Environmental Studies Program

Assessing Pollinator Habitat at Boston College

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Introduction

Bees are a vital part of both natural and agricultural ecosystems, providing pollination to 75% of crop plants globally (Senapathi et al). Despite this, bee populations are declining in number, range, and diversity at an alarming rate. One of the main causes of population decline is habitat loss. Urbanization and fragmentation of bee habitats has been shown to affect both plant and pollinator densities by having an influence on pollinator behavior and pollination dynamics. However, cities do hold potential to be favorable living environments for many bee populations given the reduction in large herbivores (which reduce plant foliage) and agricultural pesticides. Urban landscaping thus becomes of practical purpose in trying to provide effective habitat for bees. Landscapes with adequate and diverse pollinators as well as proximity to green space prove to me the most effective in supporting bee populations. Thus, Boston College holds the potential to be a great oasis for urban bee population given its adequate green space and plant species. The aim of this project was to answer the following question: What kind of habitat and nutrition do we and can we provide bees? This study assess the current quality of BC as an urban landscape for bee populations and, in turn, makes recommendations of how BC can improve the landscape quality for bees.

Methods

In order to answer the question of what kind of habitat Boston College can provide for bees it was first necessary to answer the question of what kind of habitat BC already provides. To do this, Boston College Grounds provided landscaping plans for four areas around campus (which were used to represent all of campus). The diversity (species) and quantities of plants on these plans were compiled and used as a model for the entirety of the campus. Species were separated into three groups titled “Trees,” “Shrubs,” and “Perennials/Groundcover.” The common name of species was recorded under one of these groups along with the quantity of each species.

The next step was assessing the value (to bees) of each species. In order to do this, information regarding whether the plants attracted bees and was an adequate pollinator was gathered and recorded as a “yes” or “no.”

To know what kind of habitat Boston College currently provides, averages of “adequate pollinator species” for each group were determined. They were calculated in two ways: by quantity and by area. The first was done by adding the quantities of “adequate pollinator species” in each specific group and dividing by the total number of species in the corresponding group. The resulting percentages were recorded. The second value was obtained by using average spread measurements of each species to find the area of the species. These values were multiplied by the quantities of species to find (total area/species). Results of (total area/species) of all adequate pollinator species were added and divided by the total area of all species - attained by adding all of the (total area/species) values - in order to yield a percentage of adequate pollinator species by area.

Next it was determined when each plant blooms on campus, as bees can only collect nectar and pollen when flowers are present. “Months of bloom” for each species were researched and recorded. This allowed for a more thorough review of how much food is available for bees throughout their active foraging months of the year .

Whether plants were native to the area was also assessed even though research has shown that bees benefit from both native and nonnative plants (Hall et al.). This was initially done merely as a form of further assessing the Boston College landscape, but was later used as a form of comparison with recommended native “adequate pollinator species.”

For the purpose of comparison, maintenance levels of all of the species were also researched. These were recorded as “low,” “medium,” or “high.” This was done in order to give Boston College Grounds an idea of how high maintenance levels of recommended “adequate pollinator species” would be.

Once the question of what kind of habitat Boston College provides for bees was determined, the question of what kind of habitat Boston College could provide for bees in the future was researched. To answer this question, the USDA Plant Hardiness Zone Map was used to first determine what zone Boston College is in. Afterwards, good pollinator plant species were researched and recorded; their respective blooming months and whether they are native were recorded. Maintenance requirements for each species were also recorded, This information was used, along with the assessment of Boston College’s current landscape, in order to provide recommendations of what bee-benefiting plant species could be incorporated on campus in future landscaping plans.

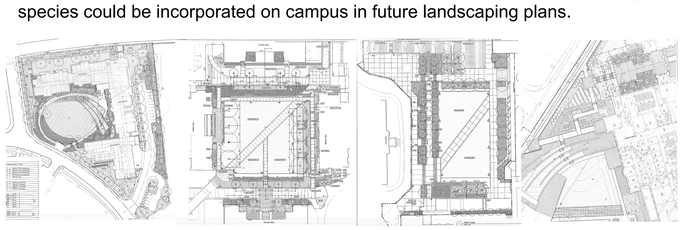

Figure 1. Landscape plans provided by Boston College Grounds. The flora in these four areas were used as a model for all of campus.

Figure 2. Scintillation Rhododendron in Lyons/Devlin Plaza.

Results

Adequate Pollinator Species by Quantity and Area

Trees: 41% by quantity; 43% by area
Shrubs: 76% by quantity; 84% by area
Perennials/Groundcover: 82% by quantity; 42% by area
Total: 81% by quantity; 47% by area

Figure 3. Korean Spice Viburnum in O’niel Plaza.

Maintenance Levels

Table 1. Maintenance Levels of Trees, Shrubs, and Groundcover plants on campus and levels for recommended plants for comparison purposes.

