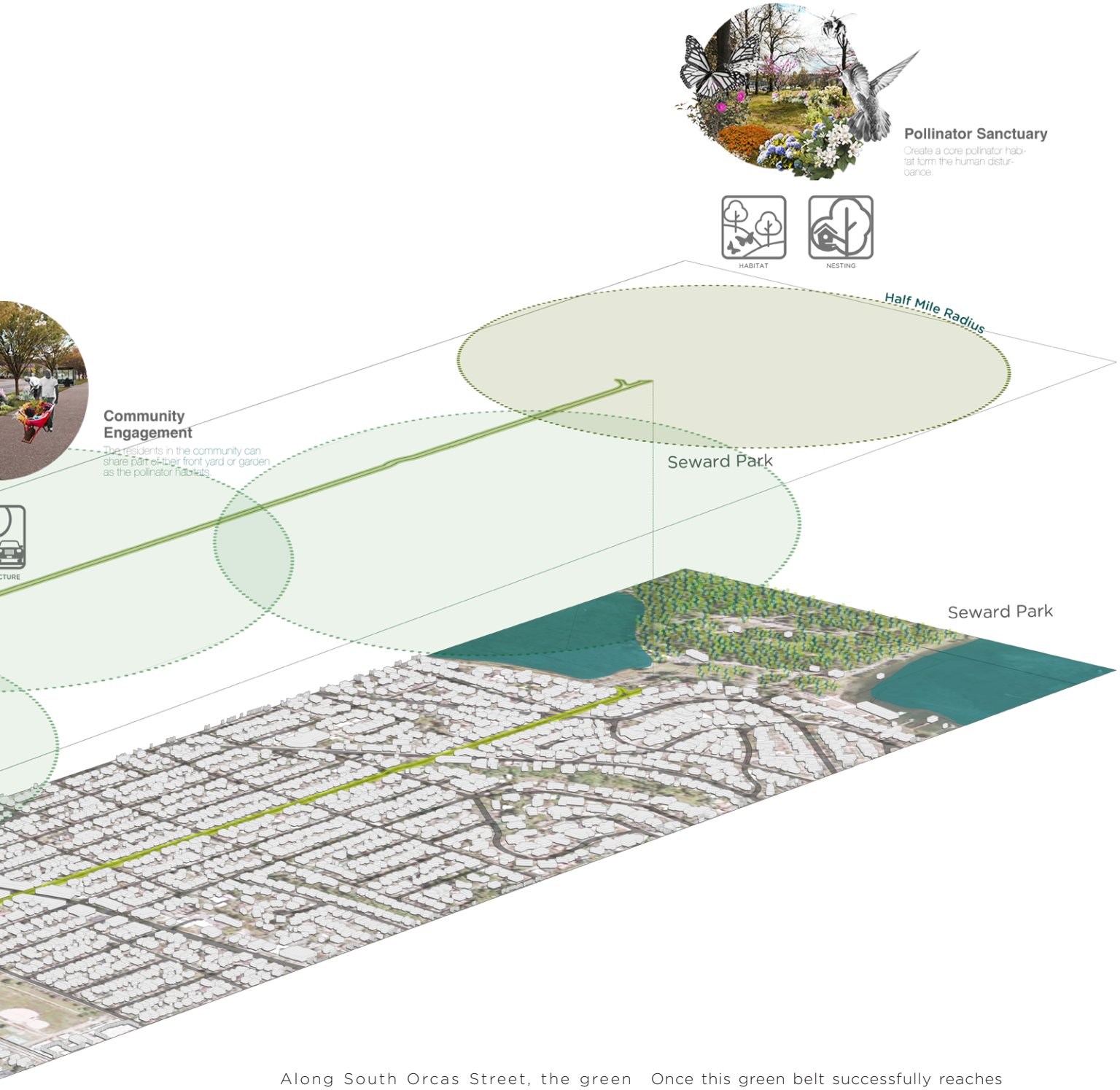


Fig. 3-7: The design strategy of the network system
GIS map: Seattle.gov



Along South Orcas Street, the green infrastructures could be the new green belt go all the way to Seward Park, which is the ideal open green space in South Seattle for the pollinator sanctuary. This green belt can fulfill the habitat gap which between the Chief Sealth Trial and Seward Park by creating the stepping stone habitats.

Once this green belt successfully reaches Seward Park, this typologies can also be applied in other streets and sidewalks within every community in South Seattle. The network system based on the green infrastructures will be connected. In addition, the rain garden and swale which, along the sidewalk can provide the buffer zone for the pedestrian and vehicles and creating the microhabitats in between.

4 Site Design
Envisioning a Network for Pollinators

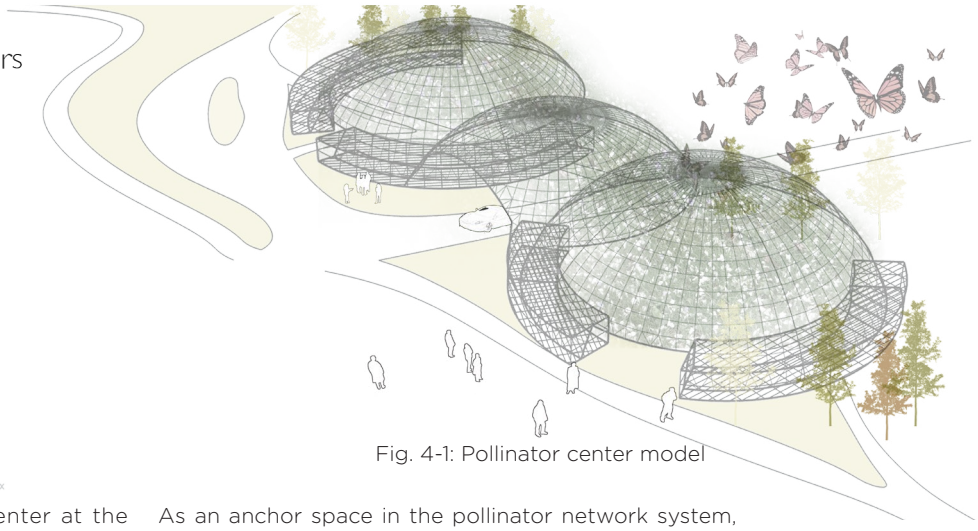


Fig. 4-1: Pollinator center model

In this chapter, I propose a pollinator center at the intersection of Chief Sealth Trail and South Orcas Street, which would be an important civic and habitat destination. I chose this place as the pollinator center within the whole network system design to fill the existing gap of pollinator habitat between the Chief Sealth Trail and Seward Park.

The site, at the cross point of S. Orca Street and Chief Sealth Trail, is envisioned as a hub, where a greenway connection along the S. Orca Street will reach Seward Park, which is one of the biggest green parks in South Seattle. According to the forage habitat analysis map (Fig 4-1), it seems there are not enough green spaces between these two potential habitats to support and continue the network system for nesting or pollinating. As an anchor site to stretch out the green belt to the Seward Park as a whole network system, I think this site is an ideal location to demonstrate and test habitat. Also, it could be the center for the local community to learn about the information on pollinator habitats and urban agriculture as much as possible.

