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Determining the Feasibility of Implementing a Beekeeping Cooperative in the Bloomington-Normal, Illinois Area

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Abstract: The purpose of this study was to determine the feasibility of implementing a beekeeping cooperative in the Bloomington-Normal, Illinois area. Through the literature review, it is exhibited that honeybees play a very important role in the pollination of certain crops, but there has been a decline in honeybee population, which could result in possible crop reduction. My research was determining benefits and feasibility in the formation of a beekeeping cooperative. Through conducting interviews with beekeepers, farmers, cooperatives, and agricultural organizations, I have determined that there are significant benefits to be gained from the presence of a cooperative, although there are substantial barriers that could prevent the cooperative from being successful. I would recommend future study in gauging interest to determine if the biggest barrier of lack of dedication could be avoided.

Introduction

Ecosystems regularly provide services that often go unnoticed. Examples of ecological services include air and water filtration, waste decomposition, and seed dispersal. One major service that is crucial to human survival is pollination of plants. Without pollination, the majority of plants would not be able to reproduce, and a large majority of those plants are dependent on animals for pollination (Klein, et al. 2007). Bees are perhaps the most well known of animal pollinators, but even their contributions to plant reproduction are often overlooked.

There are almost 20,000 species of bees worldwide (Seeley 2010), but only one has managed to be successfully introduced into almost every country and to adapt to nearly every climate. *Apis mellifera*, commonly known as the honeybee, is one of the most widespread and abundant insects on earth (Goulson 2003). Used throughout history for the production of honey and for the pollination of crops, *A. mellifera* has proved itself to be an extremely useful species. It is estimated that the total value for worldwide crop pollination is 153 billion euro (Gallai, et al. 2009), while the value attributed to pollination in the United States from honeybees specifically is $15 billion (Isaacs 2010).

Expansion of agricultural land has created an increased need for pollination that is not being easily met. In an effort to meet the need for pollination efficiently, most agricultural fields are pollinated by managed colonies of *A. mellifera* that are kept, or even rented, by farmers specifically for pollination. Beekeepers have an increasingly important role in preserving colonies as evidence shows declining populations. Managers of colonies play a direct role in the health and activities of the colony through placement, treatment, and honey extraction. It can be a difficult task to manage hives, and beekeepers often benefit from having regular contact with other experienced beekeepers. Cooperatives have proven to be a useful tool in creating a network of people with similar purpose that can share ideas and knowledge. In this case, a beekeeping cooperative would provide support for beekeepers through the sharing of knowledge, advice, and equipment.

My study examines the advantages and disadvantages of a beekeeping cooperative in the Bloomington-Normal, Illinois area while gauging interest to determine if a cooperative would be feasible and productive. In order to understand why bees are necessary, I first present an examination of the literature on honeybees and native bees, the role pollination plays in agriculture, threats to bee survival, the role beekeepers play in pollination, and the success of beekeeping cooperatives in other places. I then explain my methodology for determining community interest, exposing possible barriers, describing benefits, and understanding cooperative structure. After the collection of information, I then assess the benefits, disadvantages, level of interest, and best structure options for a beekeeping cooperative in the community of Bloomington-Normal, Illinois.

Literature Review

Of nearly 20,000 species of bees that exist on the earth, only one has been successfully introduced to nearly every country around the world. The well-known honeybee, *Apis mellifera*,

has been domesticated for about 4,000 years and has since been used for honey production and pollination services (Goulson 2003). While believed to have been native to Africa, western Asia, and southeastern Europe, honeybees were introduced in North America around the year 1620 (Goulson 2003). Since then, this social bee has played an increasingly important role in agriculture around the world alongside many other species of bee.

Types of Bees

The honeybee has been introduced around the world and therefore is not considered native in most places. Even in areas where honeybees are considered to have originated, colonies are often strains created by bee breeders and are managed by people, resulting in the species being considered non-native even in the areas where they have originated (de la Rua, et. al 2009). With the few exceptions of certain other species of bees (*Osmia cornuta*, *Bombus impatiens*, and *Megachile rotundata*, among others), which are not discussed here, the honeybee is the predominant species of managed bee. Until recently, it was the only managed pollinator for certain crops, such as almond (Bosch 1994). In this discussion, when speaking about managed or cultivated bees, the species *Apis mellifera* (honeybee) is implied. Therefore, any bees that are designated as wild or native are simply bee species that exist naturally in that area. Wild bees are unmanaged, but still provide pollination for plants. The term bumblebee is used as well, which is a specific family of native bee, and while there are many different species of bumblebees in different regions, in this discussion bumblebees can be considered synonymous with native or wild bees. Other families of wild bees include leafcutter bees, mason bees, carpenter bees, and hornfaced bees.

The reason humans have been able to so successfully manage honeybees, and a limited number of other species, is because honeybees are a social bee. Honeybees live in colonies that can have greater than 60,000 individuals in a single hive (Morse 1975). Worker bees, which are all females, produce and store honey in honeycomb, along with a myriad of other tasks including cleaning, larval feeding, and even acting as undertakers and removing dead bees from the hive (Morse 1975). A hive contains one queen bee whose sole task is to lay eggs (more than 1,500 eggs a day [Seeley 2010]), a job she must be proficient at if she does not want to be removed by other bees. Worker bees that sense that their queen is not producing enough eggs will rear a new queen and remove the old one. All of the bees work for the greater good of the entire colony (Seeley 2010), making them extremely efficient. So efficient that beekeepers can "trick" honeybees into storing more honey than they naturally would by providing them with a larger hive than they would live in naturally; colonies induced to store honey this way can store more than 220 pounds of honey in a single summer (Seeley 2010). It is an incredible feat, considering that ten flowers need to be visited to collect one drop of nectar, and ten drops of nectar are needed to create a single drop of honey (Sweet Virginia).

Most types of wild bees are solitary, meaning they do not have a social group like honeybees (Spivak 2011). Only female solitary bees live through the winter. In the spring, mated females emerge to excavate a multichambered nest, provision each chamber with pollen and nectar, lay an egg in each chamber, and seal the chambers up so that the larvae can hatch and grow during the summer (Seeley 2010). The female will not survive to see her offspring emerge. The burrows, often in plant stems or in sandy soil (Seeley 2010), must remain undisturbed for

successful reproduction (Spivak 2011). All females are capable of laying eggs, in contrast to honeybees, for which only the queen is capable of reproduction (Seeley 2010). A single female reproducing makes genetic control much easier, and people who rear queens can breed for certain traits, such as resistance to mites. For these reasons, honeybees have been most successfully cultivated.