Trees		Shrubs		Groundcover		Recommended	
Species (common name)	**Maintenance**	**Species (common name)**	**Maintenance**	**Species (common name)**	**Maintenance**	**Recommended Plants**	**Maintenance**
American Elm	low	Korean Spice Viburnum	low	May Apple	medium	**Forbs:**	
Arnold Promise Witch-hazel	low	Doublefile Viburnum	low	Mix of Daffodil	low	wild geranium	medium
Red Oak	low	Gro-Low Fragrant Sumac	low	Pachysandra	low	Golden alexanders	medium
White Redbud	low	China girl Holly	low	White tulip (Darwin hybrid)	low	blue vervain	low
Scarlet Oak	low	Dwarf Korean Spice Viburnum	low	Trillium	medium	narrowleaf mountain mint	low
Star Magnolia	medium	Virginia Sweetspire	low	Periwinkle	medium	swamp milkweed	low
Red Maple	low	Boxwood	medium	Squill	low	boneset	low
Swamp White Oak	low	Compact Cranberry Bush Virburnum	low	White Flowering Lilyleaf	low	cardinal flower	low
Hawthorn	low	Slender Deutzia	low	White Periwinkle	medium	wild golden glow - aka - cutleaf coneflower	medium
Saucer Magnolia Transplant	medium	Dwarf Fothergilla	low	Siberian Iris	low	calico aster	low
Shad - Serviceberry	low	Chionoides Rhododendron	medium	Vegetus Wintercreeper	medium	gray goldenrod	low
American Beech	low	Coerulea Lace Hydrangea	medium	Creeping Liriope	low	wrinkleleaf goldenrod	low
Tulip Tree	low	Patzam Arrowwood Viburum	low	Japanese Wax Bells	low	bottle gentian	low
Donald Wyman Crabapple	low	Shamrock Inkberry	low	Boston Ivy	low	**Shrubs/Trees:**	
Spring snow Crabapple	low	Red Sprita Winterberry	low	Japanese Anemone	low	pussy willow	low
Sargent Cherry	low	Redtwig Dogwood	medium	Monkshood	medium	blackberry	medium
Crabapple - Snow Drift	medium	Dwarf Redtwig Dogwood	medium	Switchgrass	low	highbush blueberry	medium
Sugar Maple	medium	Crete Rhododendron	medium	Cinnamon Fern	low	raspberry	medium
Fastigid Beech	low	Scintalation Rhododendron	medium	Christmas Fern	low	ninebark	medium
Japanese Maple Transplant	low	Inkberry Holly	low			new jearsy tea	low
Autumn Flowering Cherry	low	Inkberry Hedge	low			american basswood - aka - linden	low
Black Gum	low	Frosty Potentilla	low			virginia rose	?
Little leaf Linden	low	Clethra - September Beauty Summers	low			buttonbush	low
White Spruce	low	Dwarf Summersweet	low				
Norway Spruce	low	Everlow Yew	low				
English Yew	low						

Figure 4. Image of Bumble bee. (Newsbarber).

Nativity

Trees: 54% native
Shrubs: 40% native
Perennials/Groundcover: 26% native
Recommended: 90% native

Figure 5. Image of Honey bee. (Reference).

Blooming Months

Table 2. Tree Months of Bloom.

Species (common name)	Feb Bloom	March Bloom	April Bloom	May Bloom	June
American Elm	■	■	■		
Arnold Promise Witch-hazel	■	■	■		
Red Oak		■	■	■	
White Redbud		■	■	■	
Scarlet Oak		■	■	■	
Star Magnolia		■	■		
Red Maple		■	■		
Swamp White Oak		■	■	■	
Hawthorn		■	■		
Saucer Magnolia Transplant		■	■		
Shad - Serviceberry		■	■		
American Beech			■	■	
Tulip Tree			■	■	■
Donald Wyman Crabapple			■		
Spring snow Crabapple			■		
Sargent Cherry			■		
Crabapple - Snow Drift			■	■	
Sugar Maple			■		
Fastigid Beech			■	■	
Japanese Maple Transplant			■		
Autumn Flowering Cherry			■		
Black Gum				■	■
Little leaf Linden					■
White Spruce	*non-flowering				
Norway Spruce	*non-flowering				
English Yew	*non-flowering				

Table 3. Shrub Months of Bloom.

Species (common name)	March Bloom	April Bloom	May Bloom	June	July	Aug	Sept	Oct
Korean Spice Viburnum	■	■						
Doublefile Viburnum		■	■					
Gro-Low Fragrant Sumac		■	■					
China girl Holly		■						
Dwarf Korean Spice Viburnum		■	■	■				
Virginia Sweetspire		■	■					
Boxwood		■	■					
Compact Cranberry Bush Virburnum		■	■					
Slender Deutzia			■	■				
Dwarf Fothergilla			■	■				
Chionoides Rhododendron			■	■	■			
Coerulea Lace Hydrangea			■	■	■			
Patzam Arrowwood Viburum			■	■				
Shamrock Inkberry				■	■			
Red Sprita Winterberry				■	■			
Redtwig Dogwood				■	■			
Dwarf Redtwig Dogwood				■	■			
Crete Rhododendron				■	■			
Scintalation Rhododendron				■	■			
Inkberry Holly					■	■	■	■
Inkberry Hedge					■	■	■	■
Frosty Potentilla					■	■	■	■
Clethra						■	■	
Dwarf Summersweet						■	■	■
Everlow Yew	*non-flowering							

Table 4. Perennials/Groundcover Months of Bloom.