As an anchor space in the pollinator network system, this pollinator center could be an ideal spot within the Chief Sealth Trail to show how the habitat typologies and toolbox described in the next chaptercould be implemented in the community or urban area . People could visit the different themes in this center, including community gardens, parking lot, outdoor classroom and sphere structures. Each of the themes has their essential and indispensable functions and capabilities in the network design such as food production, habitat compensation, wayfinding and ecological legibility. By visiting the pollinator center, people are able to further understand the importance of these tiny creatures and their tight relationship with our life. In addition, other communities can also choose the feasible design or concept and bring it back to their community garden or public space to replicate and generate more microhabitat for fulfilling the pollinator network in South Seattle. As a result, this scientific pollinator center design is able to show the functionalities and flexibility not only from the bottom to the top but also the scales from the small to the big.

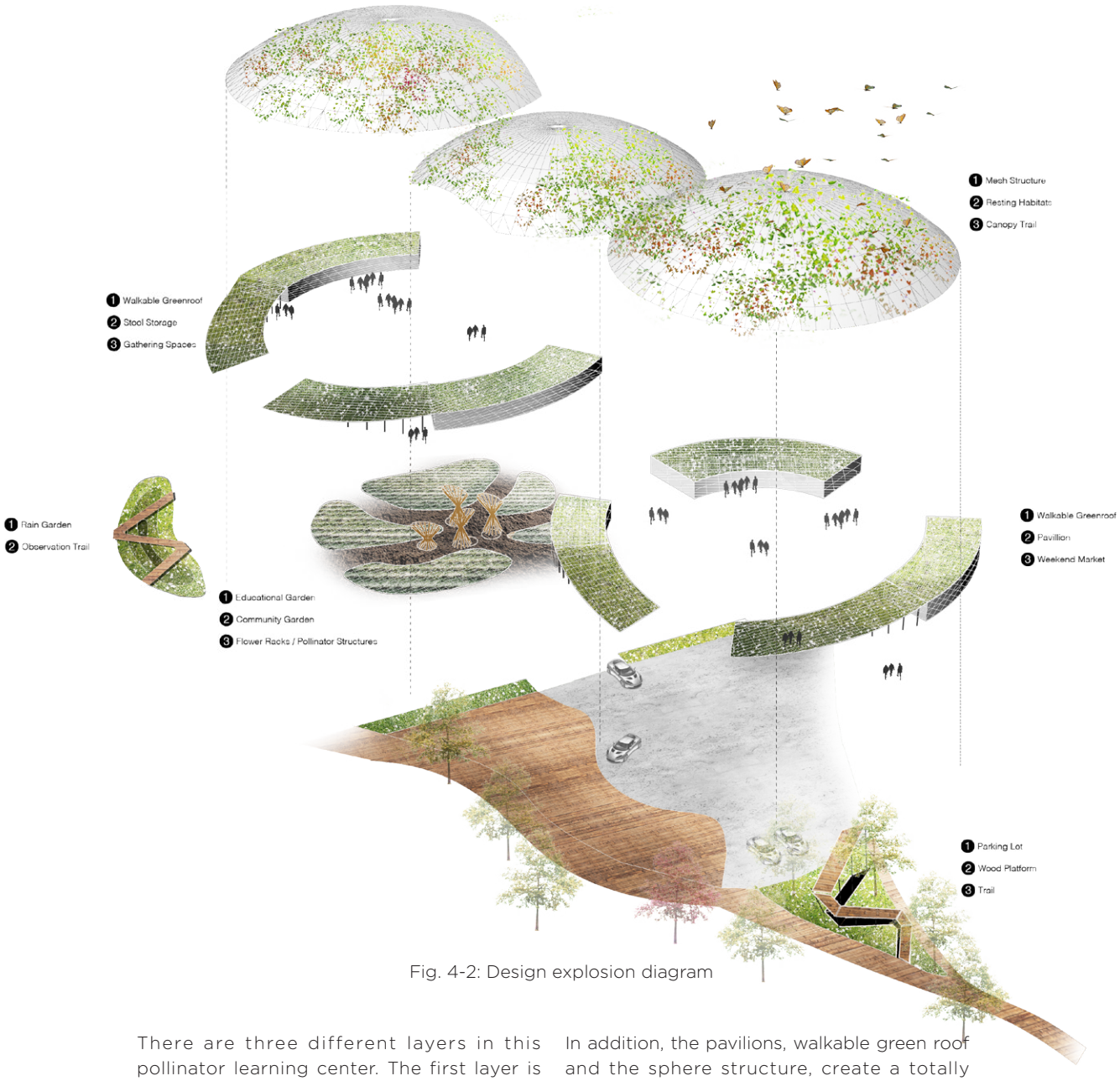


Fig. 4-2: Design explosion diagram

There are three different layers in this pollinator learning center. The first layer is the ground layer which includes the parking lot and community garden. The second layer is the workable green roof and ADA ramp for visitors to access the canopy in order to observe the pollinators from a different height. Last but not least is the bionic sphere structures which are not accessible to people and mainly serve the resting habitats for the pollinators.

In addition, the pavilions, walkable green roof and the sphere structure, create a totally different space with the learning garden at the ground layer. These pavilions can be the gathering space to host community events, a working office or the outdoor classroom. People are able to observe the pollinator habitat in the canopy layer so that they can have a chance to experience this different learning environment.

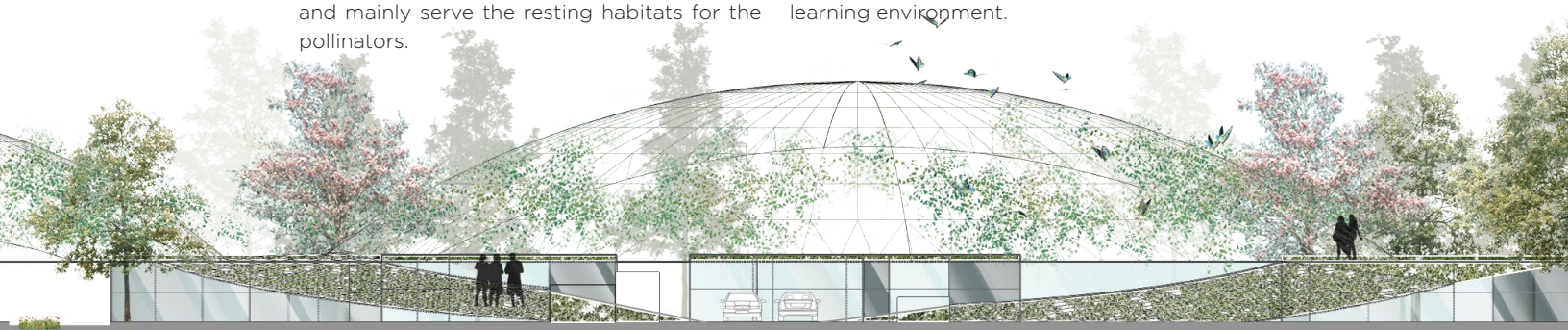
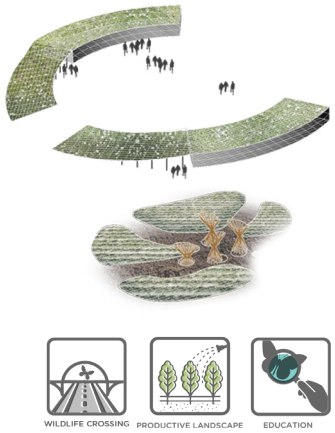


Fig. 4-3: Design section

Fig. 4-4: Site design plan

The design map includes four different themes to demonstrate design typologies and pollinator facilities and shows how this design can be implemented in the urban area.