Pollination

Pollination allows for sexual reproduction of plants, usually resulting in fruit or seed formation, which is important in the growth of food. The majority (70%) of the main crops used for direct human consumption throughout the world are dependant on insect pollinators (Gallai 2009). Out of total world crop production, insects are responsible for an estimated 35% (Breeze 2001; Spivak 2011). The economic value of this service has been estimated to be about 153 billion euro, which accounts for 9.5% of the value of world agricultural production in 2005 (Gallai 2009). Pollination has the most value for production of fruits and vegetables, with values of 50 billion euro each, followed by values for edible oil, stimulant (such as tea or coffee), nut, and spice production (Gallai 2009). Indirect pollination value is the result of beef and dairy production; pollination is necessary for alfalfa production, an important forage legume (Gallai 2009). Out of all insect pollinators, bees are widely considered the most important, and 80% of global pollination is attributed to the honeybee (Breeze 2011). Honeybee pollination in the United States alone has been valued at $15-20 billion annually (Isaacs 2010; Stone 1997).

Role of the Honeybee

Managed honeybees have been so successful in agriculture due to a number of reasons. Their generalist nature allows them to make use of many different types of plants for food, and thus they are able to pollinate many species of plants, making them extremely useful as crop pollinators (Ghazoul 2005). Honeybees have been known to visit one hundred or more different plant species in a single region and have been recorded at 40,000 different species of plants in total (Goulson 2003). They also have a vast foraging area, traveling kilometers away from the hive in search of resources (Jaffe 2009). As a social species of bee, honeybees live in colonies consisting of 500 to 50,000 individuals (Goulson 2003). Colonies allow for a higher population density than semi-social or solitary bees (Goulson 2003), and higher population density means more bees pollinating a field. On top of that, honeybee colonies are easily managed, versatile, active early in the year when compared to other species, and can be transported between blooming crops (Breeze 2011). These factors make honeybees extremely efficient economically for the agriculture industry. Some even call honeybees “rescue pollinators” because they can compensate for a decline in wild pollinators (Jaffe 2009).

Although honeybees are convenient and versatile, there is some evidence showing they are not always the most effective of pollinators (Klein 2007; Breeze 2011). Effectiveness is used to describe the efficiency of pollen transfer and visitation frequency (Rader 2009). Pollen transfer is the event that occurs when the insect comes in contact with the stigma of a flower while carrying enough pollen grains from a compatible flower (Bosch 1994). In cranberry crops, it has been determined that honeybees are less effective than bumblebees in pollination (Broussard 2011). It has also been shown that honeybees, despite being used extensively, are less

effective than other pollinators in pollinating almond crops, largely due to the tendency of honeybees to orient themselves along rows of trees, which all consist of a single cultivar, rather than switching among rows to cross-pollinate cultivars (Bosch 1994).

Role of Wild Bees

The pollination capacity of honeybees in the United Kingdom has fallen by 50%, but there has not yet been a detectable loss of pollination services (Breeze 2011). While that seems to be contradictory, studies have shown that wild bees can provide a supplement to managed bee pollination (Winfree 2008, Isaacs 2010). The value of wild bee pollination in the United States has been estimated to be $3.1 billion annually (Isaacs 2010), but some studies have established that wild pollination accounts for more of pollination services than previously realized (Breeze 2011). One study showed wild bees to be responsible for the majority of the crop flower visitations of three to four summer vegetable crops, even though honeybees had been rented to provide pollination (Winfree 2008). In Michigan, even though wild bees provide only 10% of pollination to blueberries, it has been shown that they have higher relative pollination efficiencies than honeybees (Isaacs 2010). The same evidence has been shown for cranberries: bumblebees are better pollinators than honeybees (Broussard 2011). The same is also true of other crops such as watermelon, coffee, pumpkins, and almond trees (Rader 2009; Bosch 1994; Spivak 2011). One possible explanation for better efficiency at pollination is the adaptation of wild bees to specific regions, conditions, and plant species (Broussard 2011).

While wild bees' specialization makes them more efficient pollinators of some crops, it also makes it challenging to provide full pollination from wild bees alone (Isaacs 2010). Indeed, even the presence of a market for renting honeybees for pollination speaks to the insufficiency of wild pollination (Gallai 2009). Agricultural intensification reduces the abundance and diversity of wild bees through reduced habitat, lower flower diversity and abundance, increased pesticide use, and nesting site disturbance (Winfree 2008; Bosch 1994; Rader 2009; Jaffe 2009; Isaacs 2010). In a study on Michigan blueberry field pollination, it was shown that honeybees provided 89% of the pollination for the large fields (higher intensification) while wild bees dominated pollination on small fields (lower intensification) (Isaacs 2010).

While some studies conclude that honeybees are not the most effective pollinators, a study conducted by Rader, et al. claims that honeybees were the most effective at pollinating certain crops (Rader 2009). This study found that honeybees deposited three times more pollen grains on flowers of *Brassica rapa*, or "Pak Choi," than four native species, and also visited the flowers at a significantly higher rate (Rader 2009). The study concludes by saying that there are several potential alternatives to honeybees, but the smaller population of these species renders them less efficient (Rader 2009). Thus, honeybees remain the most economically valuable pollinator of crop monocultures worldwide (Klein 2007).

Global Bee Decline

There is some concern that current honeybee pollination services will not meet agricultural demand (Jaffe 2009; Goulson 2003; Ghazoul 2005). Honeybees are susceptible to a variety of diseases and environmental threats, some of which have increased significantly during

the past decade (Genersch 2010). Populations of honeybees have exhibited a decline around the world (Jaffe 2009; Rader 2009; Breeze 2011; Klein 2007; Gallai 2009; Winfree 2007; but see Ghazoul 2005). Not all countries have been affected equally, however. Decreases in managed honeybee colonies in Austria, Germany, Sweden, and Switzerland are particularly severe (Genersch 2010). In England, there was a 54% fall in honeybee hive numbers between 1985 and 2005 (Breeze 2011), and in the United States, colonies dropped by 59% over 58 years (Winfree, et al. 2007). A large decline in honeybee colonies in Europe happened during the 1990s, due to the collapse of the Soviet Union (Genersch 2010). Countries in the Soviet Bloc had honeybees because honey had been used like a second currency, but with the upheaval of the economic system, the incentive to have bees was lost (Genersch 2010).

