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Project Title: Implementing pollinator habitats into golf course native areas

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Introduction:

The purpose of this project was to build upon an existing pollinator habitat on the College Golf Course at SUNY Delhi. The pollinator habitat will serve as an outside living laboratory used to educate students and the general public. Our primary goal is to bring awareness to the complexity of pollinator health (in particular, the Western Honeybee *Apis mellifera*) and their role in global food systems.

The Western Honeybee is a major contributor to the pollination of agricultural crops such as almonds, apples, blueberries, and many others. Without honeybees many of these crops would not be pollinated resulting in substantial decreases in crop yields. In the past decade the decline of the western honeybee (*Apis mellifera*) has become a concern across the United States and Europe. Substantial annual declines of honeybees have been observed in a phenomenon known as Colony Collapse Disorder (CCD). CCD was first reported in 2006 when it was observed that hives would come out of winter with substantial losses. From 2006-2008 these losses totaled 30% annually (Pettis and Delaplane (2010). Sustaining losses of this magnitude make it difficult for beekeepers to fulfill orders for pollination. While many factors can contribute to bee health, the insecticide called imidacloprid was first publically identified as a hazard to bees when its use was restricted in France (Doucet-Personeni et al. 2003 as cited in Creswell et al. 2012). Imidacloprid belongs to the neonicotinoid class of insecticides which also includes other compounds such as acetamiprid, clothianidin, dinotefuran, and thiamethoxam. It is a systemic insecticide which means that its phloemic and xylemic transport can result in harmful concentrations in nectar and pollen where bees can then become exposed (van der Sluijs 2013).

Imidacloprid is a widely used insecticides to protect turf from soil dwelling insect pests (Peck 2009). In New York State imidacloprid is the only registered neonicotinoid for use on turfgrass. It is a popular white grub control product and these applications are applied preventatively during or immediately after egg laying (Grewal 2001). Coincidentally, this often coincides with bloom of *Trifolium repens* (white clover). This creates a precarious situation in which honeybees can easily be exposed to the insecticide while they are foraging.

Neonicotinoid content in pollen is not the only factor contributing to colony losses, but rather one of many other compounding stressors such as poor forage and disease (Creswell et al. 2012). Mites and climate change have also been implicated with honeybee decline (Rogers, personal communication). Other factors include lack of genetic diversity, poor beekeeping practices, and various diseases. There is

a need for educational institutions to create public gardens that serve to inform the general public on the role pollinators play in agriculture and shed some light on the many factors contributing to pollinator decline.

Work completed:

The project started in June 2017 with the initial clearing and establishment of the trail way system used to move students and the public throughout the habitat. From there, the electric fence was installed and the two hives placed inside. The hives performed well all year with both hives putting on significant weight which is a sign of good hive health.

The site previously had good forage with a combination of Goldenrod (*Solidago canadensis*), White Heath Aster (*Aster ericoides*), Blackberry (*Rubus armeniacus*), among others. However, there was a need to enhance the natural vegetation and the availability of quality of nectar and pollen during times when established plants were not in bloom. Lilac (*Syringa vulgaris*), Coneflower (*Rudbeckia laciniata*), and Joe Pye Weed (*Eutrochium purpureum*) were planted throughout July 2017. The remaining plant material (Toadflax *Linaria vulgaris* and Wild Carrot *Dacus carota*) will be started in the greenhouse (via seed) during February 2018. They will be up potted and eventually transplanted into the pollinator habitat during Spring 2018.

The habitat was toured for the first time on October 4, 2017 during the New York State Turfgrass Association (NYSTA) Winning Fields Winning Fairways educational seminar. There, industry professionals were shown how they can also implement pollinator friendly habitats at their facilities. It is our plan to have tours continue in 2018 and beyond.

Results (Hive survival): Two hives (Hive 1 and Hive 2) were raised through summer 2017 to the point in which each hive was supported by two deeps and one medium super. On October 24th the queen excluders were removed and hives were inspected for honey and mites. Honey was not removed from either hive going into winter 2017-2018. In late October weight readings were taken from Hive 1 to determine honey consumption throughout the winter. Weight data for Hive 1 is listed in Table 1. The gradual decrease in weight is primarily attributed to the bees' consumption of their honey supply.

Table 1:

Date	Weight (Kg)
October 1, 2017	110.1
October 25, 2017	104.8
December 4, 2018	96.25
January 4, 2018	90.35
February 4	84.97
February 14 th	83.66

Hives were checked periodically throughout the winter. In early December both hives were inspected and observed that several hundred bees from Hive 2 were dead on the bottom board (landing pad). While some mortality is expected throughout the winter, this seemed unusual to the investigators. Due to the cold temperatures hives were not opened to investigate further. However, an inspection on an unusually warm day on February 20th, 2018 revealed that the whole hive had been lost. Possible

explanations for this include death of the queen during a miticide treatment (inadvertent crushing by beekeepers) in early October or exposure to lethal temperatures during the first cold snap of winter. Other commonly known reasons for winter decline such as Varroa mite (*Varroa destructor*) or starvation were ruled out because routine inspections didn't reveal any mites and ample honey was left when Hive 2 was opened on February 20th. Lastly, lethal or sub lethal effects of insecticides were ruled out because the golf course did not make a traditional imidacloprid application to fairways in 2017 for white grubs.

Discussion: Golf course native areas appear to be excellent habitats for honeybees and other pollinators. As evident from our quick establishment of the hives, ample pollen was available to support brood rearing. Also, ample honey was produced to support the colony through the winter as seen by fall hive weight (see Table 1). Lastly, inspection of Hive 1 on February 20, 2018 revealed a healthy hive along with sufficient honey reserves left to support the colony until spring.

Successful implementation of pollinator habitats in golf course native areas is dependent on a variety of factors including season long forage, control of Varroa mites, and proper beekeeping practices. Novices would wise to seek the help of experienced beekeepers to help manage the colonies and reduce the potential for preventable losses so often seen by hobbyist.

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