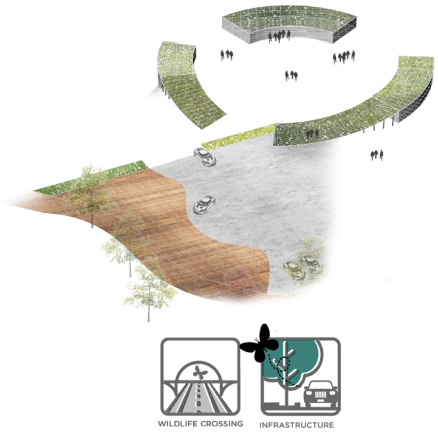


WALKABLE GREEN ROOF & LEARNING GARDEN

The upper side of the pollinator center is the learning garden which is the educational community garden to teach the residents about the knowledge of the pollinator species, habitat requirements, food resources and life cycle. People can learn about which vegetation species are the pollinator attractive plants to attract the pollinators, so that they can plant these species of the plants in their private yard or garden. The flower structures to attract the pollinator at the middle of the garden become to the significant hint to remind people that here is the learning garden. Follow these graceful structures, and people can easily find the home of the pollinators!

Also, there are several kinds of facilities in the learning garden to provide people with a wonderful chance to not only get close to the pollinator habitat but also learn about urban agriculture. Within the learning garden, even the pattern on the paving represents the flight path of different pollinators, so that children in the learning garden can mimic the pollinator to learn about these creature's habits! Not only kids, but adults can all learn about the pollinators in this community garden. Last but not least, with different scales of the agriculture facilities, they are able to learn about the comprehensive ecological production system from the food resources to the ideal habitats for the pollinators.

Fig. 4-5: Learning garden



PARKING LOT

The bottom side of the design plan is the parking lot, which next to the Seattle Chinese Alliance Church with concrete pavement. How to mitigate this hard-paving lot and reduce the heat in order to create the better place for pollinators could be an issue. Thus, switching the existing paving to permeable pavement like grass brick could effectively reduce the heat. Also, when vine plants climb on the sphere frame structure, it will naturally form a green dome to create shade and thus lower the glare and the temperature.

During the weekend, this parking lot can be the place to hold a weekend farmers market to sell products related or produced mainly by pollinators. The local community also can sell their products which grew in the community garden. And events could be held here, such as a Bee festival or Pollinator day. For people to better understand that our everyday food such as vegetable and fruits have an indispensables relationship with pollinators.

As a result, after visiting this area, people are able to better know how to switch the existing hard paving place in their community to be pollinator-friendly or even educational space.

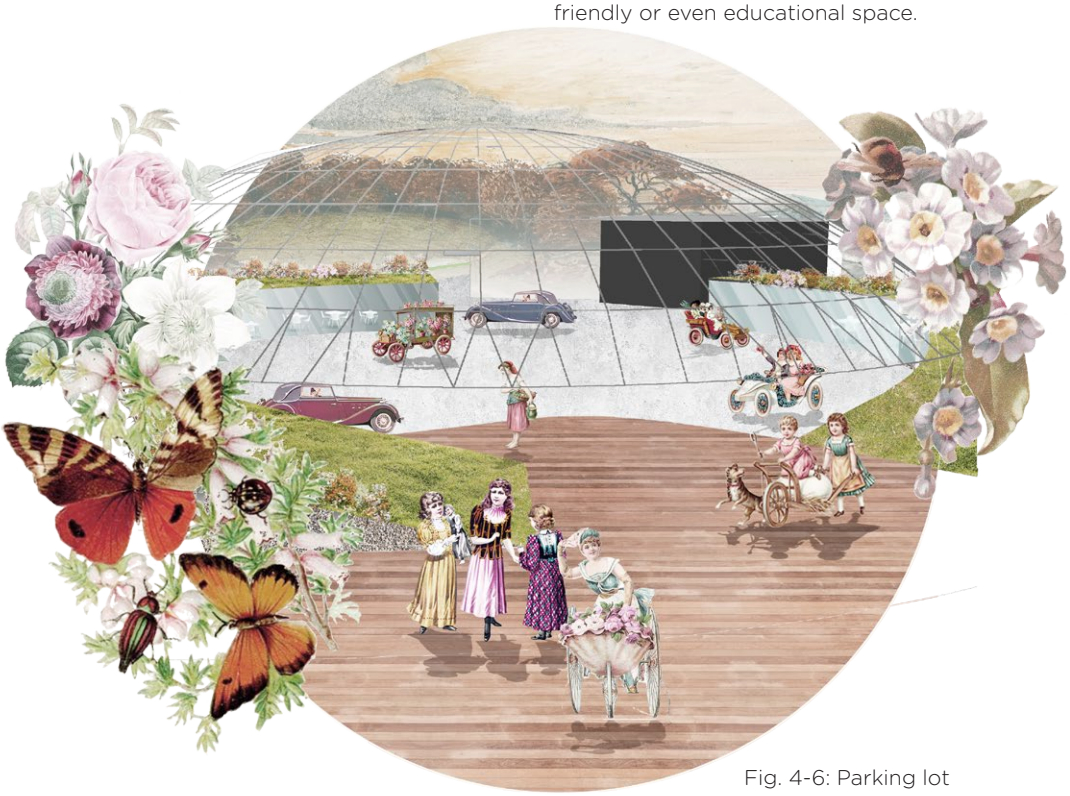
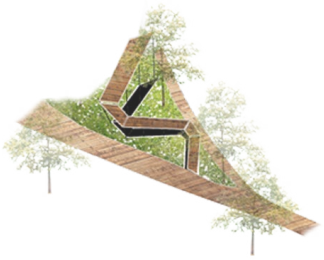


Fig. 4-6: Parking lot

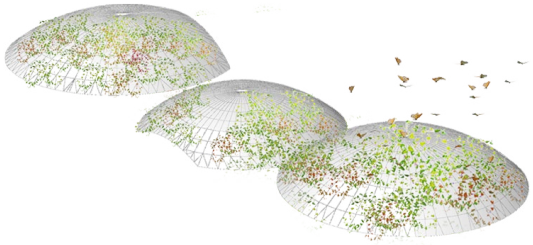


OUTDOOR CLASSROOM & TRAIL

The design approaches can combine with the outdoor classroom, which next to Dearborn Park International Elementary School, for children to learn about ecological environments within real habitats. There are many existing trees and vegetation which could be the ideal place for children to explore and learn about species when they are playing outside the classroom. As a result, there are only two pavilions and ramps in this outdoor classroom to avoid too many artificial facilities and structures and to minimize the disturbance by human beings in this area.