There could be serious implications in crop production with falling honeybee population (Breeze 2011). The decline of pollinating species can lead to a decline of plant species as well (Klein 2007). Since the majority of global crops depend on insect pollination, a considerable production loss could be experienced following pollinator limitation (Klein 2007). One study even notes that the capacity of honeybees to meet the demand for pollination services in the United Kingdom fell by 50% between 1984 and 2007 (Breeze 2011). Intensive fields become dependent on managed honeybees for pollination (Isaacs 2010). In order to provide pollination for high-density fields, farmers commonly rent colonies of bees for the duration of the bloom (Isaacs 2010). The rented bees supplement local wild bees, which would otherwise be unable to provide pollination for the entire field (Gallai 2009). Cranberry farmers in Oregon utilize 0.5 – 1.0 honeybee colonies per hectare of crop (Broussard 2011), while blueberry farmers in Michigan rent two to twelve colonies per hectare (Isaacs 2010). The market for colony rental in the United States and Europe is well developed and organized (Gallai 2009). It can be a lucrative market for beekeepers as prices rise for pollination services (Breeze 2011). Almond growers paid $35 per hive in the early 1990s, but in 2007 hive rentals cost $150 per hive (Winfree 2007). With two to six hives recommended per hectare on an almond orchard (Bosch 1994), the price per acre could range from $300 to $900. Although this number is low compared to what it would cost in labor to pollinate using human workers, the rise in price is indicative of honeybee shortages.

Effects of Decline

In general, pollination can increase quantity and quality of fruit or seeds, hasten crop production, improve fruit weight, and increase genetic diversity (Isaacs 2010; Breeze 2011; Allen-Wardell, et al. 1998; Rader 2009). Some crops, like cotton, that do not need pollination can still produce improved yields when pollinated (Allen-Wardell, et al. 1998). One study maintains that fruit set and fruit size in cranberries are maximized when eight or more pollen grains are transferred (Broussard 2011). Fruit size of blueberry crops will be increased with more pollination (Isaacs 2010), and fruit set of almonds is dependent on pollination (Bosch 1994; Allen-Wardell, et al. 1998). In several states, a lack of pollination, resulting from shortage of pollinators, has been blamed for reduced crop yields (Allen-Wardell, et al 1998). There have been reports of widespread alfalfa seed loss, decreased pumpkin yield in New York, and cashew failures in Borneo from pollinator losses (Allen-Wardell, et al. 1998). In New Brunswick, pesticide use killed pollinators to such an extent that the blueberry crop suffered a multi-million dollar loss, although it did not result in substantial food production decrease (Allen-Wardell, et al. 1998).

While insect pollination is thought to benefit the yields of 75% of globally important crops (Breeze 2011), animal pollination, including insect pollination and pollination via vertebrates including some species of bats and birds, is irrelevant to 28 of the world's leading crops (Klein 2007). Many staple crops, including wheat, rice, maize, roots, and tubers, do not need insect pollination and therefore would not be affected by the loss of pollinators (Gallai 2009; Ghazoul 2005). Species that would be affected by pollinator loss, however, make up an important part of our diet, namely fruits and vegetables, that supplies many essential nutrients, and disruptions in production could have implications on human health (Spivak 2011; Gallai 2009; Genersch 2010). Pollination limitation in some of these kinds of crops can decrease yield by 50-90% (Allen-Wardell, et al. 1998; Klein 2007).

Although there is evidence of pollination-limitation in some crops, there is none that shows that pollinator declines have translated into substantial decreased food production (Winfree 2007). Most crops that are animal pollinated are grown on a small-enough scale that pollinator declines will not be drastic or even noticeable (Ghazoul 2005). Although a food crisis is unlikely, declining crop yields as a result of pollination-limitation (Winfree 2007) could mean more acres of farmland will be needed to meet food demand (Spivak 2011). Fruit production in North Africa and parts of Asia might fall below the consumption level following loss of pollinators, and North America and the European Union could have a severe loss in fruit production (Gallai 2009). The area of pollinator-dependent crops is increasing while supply of pollinators is decreasing (Winfree 2007). The increased demand for pollination is also coming from commodity crops, such as oilseed rape in the United Kingdom, which are used in the production of some biodiesel fuels (Breeze 2011). Pollination limitation will only increase as populations of pollinators decline and demand for pollination services rises.

Threats

It is vitally important to understand exactly what is causing the decline in honeybee population because of the beneficial role they play in agriculture. Major population decline of honeybees has been attributed to habitat fragmentation and loss, nutritional stress, migratory apiculture, pesticide use, parasitic mites, pathogens, and viruses (Allen-Wardell, et al. 1998; Bacandritsos 2010; Jaffe 2009; Spivak 2011).

Land Use and Habitat Loss

Mounting evidence of declining wild bee populations around the globe speaks for the importance of land management (Breeze 2011; Winfree 2008). Reduction of abundance and diversity of bees in agricultural landscapes is correlated with habitat fragmentation and loss, and reduced quality of habitat diversity (Holzschuh 2010). These types of habitat degradation often are the result of agricultural intensification. Habitat fragmentation arises from physical divisions, but also through the use of herbicides (Allen-Wardell 1998). Herbicides are used not only within crops, but to remove unwanted weeds along edges of fields. The removal of weedy patches eliminates sources of supplemental pollen and nectar that are beneficial to the health of bees (Spivak 2011). The lack of diverse floral resources weakens the immune response of bees, leaving them more susceptible to other stressors (Spivak 2011). The effects of habitat isolation

are often more consequential than those of land management (Kremen, et al. 2002), and bee populations are enhanced by high proportions of non-crop habitats (Holzschuh 2010).

The monoculture that agricultural intensification produces contributes to the lack of resource diversity and creates a boom and bust cycle of extreme abundance of flowers for a few weeks followed by an extreme dearth of flowers for most of the season (Winfree 2007; Spivak 2011). Cover crops such as alfalfa and clover, used in the past as nitrogen-fixers in crop rotation, would provide reliable sources of pollen and nectar, but increased fertilizer use now replaces the practice of crop rotation, therefore cover crop forage is now rare (Spivak 2011). This reduces the diversity and abundance of forage available, decreasing the health of bees.

Pesticide use on agricultural land has increased as well, with detrimental effects on bees. Doses are usually not high enough to kill a bee outright, but sub-lethal doses create problems that have been thus far little studied (Spivak 2011). Some pesticides, such as deltamethrin, disrupt homing flights of honeybees, while some, such as parathion, disrupt communication dances (Stone, et al. 1997). A disrupted homing flight may not only result in the death of a confused bee, but could also result in the loss of forage resources returning to the hive, causing scarcity for the colony. Disruption of communication dances will prevent forage scouts from communicating to other bees where to find resources, resulting in decreased collection. Still other pesticides, such as permethrin, neonicotinoids, and pyrethoids, affect learning (Stone, et al. 1997; Spivak 2011). Furthermore, chemicals can be transported into hives, causing effects on the brood and possibly contaminating honey (Koch 1997).