Species (common name)	March Bloom	April Bloom	May Bloom	June	July	Aug	Sept	Oct	Nov
May Apple	■	■	■						
Mix of Daffodil		■							
Pachysandra		■							
White tulip (Darwin hybrid)		■	■						
Trillium		■	■	■					
Periwinkle		■	■						
Squill		■							
White Flowering Lilyleaf		■							
White Periwinkle			■	■					
Siberian Iris			■	■					
Vegetus Wintercreeper				■	■				
Creeping Liriope				■	■				
Japanese Wax Bells				■	■				
Boston Ivy				■	■				
Japanese Anemone						■	■		
Monkshood						■	■		
Switchgrass						■		■	■
Cinnamon Fern	*non-flowering								
Christmas Fern	*non-flowering								

Table 5. Blooming months of recommended plants.

Recommended Plants	April	May	June	July	August	September	October
Forbs:							
wild geranium	■	■					
Golden alexanders		■	■				
blue vervain				■	■	■	
narrowleaf mountain mint				■	■	■	
swamp milkweed						■	
boneset				■	■	■	
cardinal flower				■	■	■	
wild golden glow				■	■	■	
calico aster					■	■	■
gray goldenrod					■	■	■
wrinkleleaf goldenrod					■	■	■
bottle gentian							■

Table 6. Blooming months of recommended plants continued.

Shrubs/Trees:	March	April	May	June	July	August
pussy willow	■	■				
blackberry		■	■			
highbush blueberry			■			
raspberry			■			
ninebark			■	■		
new jearsy tea			■		■	
linden				■		
virginia rose				■	■	■
buttonbush				■		

Discussion

After assessing the state of Boston College’s campus, it was determined that the landscape is adequately set up as an urban bee habitat with 46.7% (by area) of all plants acting as attractive pollen sources to bees. In addition to the amount of pollinating plants available, there is also an assorted range of plant species on campus (more than 70 different plants) that provide a good level of biodiversity to the landscape. It has been shown that biodiversity in urban landscape is a key indicator of habitat health for foraging bees. The requirements of bees as consumers is more sustainable with higher plant and flower diversity, and one study showed that the diversity or quantity of plant type may be more significant in determining pollinator viability then plant quality (Bluthgen & Klein). Given the amount of biodiversity, green landscape, and adequate forage it appears that Boston College already serves as an adequate urban landscape for bee populations. Another important factor for bee foraging practices is the presence of flowers throughout the foraging season. For this reason, the bloom times of all plants on campus were also analyzed and revealed that 18.6% of plants bloom in late winter (February-March), 61.4% bloom in spring (April-June), and 11.4% bloom in summer (July-September). The lack of summer blooming trees is of somewhat concern, as some bee species are more active foraging in summer months and thus is an area that Boston College could work to improve. The lack of summer blooming trees and the moderately low levels of pollen producing plants are areas of slight concern for harboring rich bee populations, and thus areas that can be improved, but overall Boston College’s campus appears to be adequately set up to provide a healthy landscape for bee species.

Recommendations

Our recommendation is for Boston College to implement more plants suitable for bee populations, especially those which bloom later in the spring and into the summer months. BC is already a fairly effective urban landscape for pollinators, so it makes sense for them to go a little further and become a great landscape for bees. In doing so they wouldn’t just be doing their part in supporting the population of super important organisms, but they would also be able to advertise it as a way to boost the school’s public image.

Table 1 shows the maintenance levels of the recommended plants along with those of the current plants on campus. As shown, all of the recommended plants match the maintenance levels of the plants already on campus, which should make the argument that perennials require more maintenance than other plants obsolete (especially since all of the plants on all of the lists are perennials). Tables 5 and 6 show the blooming months of recommended species. Many of the plants recommended bloom during the summer months, effectively targeting the issue of a lack of blooming summer plants on the Boston College campus.

It is also important to note that some of the plants on the recommendation list are already on campus. For example, lindens are present on campus (Linden Lane), but because the four landscape plans used did not include them we decided to include the species either way.

Another interesting observation is that most of the recommended plants (90%) are native to the Boston area. This is significantly higher than the percentage of native plants already on campus - 54% for trees, 40% for shrubs, and 26% for groundcover. While studies have shown that bees will forage on non-native plants, we believe that including more native plants on campus could only benefit local ecosystems rather than hinder them.

Figure 6. Image of Linden Lane.

References

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