Using the pavilions to create multi-layers enables kids observe the pollinators closely at the canopy layer and ground layer. Thus, they will better understand the nesting and the pollinating habitat conditions for different species of pollinators. These pavilions can be the exhibition area to display the data, photos and all kinds of information associated with the pollinators. Children in this outdoor classroom are able to further understand about what kind of lovely creatures live in their community garden and yard!

Fig. 4-7: Outdoor classroom & trail



SPHERES

The bionic spherical design is trying to mimic the shape of the hills along the Chief Sealth Trail and naturally merge with the existing landscape. These structures will be put in the highest layer in the pollinator center. And people are unable to reach to this layer since the main purpose of these structures is serving as resting and feeding habitats for the migratory pollinators. Without disturbance from people and vehicles, the pollinators are able to pollinat, rest, or migrate in this quiet and safe place.

In addition, these spherical structures also have other environmentally friendly functions for the pollinator network system. These include reducing the urban heat, reducing the wind drag, purifying the air pollution and decreasing the noise. Those benefits are not only significantly helping to create the pollinator-friendly habitat, but also improving the quality of the urban environment. Last but not least, these giant green structures can also provide the way finding function for people to see the pollinator center.

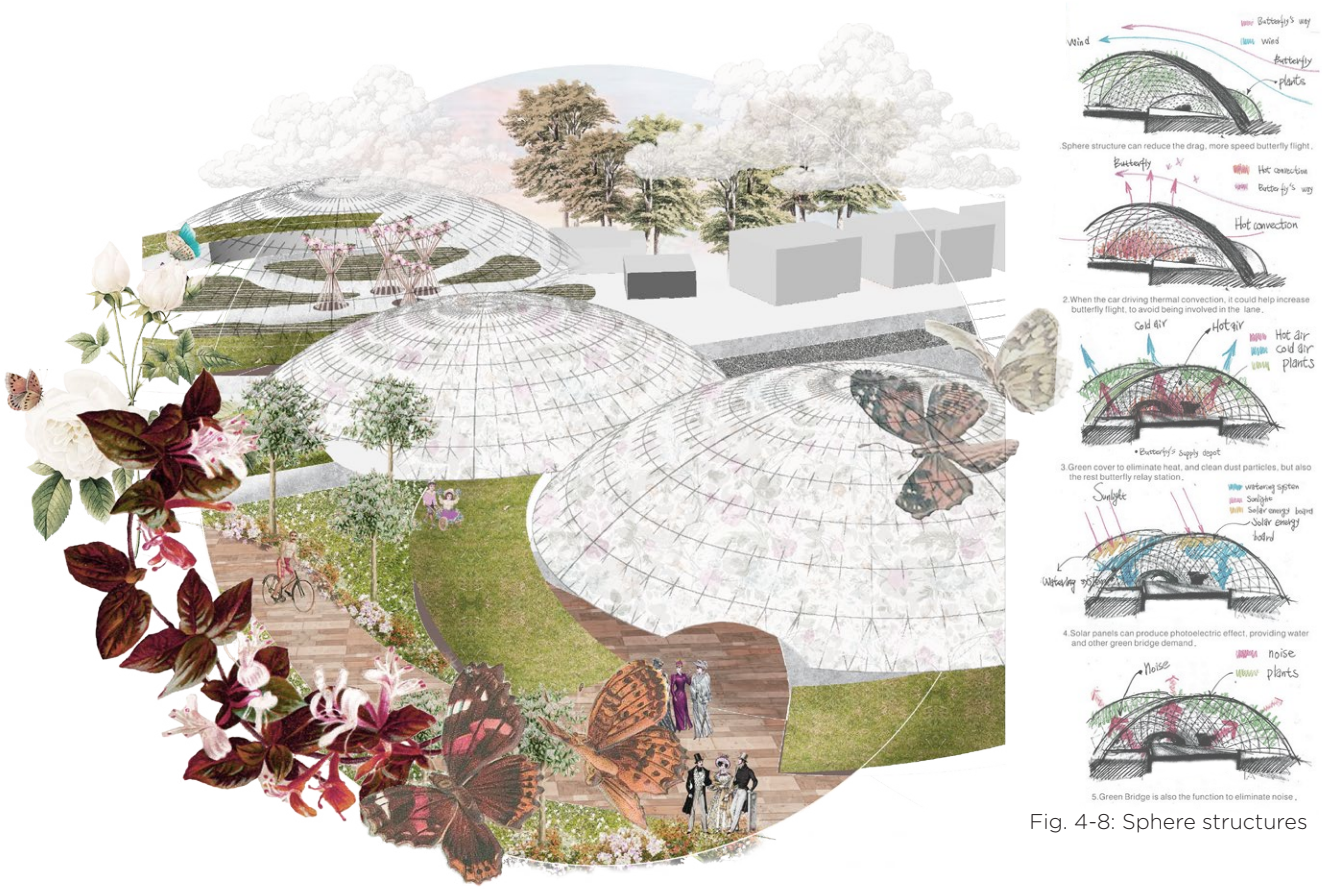


Fig. 4-8: Sphere structures

Fig. 4-9: Design rendering

The sphere structures provide the wildlife crossing function along the Chief Sealth Trail at South Orcas Street. They provide the resting and nesting habitats for not only the migratory pollinators such as Monarch butterflies and Rufous hummingbirds, but also the Seattle based pollinator species in order to avoid the potential threatens like being hit by vehicles when they cross the driveway or street.

Also, once the plants grow and climb over these design structures, the spherical dome can mimic the hills and perfectly merge with the existing hills along the trail to create the continued green belt in South Seattle. As a result, these structures are able to achieve the goal of continuity of pollinator habitat in the network system design.

5 Design Toolbox & Site Applications

Envisioning a Network for Pollinators

This chapter provides five different landscape typologies that support particular pollinator habitat. Each typology includes a description of the landscape functions, the types of pollinators who would benefit, and a list of some potential plant species. Additionally, each typology is illustrated in the context of the proposed South Seattle pollinator network, offering site-based applications.

1. RAIN GARDEN & SWALE:

Plant list:

1. Goldenrod
2. Puget sound Gumweed
3. Autumn Sage
4. California Poppy
5. Western Columbine

The rain garden and swale can actually be the ideal place for providing microhabitats for the pollinators. Among the five habitat typologies, this category is the smallest one, but also the most flexible one , as it can be put into the network system. The selected species can be planted in the rain garden and swale design in order to create the microhabitats for the pollinators. It could also combine with the green infrastructures in the city to serve the multiplefunctions of habitat and also filtering and infiltrating stormwater in the context of climate change.

During the raining season, the rain garden can provide the water detention capacity to prevent the flooding. Then, these green infrastructures are able to provide abundant habitat in the blooming season. The flowers in the rain garden and swale can also add beautiful colors along the sidewalk. As a result, since these plants just need to be planted in the existing rain garden or swale, this typology is the most applicable one for the local community to utilize in their public environment.