Native bee species are especially sensitive to habitat degradation. Species composition and richness change with habitat loss; smaller patches of habitat leads to the loss of small, specialized species and favors generalist species, such as honeybees (Bommarco, et al. 2010). Most native bees are solitary and need undisturbed places for successful nesting sites (Winfree 2007; Spivak 2011). Agricultural intensification reduces native bee diversity and abundance and diminishes native bee pollination services by 3- to 6- fold (Kremen, et al. 2002), which exacerbates the need to import honeybees as pollinators (Ghazoul 2005).

The introduction of imported honeybees, however, can have consequences of its own. Honeybees are an exotic species and the effects they have on native bee populations have not been extensively studied (Goulson 2003). Their introduction, therefore, should be met with caution because of their unknown effect on forage resources (Breeze 2011). Because of the extreme similarity in niches of honeybees and native bees, one study claims that "competition is inevitable," although it is difficult to prove through experimentation (Goulson 2003). Honeybees, when compared with native species, can start foraging earlier in the day (due to their large size and heat retention ability), collectively learn where new resources are and get to them first, fly 10-20 km away from the hive to forage, and reach into deep flowers with their longer tongues (Goulson 2003). All of these traits make honeybees extremely competitive, and it is probable that their substantial use of resources to stockpile honey has a negative effect on some species of native bees (Goulson 2003). While honeybees are not particularly aggressive towards other species of bees, they regularly deter other species from foraging on the richest resources (Goulson 2003). In addition, honeybees have been known to attack nests of other honey-storing species to steal the honey inside (Goulson 2003). Even with all of these possible sources of

competition, however, there has been little evidence showing that the presence of honeybees has any impact on native bee populations (Goulson 2003; Paini 2004; Kremen, et al. 2002; Roubik 2001).

Mites and Viruses

The increased need for rented pollinators causes an increase in the movement of hives around the United States, but cross-country transport imposes a great deal of stress on honeybees (Spivak 2011), and the high density of hives in a small area, which occurs when the hives are loaded in trucks for transport, causes the increased spread of parasites and disease (Downey 2001; Jaffe 2009). The stress decreases immune systems, which in turn advances contagious disease and leaves bees more susceptible to parasitic infestation (Bacandritsos 2010). The parasitic mites are the most destructive of ills that could be introduced to one colony from another (Otterstatter 2009). Mites feed off of the hemolymph of the bees, causing the bee to become weak and less able to withstand adverse conditions (Spivak 2011). Mites are also quick to develop a resistance to synthetic pesticides (Spivak 2011), which are often used as a treatment to eradicate mites.

Perhaps the most widespread and notorious of honeybee mites is the *Varroa destructor*. It is native to Asia and is responsible for reduced honey and brood production, reduced lifespans of adult bees, suppressed immune systems, and higher winter mortality (Spivak 2011; Downey 2001). *V. destructor* often kills an entire colony within two years if left untreated, however the mite is becoming resistant to fluvalinate treatment, a synthetic pesticide injected in small amounts in brood caps where larval bees and mites are developing simultaneously (Downey 2001; Spivak 2011). Other mites can be as pervasive, although not as deadly. Tracheal mites are widespread and can cause a reduction in honey yield and brood production (Downey 2001). In colder climates the infestation can also result in less effective respiration which reduces the bees' ability to maintain core temperatures during winter, leading to higher mortality rates (Downey 2001).

Another threat that comes with the mites is the transmission of viruses (Chen, et al. 2004). Mites transmit viruses horizontally, between adult bees and larvae, and have been shown to be vectors of at least five different viruses (Spivak 2011). Kashmir bee virus, a virus originating in Kashmir, India and now reported on four continents, can be transmitted through mites at a transmission efficiency of 70% (Chen, et al. 2004). Mites can pick up a virus by parasitizing an infected bee, thereby spreading the virus throughout the mite population as well (Chen, et al. 2004). A few more examples of viruses carried by mites are acute bee paralysis virus, black queen cell virus, deformed wing virus, and cloudy wing virus (Chen, et. al 2004). Mites are mostly found in honeybee colonies and are not as prevalent in native bee species (Otterstatter 2004), which could be a source of genetic variation for mite resistance for bee breeders.

Colony Collapse Disorder

The most puzzling of honeybee threats is a phenomenon known as Colony Collapse Disorder (CCD). Recently, commercial beekeepers throughout the United States have reported

sudden, unexplained losses of colonies (Bacandritsos 2010). The deaths of thousands of colonies, earmarked by workers abandoning their queen and brood (developing bees) in a hive leaving them to starve, was first seen in 2006 (Spivak 2011; Winfree 2007). Increasing numbers of incidents of honeybee colony losses have been reported in the media (Genersch 2010), potentially altering the perception of the problem to its being more prevalent than in reality. Different parts of the world are affected differently. No one has so far been able to pinpoint the exact cause of the die-offs, but it is most likely to be caused by a combination of multiple interactive factors, including parasites and pathogens (Spivak 2011). Most recent evidence has found a high correlation between CCD and a pathogen known as Israeli acute paralysis virus (Winfree, et al. 2007; Genersch 2010), but more evidence is still needed.

It is impossible to determine a single factor that causes premature colony mortality; it is clear that "several biological and environmental factors acting alone or in combination" affect colony health and lifespan (Genersch 2010). It is fairly certain, however, that pests and pathogens can be identified as the single most important cause of colony losses so far (Genersch 2010). The threats discussed in this review have demonstrated the importance of land management in keeping bees healthy enough to fight off the risks of mites and disease.

Conservation

Governments are starting to realize the risks involved with pollinator decline. Pollinator initiatives exist around the world and are finding ways to protect bee populations. Examples include the International Initiative for Conservation and Sustainable use of Pollinators, European Pollinator Initiative, North American Pollinator Initiative, and African Pollinator Initiative (Ghazoul 2005). European governments have implemented policies to protect native bee species (Jaffe 2009), and the United States has started funding research programs (Spivak 2011). The 2008 Farm Bill approved more that $17 million annually for five years to research Colony Collapse Disorder and other pollinator health issues (Spivak 2011). It is the first bill to directly prioritize pollinators in the United States Department of Agriculture administrative programs (Spivak 2011). Other efforts to address the issues of pollinator decline include research on mites, the value of other species, and pesticide effects, as well as implementing educational programs to encourage beneficial land management such as bee-friendly cover crops (Allen-Wardell, et al. 1998).

The danger of relying on one species for pollination is increasing as honeybees become more genetically identical (Allen-Wardell, et al 1998; Winfree 2007). The increasing dependence on honeybees could lead to increased risk of future crisis through the spread of parasites and disease (Winfree 2007). Relying on native bees as well as managed ones will prevent overburdening honeybees (Breeze 2011). Diversifying the stock of pollinators is an appropriate management response because it creates an insurance against honeybee decline (Ghazoul 2005; Kremen, et. al 2002). Some possible strategies to help alleviate strains on bee populations include reducing pesticide use, restoring native vegetation, providing forage resources throughout growing season, and avoiding disruptive management like tillage (Kremen, et al. 2002; Spivak 2011).

Beekeeping and Cooperatives

The importance of beekeeping, in addition to the previously described management techniques, is significant for the conservation of honeybees. One study states that without beekeeping, honeybees in Europe would be close to extinction (Jaffe 2009). Managers of colonies are vital in treating mites and providing resources in times of scarcity. Promoting beekeeping would increase the number of managed colonies, which could compensate for native species decline resulting from habitat loss and would also help to ensure pollination to meet agricultural demands (Jaffe 2009). There is also an increasing economic incentive for beekeepers as profitability increases, which could contribute to a lasting stabilization of population as more beekeepers emerge to reap the benefits (Genersch 2010). There is an African race of honeybee that is hybridizing with honeybee populations around the world. The Africanized honeybee has greater resistance to mites, disease, and certain pesticides, and might even be superior at pollination (Ghazoul 2005). This genetic variation could be of great benefit in ensuring the honeybees' long-term survival, although beekeepers are wary of this race's notorious aggression (Kremen, et al. 2002). Africanized honeybees also exploit a smaller forage area and are less likely to survive transportation (Ghazoul 2005). These problems are considerable obstacles to using hybridized bees commercially in the United States.

Due to the increasing threats to honeybees, beekeeping has become more challenging. Beekeepers, especially those who lack experience, benefit greatly from being in contact with other beekeepers to share information and get advice. One common way to increase networking among beekeepers is through the formation of a cooperative. A cooperative is most often defined as a business that is owned and controlled by the people who use its services (Rapp and Ely 1996). It is an association of people meeting voluntarily to meet their "common economic, social, and cultural needs and aspirations through a jointly-owned and democratically-controlled enterprise," (Gotham City). A cooperative assumes equal participation and involvement by all members (Mountain High) and is considered to be user-owned, user-controlled, and user-benefited (Rapp and Ely 1996). Values that are upheld by cooperatives include self-help, self-responsibility, equality, solidarity, honesty, social responsibility, and caring for others (Gotham City).

Cooperatives are formed for various reasons and for various purposes, but common objectives are to cultivate a larger vision, distribute benefits, increase market access, and reduce costs for members (Mountain High; Rapp and Ely 1996). Beekeeping cooperatives often are very active in education, both for its members and for the public (Burgh Bees; Mountain High; Sweet Virginia; Toronto Beekeepers Co-op; Chicago Honey Co-op). Some other specific purposes for formation include a job training program (Chicago Honey Co-op), to promote stewardship (Burgh Bees), a desire for a source of beekeeping information (Mountain High), to market members' honey (Gotham City), and to promote "the impact of giving and the importance of cherishing life," (Sweet Virginia).

The specialization of each cooperative to meet the needs of its members is what makes them so beneficial. The benefits members gain from cooperatives include practical and educational support (Mountain High), reduction of costs, reaching objectives unattainable if

acting alone, and, maybe the most important, broadening market opportunities through increased credibility and having increased product quantities of reliable quality (Rapp and Ely 1996). With beekeeping cooperatives, a huge benefit to new beekeepers is the availability of support and information (Mountain High; Burgh Bees; Toronto Beekeeper's Co-op). Other benefits are received by the community, such as increased education opportunities (Toronto Beekeeper's Co-op; Northern Kentucky Beekeeping Co-op; Burgh Bees; Chicago Honey Co-op) and availability of high-quality, local products (Sweet Virginia; Burgh Bees; Chicago Honey Co-op).

Different purposes for the organization lead to different structures in management. While the administration and decision making of all cooperatives are done collectively (Mountain High), beekeeping cooperatives can have very different structures in other aspects. A common framework is of a club directed towards charitable, scientific, and educational purposes (Burgh Bees; Toronto Beekeeper's Co-op; Chicago Honey Co-op). In addition, cooperatives will often "specialize" in an area that is of interest to its members. For example, the Gotham City Co-op plans to operate a shared honey extraction and bottling facility (Gotham City); the Chicago Honey Co-op is implementing a research project to learn how to raise queen bees to use and sell (Chicago Honey Co-op); and the Toronto Beekeeper's Co-op does offseason experiments with making creams, salves, candles, and mead from bee products, as well as designing and constructing equipment (Toronto Beekeeper's Co-op). One very unique beekeeping cooperative is the Sweet Virginia Foundation, a group of beekeepers who do not sell their honey but give it away to people who give money to various local charities (Sweet Virginia). These beekeepers shoulder all costs of production and shipping in order to donate 100% of proceeds (not profit) to charity (Sweet Virginia).

In order to form a cooperative, careful planning is needed. The responsibility for starting a project and seeing it through usually rests with the leadership groups (Rapp and Ely 1996), so strong leaders are essential. An exploratory meeting at the onset of idea implementation is necessary to understand the need for whatever service will be provided, set out cooperative principles and terminology, organize operation procedures, discuss the advantages and disadvantages, and assess the financial requirements (Rapp and Ely 1996). Without fully addressing these issues, it is easy to run into a few pitfalls, especially in a member-controlled organization. Common sources of cooperative failure stem from lack of leadership, commitment, and management (Rapp and Ely 1996). Many beekeeping cooperatives are short-lived because they are formed during an economic upswing or an upsurge of interest and enthusiasm, only to break up when interest dwindles or the economy removes incentive (Sanford 2006). Some of the issues that can lead to the demise of a cooperative include modest returns, ill-defined marketing programs, and fluid membership (Sanford 2006). Avoiding these problems requires careful planning, clear expectations, and good communication.

Conclusion

From the literature, it is apparent that honeybees play an important role in agriculture. Without the valuable pollination these insects provide, many crops would suffer. Honeybees, along with native bees, experience threats to their colonies that are causing populations to decline around the world. It is important to alleviate these stresses as much as possible to preserve species diversity and to ensure adequate pollination. Along with various policies and

initiative groups, there are ways to protect bee habitats on an individual scale, including planting a variety of native plants and decreasing use of pesticides. Beekeeping is becoming an important way to sustain honeybee populations.