Fig. 5-1: S. Orcas Street

RAIN GARDEN & SWALE

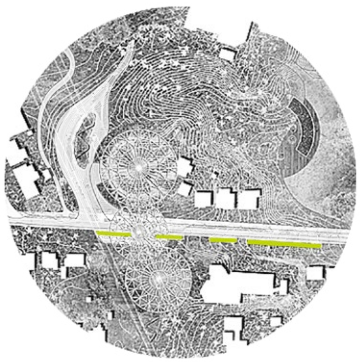
These plants can plant in the rain garden and swale design to create the microhabitats for the pollinators. It could also be combined with the green infrastructures.

Fig. 5-2: The Collage diagram of Rain Garden & Swale

The collage diagram shows plant species can be utilized in the rain garden and swale.

5 Design Toolbox & Site Applications
Envisioning a Network for Pollinators

1. RAIN GARDEN & SWALE:



The green infrastructure in the pollinator centre is located along the S. Orcas St. to the Seward Park forming the green belt to fill the gap of the habitat formation.

Fig. 5-3: Rain garden & Swale

Along South Orcas Street, the green infrastructures could be the new green belt goes all the way down to the Seward Park, which is the ideal open green space in South Seattle for the pollinator sanctuary. This green belt can fill the habitat gap between the Chief Sealth Trail and Seward Park by creating the stepping stone habitats.

Once this green belt successfully reaches Seward Park, this typology can also be applied along other streets and sidewalks within every community in South Seattle. The network system based on the green infrastructures will be connected. In addition, the rain garden and swale along the sidewalk can provide the buffer zone between pedestrians and vehicles while creating these microhabitats.

2. STREET TREE & BUSH:

Plant list:

1. Pacific Dogwood
2. Oregon white Oak
3. Tall Oregon Grape
4. Serviceberry
5. Flowering Cherry

The selected tree species can plant as street trees, orchards or small forests in the community in order to provide nesting habitats and hiding sanctuary for the pollinators along the streets, parks or any open space within the community. It is important for people to observe and understand the habitats of pollinators. Still, these tiny creatures need some quiet place to make their home and breed. Thus, these trees are able to provide a hiding place for the pollinator from being disturbed by human beings.

These tree species also can be planted around the outdoor classroom within the pollinator center. When people go on the walkable green roof, they can easily experience the different atmosphere when they walk through the canopy layer. With the well-controlled and the limited number of visiting people, visitors are able to observe the nesting habitats of the pollinators and their habits from this different perspective without making too many disturbances. Therefore, people can understand the importance of planting the trees and bushes in their community in order to make the home for these creatures.

Fig. 5-4: Dearborn Park International Elementary School

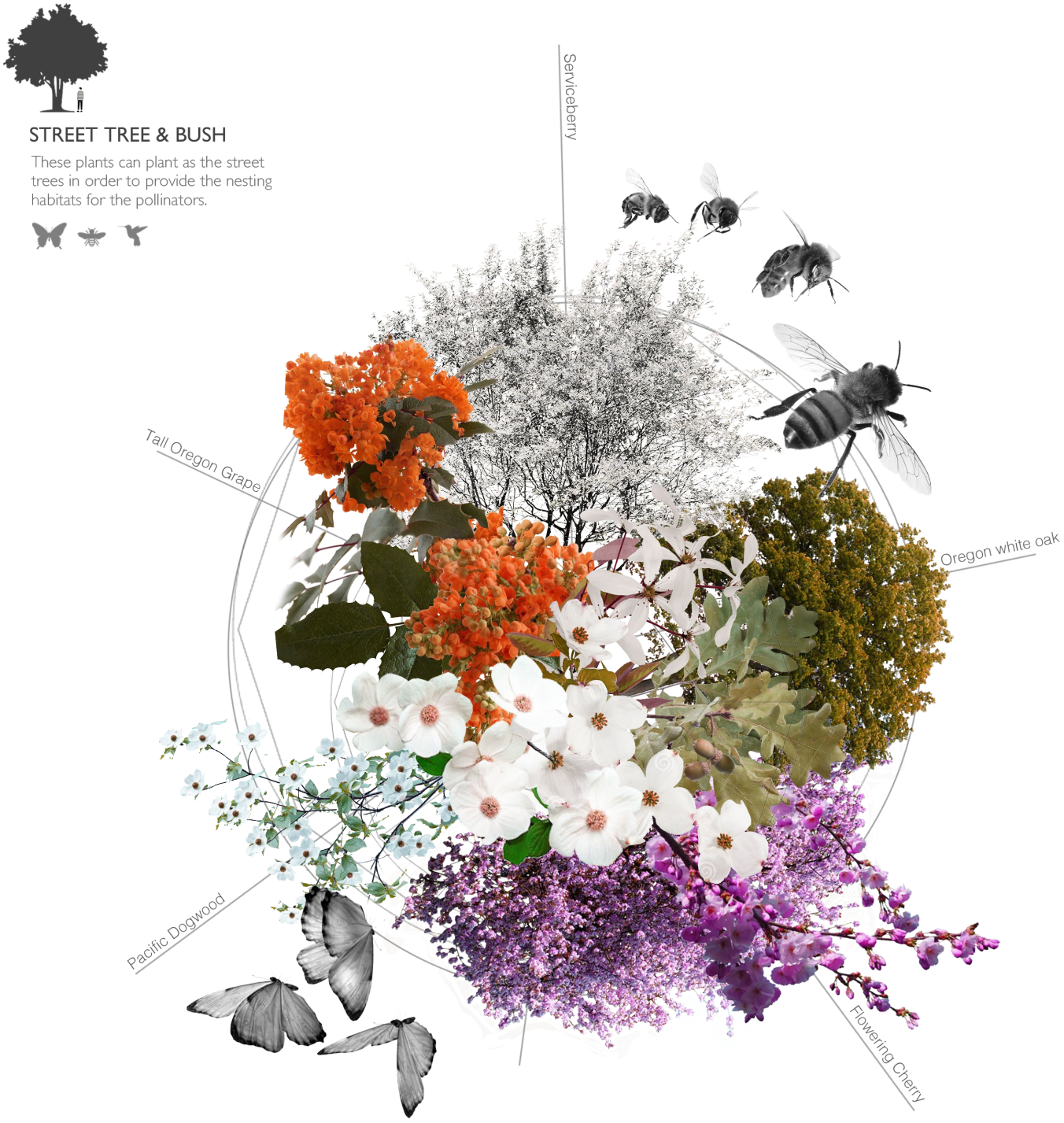
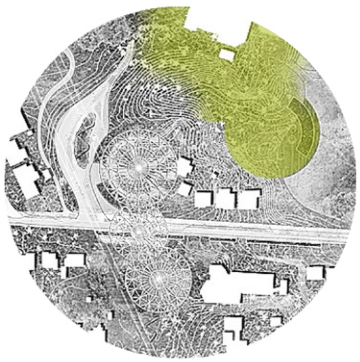


Fig. 5-5: The Collage diagram of Street Tree & Bush

The collage diagram shows the plant species that can be utilized for the street trees and woods.