Research Design and Methodology

Purpose and Questions

The primary purpose of this research is to determine the feasibility of a beekeeping cooperative in the Bloomington-Normal, Illinois area by gauging interest in local beekeepers and farmers, and investigating the structure and formation of existing beekeeping cooperatives. Tom Pankonen, a local beekeeper, has expressed an interest in the formation of a cooperative, and I worked with him to determine feasibility as the first step of implementation. The main goals of the cooperative would be pairing beekeepers with farmers for the use of the farmers' land to place hives, and the sharing of equipment and knowledge among members. I used qualitative research methods to answer the following questions: 1) Would a beekeeping cooperative be beneficial to local beekeepers and farmers? 2) Is there enough interest to support the formation of a beekeeping cooperative? and 3) What is needed in the community to make a beekeeping cooperative feasible and productive? With the development of local organizations promoting sustainable agriculture and local food (e.g., the Land Connection, Edible Economy, Illinois Stewardship Alliance, and Stewards of the Land), there is a widening interest in agricultural cooperatives. Small-scale farmers often overlook the possibility of using bees in their operations, and this cooperative would provide an easy way to connect farmers with beekeepers.

Description of Research Design

My research consisted of a combination of qualitative research methods in the form of in-depth interviews and an in-depth literature review from September through November 2011. The interviews took place either in person or via telephone, with the exception of one interview via email. I interviewed local beekeepers and farmers to determine community interest and assess the possible benefits of a cooperative in the Bloomington-Normal, Illinois area. To determine the feasibility of starting a beekeeping cooperative in the Bloomington-Normal area, I interviewed existing beekeeping cooperatives and local community organizations. I also observed an introductory beekeeping class at Sugar Grove Nature Center in McLean, IL and spoke with some of the class members. The sampling for interviewees was through identifying local Bloomington-Normal beekeepers, farmers, and community organizations, and finding existing beekeeping cooperative elsewhere. Contacts were made through an internet search, Sugar Grove Nature Center, and referrals made by other interviewees. Different question guides were used with different target groups (beekeepers, farmers, organizations, etc.) in order to focus on their particular interests, knowledge base, and opinions (Appendix A). I interviewed five beekeepers (one of which is the apiary inspector for the Bloomington-Normal region), three local, small-scale farmers, two representatives from beekeeping cooperatives, and two local, agricultural community organizations.

Determining Benefits and Interest

In order to determine benefits and interest of a beekeeping cooperative, I interviewed people who could potentially be involved as members in the local cooperative: beekeepers and farmers. Of the five beekeepers I interviewed, each represented a different perspective: a small-scale, hobbyist beekeeper; a commercial beekeeper; a self-proclaimed "retired" beekeeper; a regional apiary inspector; and a novice beekeeper. The contacts were made primarily through referrals by other interviewees or through Sugar Grove Nature Center. As part of gauging interest, I also asked about benefits and barriers of both beekeeping and a beekeeping cooperative in order to understand in which ways a cooperative would be of the most benefit to its members. I asked each interviewee how and when they got started in beekeeping, what were some challenges in getting started, what are the benefits of bees, how is the health of their hives, what are the possible positives and negatives of a beekeeping cooperative, if they would be interested in participating or in the formation of a cooperative, and what issues would need to be addressed in the formation of a cooperative (Appendix A). Through these interviews I determined interest levels and possible benefits to beekeepers in a beekeeping cooperative.

Because a main goal of the cooperative would be connecting beekeepers and farmers, it is important to get opinions and inputs from local farmers. Farmers that benefit the most from the presence of bees are the ones producing a variety of pollination-dependent crops. The farmers I contacted were all small-scale, "organic" (agriculture with minimal to no chemical use) farmers. These are important distinctions because the use of chemicals can have a detrimental effect on bees, as exhibited in the literature review. Not all of the farmers are certified organic by the United States Department of Agriculture, but they all practice typical organic agricultural methods. All of the farmers I interviewed either had their own bees on their farm, or have a beekeeper that keeps bees on their land. I asked the interviewees about their farms, benefits and drawbacks to having bees on the farm, positives and negatives to a beekeeping cooperative, if they would be interested in a cooperative, and what issues would need to be addressed in the formation of a cooperative (Appendix A). Through interviewing farmers, I determined interest and possible benefits to farmers' participation in a beekeeping cooperative.

In an attempt to learn the opinions of prospective beekeepers, I attended an introductory beekeeping class at Sugar Grove Nature Center. The class was intended for people who have no experience keeping bees, but are interested or considering starting. I planned on having a focus group with some of the members of the class, but due to lack of interest and participation in a focus group, I instead only observed the class and held small conversations with some of the members. Some people approached me expressing an interest in a beekeeping cooperative, and I asked what benefits and concerns they would have with the presence of a cooperative.

Determining Feasibility

In order to determine the feasibility of establishing a beekeeping cooperative, I interviewed representatives of existing cooperatives to learn how other cooperatives have successfully been implemented. The two beekeeping cooperatives I interviewed representatives

from are urban cooperatives that are not located in Illinois, but have been successful as cooperatives. I identified these groups with an internet search, and these cooperatives, among others, are discussed in the literature review. I interviewed cooperative representatives and asked them about the history of the cooperative, the cooperative's functions, benefits to the members, barriers to starting a cooperative, how to keep a cooperative running successfully, and how the cooperatives are structured (Appendix A). In addition to gaining information on the structure of existing cooperatives, I interviewed representatives of local, agricultural community organizations in an effort to assess community support, networking resources, and to identify an organization willing to partner with the cooperative. I identified these organizations through interviewee referrals and an internet search. The two organizations I interviewed representatives from are involved with sustainable agriculture. Through these interviews I evaluated what is needed for the implementation of a beekeeping cooperative and possible community resources.

List of Interviewees

Local Beekeepers

- **Carol Glennon:** A hobbyist beekeeper starting in 2005 or 2006, Carol Glennon taught an introductory beekeeping course at Sugar Grove Nature Center in McLean, IL.
- **David Burns:** Owner of Long Lane Honey Bee Farm in Fairmount, IL, David Burns is a commercial beekeeper with over one hundred hives. He got started in beekeeping in 1994 and a hobby grew into a business. In addition to keeping bees, he also manufactures beekeeping equipment and teaches beekeeping courses at his farm and Heartland Community College in Normal, IL. David Burns is also one of two Master Beekeepers in the state of Illinois.
- **Carl Wenning:** First started hives in 1997, but has since retired from "intentional" beekeeping. His only colony is a feral swarm that moved into an empty hive in his backyard. He has published more than fifty articles about bees and beekeeping.
- **Jim Wellwood:** Became the apiary inspector for the region of Illinois that includes Bloomington-Normal in May 2011. Jim Wellwood has been a beekeeper since 1992 and has 6 hives.
- **Josh Lindsey:** A full-time undergraduate student at Illinois State University, Josh Lindsey has been beekeeping for less than a year and manages the hives at Sugar Grove Nature Center rather than owning his own.