2. STREET TREE & BUSH:



The outdoor classroom and pavilions are located in the woods next to the Dearborn Park International Elementary School, providing the kids an outdoor space to observe and learn about the pollinator habitat.

Fig. 5-6: Outdoor Classroom

Planting these selected trees and bushes around the pavilions. Children can experience the green roof garden and observe the pollinators in the canopy layer. When children walk up the ramp, they can observe the trees and nesting habitat from the bottom to the top.

This pavilion can be the exhibition area to display the data, photos and all kinds of the information associated with the pollinators. Children in the outdoor classrooms are able to further understand about what kind of lovely creatures live in their community garden and yard! The pavilion can be an office for community groups or organizations. It also can be the place to hold the community events or activities.

3. LEARNING GARDEN & P-PATCH:

Plant list:

1. Avocado
2. Apple
3. Raspberry
4. Blueberry
5. Kiwifruit

Many people probably don't know that the listed fruits and vegetables are 90% dependent on pollinators to produce the food for the ecosystem. (source: empressofdirt.net) The reason for choosing this vegetation as representative species is that once pollinators are disappearing in our world, we are also unable to eat these fruits and vegetables anymore. Pollinators play a really critical role in urban agriculture. In the educational garden, people can understand we have an indispensable relationship with these small creatures.

It is important for people to understand the food sources for the pollinators in order to protect them. Vice versa, we also need to know how and where our food comes from. Once we better understand the tight relationship with the pollinators we can put forward our best effort to preserve and create their habitats. As a result, this category of habitat typologies expresses these concepts in the network system.

Fig. 5-7: Maa nyei lai ndeic P-Patch Community Gardens

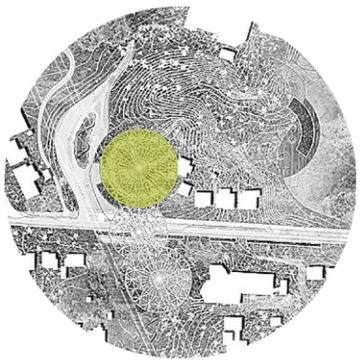
LEARNING GARDEN & P-PATCH

These fruits and vegetables are 90% depend on the pollinators to pollinate. In the educational garden, people can understand we have an indispensable relationship with these small creatures.

Fig. 5-8: The Collage diagram of Learning Garden & P-Patch

The collage diagram shows the plant species that can be utilized in the learning garden and P-Patch.

3. LEARNING GARDEN & P-PATCH:



The learning garden in the pollinator center, located at the upper side of the design plan, provides the school children and community an opportunity to learn about urban agriculture.

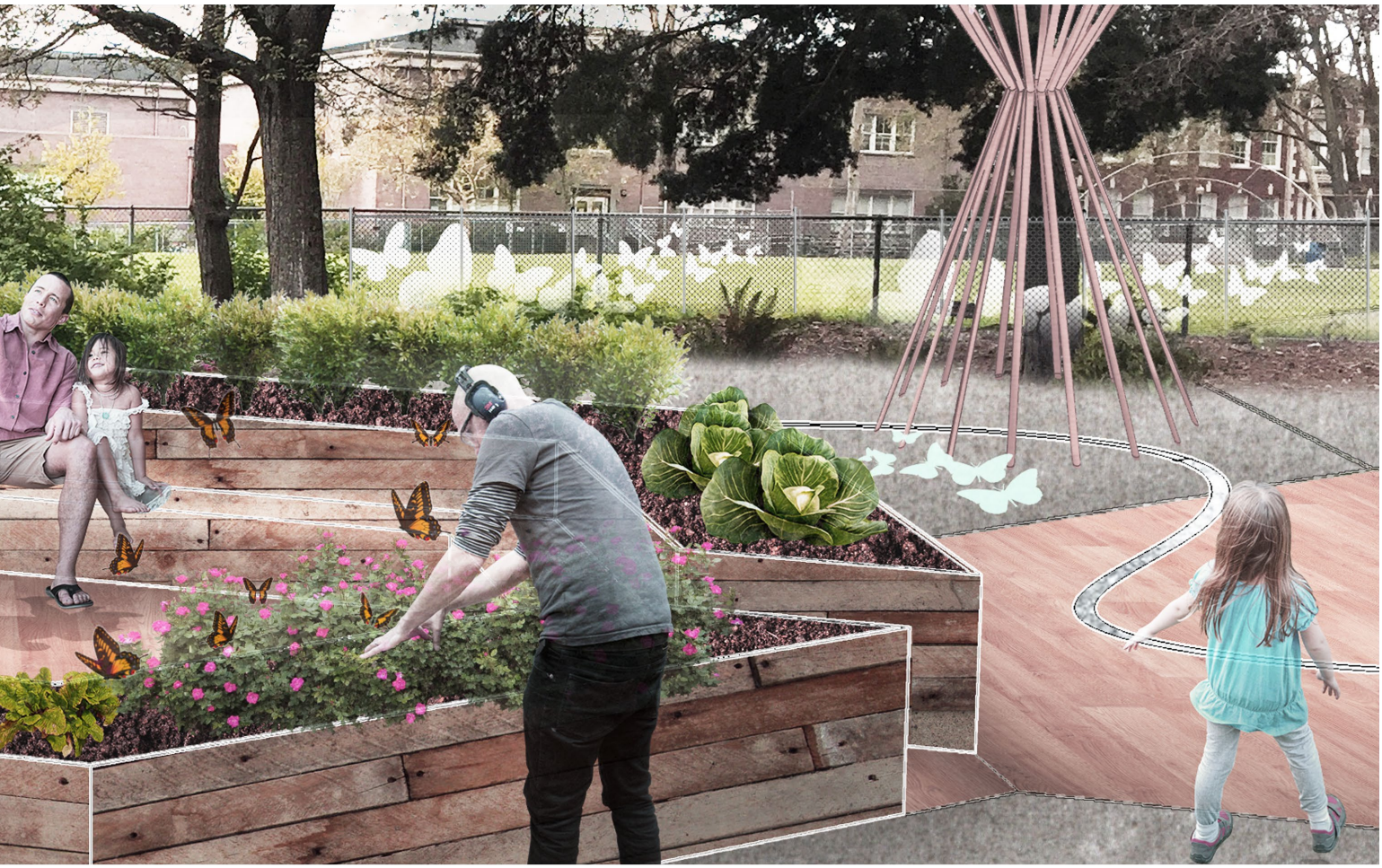


Fig. 5-9: Learnign Garden

The community garden or P-Patch is always a good place for community to directly absorb the information and knowledge of urban agriculture and pollinators. Planting the certain vegetables and fruit which really depend on the pollinators to pollinate in order to produce the food can make people clearly understand our food production and ecosystem and also cope with the issue of food shortage.

Getting your hands dirty is the most easiest and direct way of engaging with urban agriculture! Community members can install the bee box and bugs hotel in the learning garden to increase the vegetable and fruit production. These can provide an opportunity for people to better understand native pollinator species, such as Mason bees, which usually are misidentified as flies or other insects.