Local Farmers

- **Marty Travis:** Farms Spence Farm in Fairbury, IL. While not certified organic by the government, Marty Travis practices organic agricultural methods on his farm. He started beekeeping in 2004 for the pollination benefits and has three hives.
- **Dave Bishop:** His farm, PrairiErth Farm in Atlanta, IL, is a certified organic farm. There are beehives on the farm, but are managed by a beekeeper (Tom Pankonen) instead of Bishop.
- **Cathe Capel:** Started a small farm in Champaign County, IL in 2008 that is partly crop production and partly pasture land for sheep. She has beehives on her property that are managed by another beekeeper, Tim Childress.

Beekeeping Cooperative Representatives

- **Oliver Couto**, Toronto Beekeeper's Cooperative: The Toronto Beekeeper's Cooperative formed in 2001 in Toronto, Canada. It has cooperative-owned hives as opposed to individually owned hives. Couto is currently the co-chair of the cooperative.
- **Al Summers**, Mountain High Beekeeper's Cooperative: Mountain High Beekeeper's Cooperative started in 2004 and is located near Boulder, Colorado. It was started in order to provide structured educational beekeeping opportunities. Summers is the founding member and made his remarks as a member of the cooperative rather than an individual.

Local Agricultural Community Organization Representatives

- **Terra Brockman**, Director of The Land Connection
- **Lindsay Record**, Executive Director of the Illinois Stewardship Alliance

Research Findings and Discussion

Determining Benefits of Cooperative

One of the research purposes of this study is determining whether or not a beekeeping cooperative would be beneficial to local beekeepers and farmers in the Bloomington-Normal, Illinois area. A cooperative would be deemed beneficial if it addresses personal barriers and challenges to beekeeping and has the potential to alleviate them. The following were mentioned by interviewees as barriers and challenges in beekeeping: lack of knowledge or experience, fear, having space to place hives, time constraints, and expenses. Interviewees also brought up possible benefits that would come from a beekeeping cooperative; the discussion below will evaluate whether or not the benefits from a beekeeping cooperative will address and alleviate barriers and challenges in beekeeping.

Education

The biggest barrier to beekeeping that was mentioned by interviewees is lack of education or experience. Beekeeping can seem complicated, there is a lot of knowledge, experience, and practice needed to be skillful. Not having that experience can be very overwhelming to new beekeepers (Lindsey, pers. comm.). While it is possible to read a book or to learn from the internet, learning to keep bees is a skill best learned and passed on through people (Lindsey, pers. comm.; Couto, pers. comm.). Having a local group of experienced beekeepers would be beneficial for the mentoring of prospective beekeepers (Wenning, pers. comm.; Glennon, pers. comm.). Carol Glennon is a member of the American Beekeeping Federation, but a national-level group gives general information about bigger issues and does not necessarily help with hands-on knowledge of beekeeping (Glennon, pers. comm.). Carl Wenning was a member of beekeeping organizations in Peoria and Pekin, Illinois, but would have been more benefited by a group closer to him (Wenning, pers. comm.). Having a beekeeping cooperative in the Bloomington-Normal area would provide an accessible, local source of experienced beekeepers to draw knowledge from.

Structured education in the form of workshops and classes are important to keep beekeepers up-to-date and successful. Having a workshop with a very experienced instructor to act as a mentor would be a large benefit that would greatly reduce the barrier of inexperience. Glennon attended a workshop such as this in Byron, Illinois at the Jarrett Prairie Center, and said it was very helpful to attend a regular workshop led by someone who is a "wealth of knowledge," although she does not feel like she has the experience to initiate something similar locally (Glennon, pers. comm.). Since there can be more to beekeeping than simply setting up a hive, regular, structured education will help ensure the longevity of beekeeping endeavors through the passing down of knowledge (Summers, pers. comm.).

Strengthening the network of beekeepers in the area could also increase the number of beekeepers. All the beekeepers interviewed started beekeeping because either a family member or friend sparked their interest. Wenning had a beekeeping grandfather, Glennon had a cousin who had bees, and David Burns had a friend with beehives (Wenning, pers. comm.; Glennon, pers. comm.; Burns, pers. comm.). One of the beekeepers interviewed was drawn to beekeeping through local networking (Lindsey, pers. comm.), demonstrating how networks can result in more beekeepers. The review of literature exhibited the role beekeepers can play in increasing honeybee populations and the importance of having more bees. Having more bees is critical, particularly in rural areas for pollination (Wenning, pers. comm.). Some argue that the presence of a cooperative will result in the presence of more beekeepers, or at least more bees or farms with bees present (Capel, pers. comm.). Others, however, feel that a cooperative will not create more beekeepers because beekeepers will get started and then drop out after a short amount of time (Wenning, pers. comm.). This concern will be discussed later on, but a strong network of beekeepers in a cooperative could result in more beekeepers, and perhaps increase the population of honeybees in the area.

A beekeeping cooperative would be an efficient way to connect area resources, making them accessible to people who might not otherwise know they exist. For example, there is a beekeeping class at Heartland Community College in Normal, Illinois, but people must look through the course catalog to know the class is offered (Burns, pers. comm.). David Burns instructs the course at Heartland, but also instructs classes at his honey farm. As a Master Beekeeper, Burns went through a rigorous test that only four people throughout the United States complete each year (Burns, pers. comm.). Since the test covers all aspects of beekeeping, a Master Beekeeper is an extremely knowledgeable, experienced resource for the area. Other resources include the apiary inspector, Jim Wellwood, who is very informed about colony health and state regulations on apiaries, and University of Illinois's Bee Lab. When Marty Travis had problems with aggressive bees, he went to the Bee Lab, where they helped him to establish more docile colonies (Travis, pers. comm.). A beekeeping cooperative would assist emerging and existing beekeepers through connecting various resources and making a wealth of knowledge available locally.

In addition to education and resources available to members, a beekeeping cooperative would be a valuable source of education for the community. Educating farmers that use conventional agricultural practices (including the use of chemicals) about the dangers of harming bees with chemicals is one example. The literature shows detrimental effects chemicals have on bees, but many people are not aware of this problem. It is important to inform farmers how

important bees are to agriculture and, even if they do not have bees on their own property, how spraying chemicals can be harmful to bees in the area (Burns, pers. comm.). Education would also be necessary for families, especially those with small children, about how to be safe around beehives to prevent mishaps (Travis, pers. comm.). Family education can also help alleviate the fear of bees by instructing people on behavior around bees and beehives.