4. FLOWER RACK & VERTICAL GARDEN:

Plant list:

1. Trumpet Vine
2. Cucumbers
3. Passion Flower
4. Mexican Flame
5. Rose
6. Vine Maple

These vine plants can be used not only to decorate the pollinator structures, but also have the ability to attract the pollinators. With the trees, vines are an other species type that can reach to the really high layer by climbing on certain supporting structures. When these plants reach a certain height, They provide a the way finding function for people as well as the feeding function for pollinators. As a result, they could be planted at the vertical garden or flower racks which can create the different hierarchies of habitats in the pollinator network system.

In addition, these vine plants are pretty flexible and can be planted to grow on different shapes of structures or pollinator facilities, such as the spherical structures at the pollinator center or the flower racks in the learning garden or outdoor classroom. These structures and facilities are usually difficult for people to reach. Thus, without the disturbance by the people and other ground species, the pollinators can easily enjoy their feeding habitat when they fly by.

Fig. 5-10: S. Chief Sealth Trail

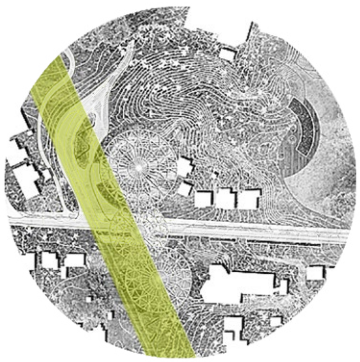
FLOWER RACK & VERTICAL GARDEN

These plants can plant in the rain garden and swale design to create the microhabitats for the pollinators. It could also be combined with the green infrastructures.

Fig. 5-11: The Collage diagram of Flower Rack & Vertical Garden

The collage diagram shows the plant species that can be utilized on the rain flower rack & vertical garden.

4. FLOWER RACK & VERTICAL GARDEN:



The flower racks and vertical garden in the pollinator center is located along with the Chief Sealth Trail, marking the green belt connection to Seward Park, and so providing the way finding function.

Fig. 5-12: Flower Rack & Vertical Garden

The vertical garden and wrapping of the pollinator tower shows strong symbol for people to notice the location of the pollinator center. It not only provides symbolic meaning or aesthetic feeling, but also serves as feeding habitats for the pollinators in this area. People as well as the pollinators would all be attracted to this pollinator center.

Also, an illumination system could be added to these flower racks so that during the night or even the winter, these pollinator installations can provide a wayfinding function for the Chief Sealth Trail. In addition, these lighting installations are able to attract and illuminatethe nocturnal pollinators, such as moths and bats to the community.

5. PUBLIC GARDEN & PRIVATE YARD:

Plant list:

1. Big leaf Lupine
2. Borage
3. Lavender
4. Larkspur
5. Fawn Lily
6. Yarrow

People usually prefer to plant floral plants in their yard or garden. These beautiful flowers can not only catch our eyes, but also pollinators' attention. Thus, these selected fragrance and colorful floral species are mostly the popular plants chosen for multicolor and good smell in backyard or community gardens to ornament and enhance the environment. These plants also provide food sources for pollinators at the same time.

This typology is the most attractive one due to the fragrance and the attractive colors. Also, it is the easiest one for everyone who wants to create a pollinator friendly garden just at home. By means of connecting yard to yard, garden to garden, these stepping stone habitats can effectively create a network system within the community and also provide the visually pleasing environment in our living space.

Fig. 5-13: S. Beacon Ave S.

PUBLIC GARDEN & PRIVATE YARD

These fragrant and colourful flowers can be the popular plant selection for people to plant in their backyard and community garden to ornament

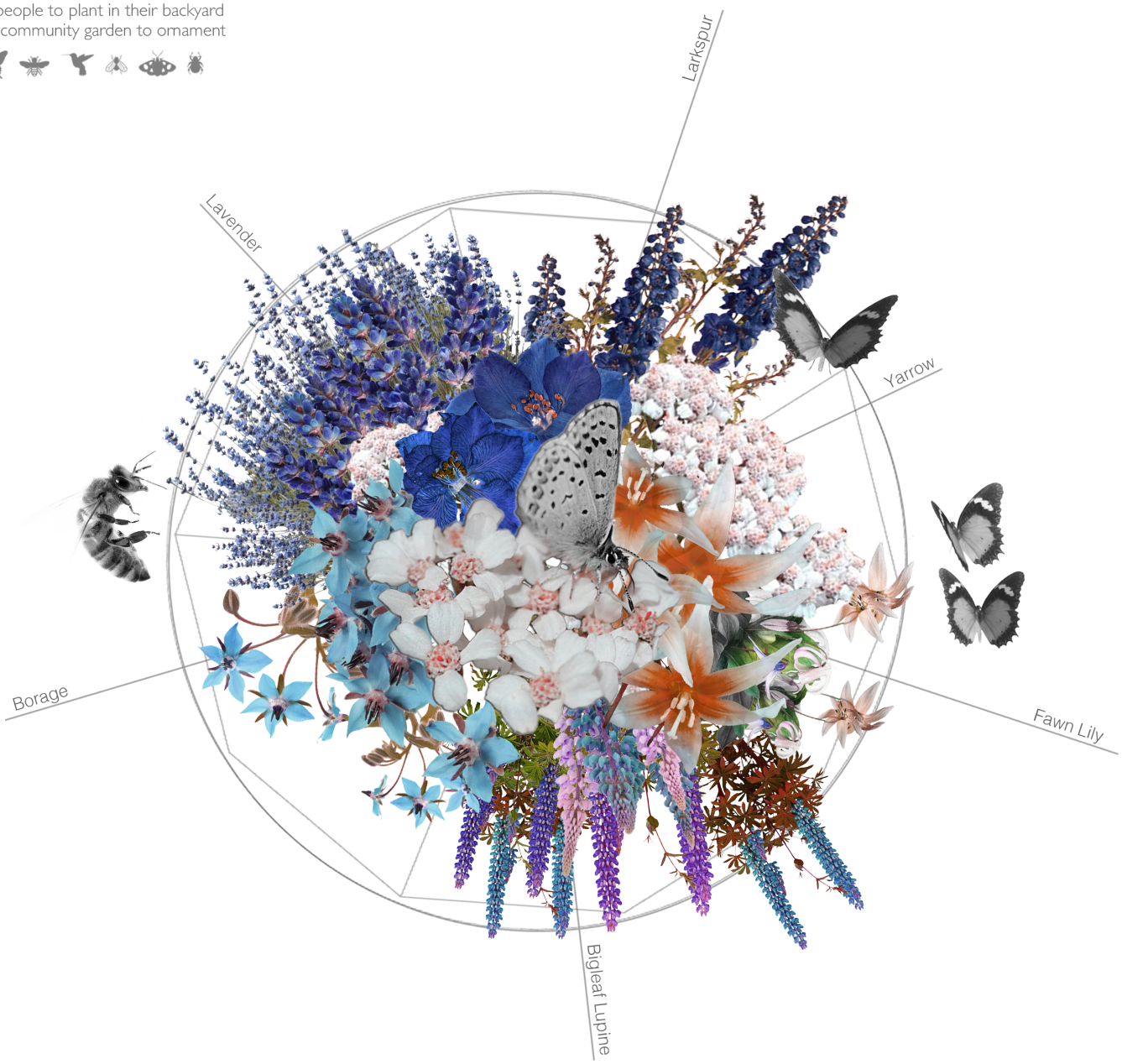


Fig. 5-14: The Collage diagram of Public Garden & Private Yard

The collage diagram shows the plant species that can be utilized in the public garden & private yard.

5. PUBLIC GARDEN & PRIVATE YARD:

The private yard section in the pollinator centre is located at residential area along the S. Orcas St. to Seward Park, forming the green belt to fill the gap of the habitat formation.

Fig. 5-15: Community Garden

No one will deny that planting beautiful flowers in the community garden or private yard is a wonderful thing! The colorful plants will not only attract the visitors, but also the pollinators. Therefore, choosing the right plant for your garden is important. If you choose the right species to plant, it will definitely bring the bees, butterflies and even the hummingbirds to visit your place!

Although people usually want to create a pollinator habitat in their back yard or private garden, it is also important to know that some of the pollinators are ground nesting species. This means they don't really prefer the plants place as their nesting habitat. As a result, people can still plant these beautiful flowers in their yard, but don't forget to provide some blank space and lawn in the garden for different pollinators!

6 Reflection
Envisioning a Network for Pollinators

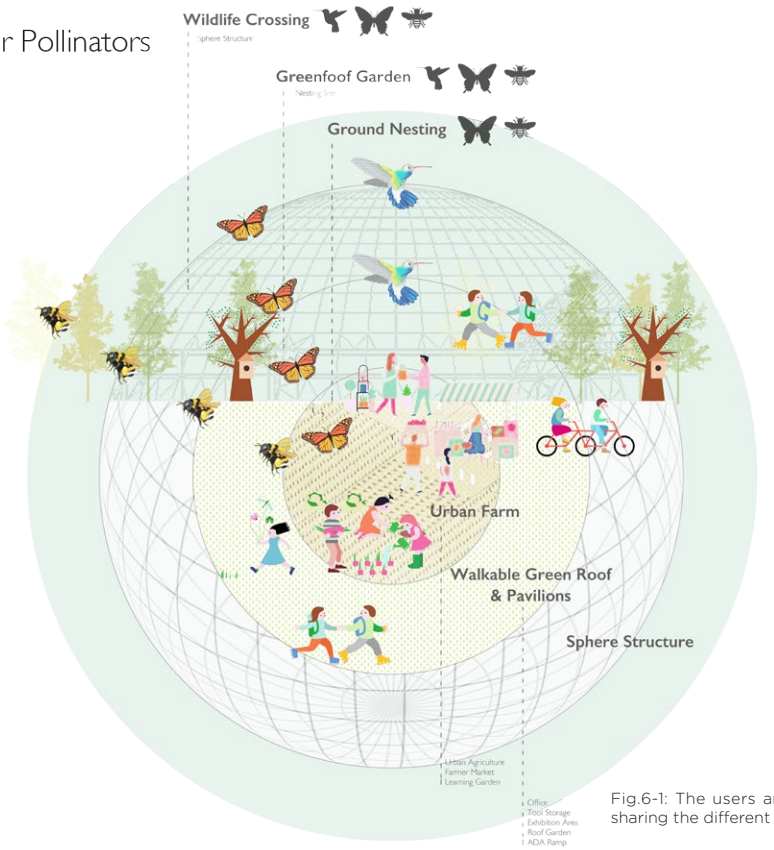


Fig.6-1: The users and pollinators sharing the different layers

Refection

This design thesis provides me a wonderful opportunity to envision the potential and valuable green space in the city for optimal use as pollinator habitat. The Chief Sealth Trail as the ecological corridor provides the support of the pollinator ecological system in South Seattle as well as green space amenities for the communities to enjoy the urban nature.

This design thesis also questions the concern of nocturnal pollinator habitat. In most of the design condition, we only think about how to create the living space for the diurnal pollinators. However, some of the nocturnal pollinators such as moths and bats (which are not counted as the pollinators in North America) are also easy to forget. Some of the man-made artificial amenities and pollinator attracted facilities interfere with the nocturnal pollinator. Therefore, we also need to take care of and respond to the ecological needs of the nocturnal pollinator when we processing the pollinator habitat design. And that is how I would love to see the success of the prosperous pollinator habitat no matter the day and night.

Hierarchy

In order to achieve the goal of the network system and maximize accessibility, engaging the decision-makers, policies, agency staff and the communities are all necessary.

Top down policy and public management for the decision making of preserving and planning for the Seattle open green space and pollinator habitat is needed. A sound policy system can secure the wildlife habitat won't be interfered with and will be preserved during urban development. Then, the public assets will be more approachable for the design implementation.

On the other hand, bottom up participation of the local community groups and nonprofit organizations also is needed. The communities definitely play a key role when setting up pollinator friendly habitat. Their engagement, intertwined with experts and professional staff, will be invaluable for supporting the pollinator habitat.

As a result, when these agents are able to cooperate with each other from the bottom to the top this network system can be realized in South Seattle.

Fig.6-2: The community activities and partnerships

Partnerships

Nonprofit groups and local communities could be vital partners to active and success the Pollinator Network System.

The **Tilth Alliance** is the nonprofit organization focusing on the urban agriculture, agriculture learning and gardening. They present the successful precedent of the urban agriculture, habitat restoration and local community engagement in the Rainier Beach Community. Undeniably, they will definitely be the powerful partner for the design of the learning garden, productive landscape and habitat restoration within the pollinator network system.
(Source: http://www.seattletilth.org/)

The **Common Acre** is another nonprofit group which also aim to propose the pollinator friendly living space by mean of the educational program, artistic intervention and fieldwork projects. I think they could be a critical and helpful agent to involve in the design process and in restoring pollinator habitat since they also work with the Tilth Alliance frequently. And I believe they also bring rich of the experience in pollinator habitat restoration.
(Source: https://commonacre.org/)

Community engagement will not only reveal and generate more potential capacities but also benefit the effort for persevering the pollinator network system.

Conclusion

The total number of pollinators is suffering a significant decrease around the world. And the disturbing climate change and increasing demands for urban expansion of the growing population are all putting pressure on the pollinator living space. Concurrently, the communities' awareness for the issues of food shortages and lack of the green space in our city could be the catalyst to commence and push forward the pollinator network design.

The Chief Sealth Trail is managed for the single function, which is providing bike trail in the city within a corridor for the electrical towers. It is really the moment to reimagine the potential functions and leverage advantages which the trail presents. Restoring and preserving the ecological habitat will offer the biodiversity and ecological sustainability to support the pollinator species and habitats. Providing the ideal microhabitat, ecological patches, green infrastructures and corridors for preserving the habitats will fulfill the connectivity needs of the pollinator habitat. Therefore, by presenting such access for the communities in South Seattle, this design supports the new creation and approaches of ecological stewardship of this precious land. Ultimately, the design and participation process is meaningful and valuable because it represents a transition when people aware of our needed habitats within our urban landscape.

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