Connection with Farmers

The goal of a local beekeeping cooperative, in particular, would be to pair beekeepers with small-scale farmers. This is important for beekeepers that do not have a place to put their hives or do not have land with much forage resources. Lack of space is a very common barrier to beekeepers, as is lack of floral resources (Lindsey, pers. comm.). Location is a very important consideration for a beekeeper when placing hives. Wenning did not have a place to put his first hives, but fortunately had a connection with a local beekeeper that had a place Wenning could use (Wenning, pers. comm.). Josh Lindsey does not have his own hives, but manages hives at Sugar Grove Nature Center, which is a beneficial connection for an emerging beekeeper (Lindsey, pers. comm.). Glennon lives in a rural area and has land, but is surrounded by corn (which bees do not forage from). Her bees forage from roadside ditches, where clover grows (Glennon, pers. comm.). Burns found beekeeping more convenient after moving to a rural area with a lot of diverse plant life (Burns, pers. comm.). Knowing bees are going to be in a place where they can find quality foraging is important for the health of the colony. Diversity, as discussed in the literature review, is vital for honeybee health. Having a cooperative that provides easy connections to available land would be a great benefit to beekeepers.

It would also benefit farmers to have connections to beekeepers. The literature showed a strong positive relationship between pollination and crop yield, particularly for certain types of fruits and vegetables. Farmers who would benefit from having honeybees do not always have hives on their farm, however. Farmers are extremely busy with managing their land and many do not have the time to take on an additional task (Capel, pers. comm.). In addition to needing time to manage the hives, time would be needed to learn how to take care of them. It is a steep learning curve and many farmers do not know how to care for beehives (Bishop, pers. comm.; Capel, pers. comm.). The pollination bees provide, however, is very valuable to farmers. Benefits were seen not only in farm produce, but also, according to Capel, in the fruit of an old pear tree (Travis, pers. comm.; Capel, pers. comm.). Having a network where farmers could find a beekeeper willing to keep bees on the farmer's land would benefit the farmers as well as the beekeepers.

Equipment Sharing

Beekeeping equipment can be very expensive and can be a large barrier for beekeepers (Lindsey, pers. comm.; Glennon, pers. comm.). Some equipment is needed only initially, such as the hive box, but some is needed periodically, such as honey frames that are inside the hive and need to be replaced occasionally. Having a local cooperative could assist in equipment expenses. Buying certain types of equipment in bulk can reduce costs for individuals, and the cooperative could also have equipment that the group owns collectively. Allowing members access to group equipment without each person needing to own personal equipment would be one of the biggest

advantages to a beekeeping cooperative according to Dave Bishop (Bishop, pers. comm.). Glennon had access to group equipment from participating in the workshop in Byron, IL, and it allowed her to save on equipment expenses (Glennon, pers. comm.). Having group equipment could also allow for members to train each other on how to use different equipment. A cooperative with strong connections to area resources could acquire equipment from sources individuals might not know about. Burns manufactures and sells equipment, for example, and although obtaining Burns' equipment might be difficult for an individual who lives far from Burns' farm (Lindsey, pers. comm.), perhaps the cooperative could sell Burns' equipment from a different location. A beekeeping cooperative could ease equipment costs for individuals in various ways.

Benefits Conclusion

In order for a beekeeping cooperative to be considered beneficial, it must address and alleviate individuals' barriers and challenges. The barriers of beekeepers and farmers include lack of knowledge or experience, fear, having space to place hives, time constraints, and expenses. The presence of a cooperative could potentially alleviate all of these barriers as discussed above. Therefore, according to the individuals interviewed, the presence of a beekeeping cooperative would be beneficial. Being beneficial, however, does not necessarily make a cooperative feasible or successful. The following section will discuss whether or not a beekeeping cooperative would be feasible in the Bloomington-Normal, IL area.

Determining Feasibility

Another of the research goals for this study is determining whether or not a beekeeping cooperative would be feasible or successful in the Bloomington-Normal, IL area. A cooperative would be deemed feasible if there are community support and resources available to meet the needs of forming and running a cooperative (needs that will be discussed below). The first part of the discussion will address the structure of cooperatives, the second part will address concerns in forming a cooperative that were brought up by interviewees, and the third part will address community support and resources available. Through this discussion, the feasibility of a beekeeping cooperative in Bloomington-Normal will be evaluated.

Cooperative Structure

Different types of cooperatives are structured in different ways, with regards to the goals of the individual cooperative. To differentiate between a cooperative and a club or organization, one cooperative representative said three things need to be defined: 1) That all members have some degree of previous experience with beekeeping (or at least have taken a class or two on the subject); 2) That all members agree (in writing or verbally) to support and help one another with their beekeeping tasks; 3) That the purposes of the cooperative be clearly defined to help *all* members, not only to enhance the status of a few members (Summers, pers. comm.). Group participation is the most defining characteristic of a cooperative (Rapp and Ely 1996).

When a cooperative is first starting out, it could have only seven to ten people, a structured organization probably would not be needed (Couto, pers. comm.). As the cooperative

grows with demand, however, it will need more formal structure with officers and administration (Couto, pers. comm.). Putting the group under another organization will help the cooperative be viable, particularly in its beginnings (Bishop, pers. comm.; Capel, pers. comm.; Couto, pers. comm.). Funding can come from membership dues and product sales (Summers, pers. comm.), but can also come from grants and awards, illustrated by the Toronto Beekeepers Cooperative which won a "Greenest Food" award for $5,000 (Couto, pers. comm.).

Cooperative Concerns

Relationships

The basis of the cooperative in Bloomington-Normal is setting up relationships between beekeepers and farmers. In order for this to be successful, specific guidelines need to be discussed between the two parties. Possible points of contention can arise from miscommunication that could lead to the failure of the cooperative. The relationship needs to be talked through specifically with the two people involved (Burns, pers. comm.), preferably during a formal meeting with a list of topics of what to discuss (Bishop, pers. comm.). An example of a topic to include in discussion is compensation for land use. Traditionally, beekeepers pay in honey to the landowners, and establishing a percent of the honey crop as compensation is a method that takes into account the varying amounts of honey that bees produce each season (Glennon, pers. comm.). Also, because beekeepers would need access to their hives, farmers would need to be willing to allow someone access to their land (Lindsey, pers. comm.). The possibility of miscommunication in the business relationship between a landowner and a beekeeper is a source of potential cooperative failure that will need to be addressed.

Liabilities

Liability issues are of great concern when forming a relationship between farmers and beekeepers (Bishop, pers. comm.; Capel, pers. comm.; Wenning, pers. comm.). Issues in case of loss or injury are possible sources of liability problems. Respecting property is important from both perspectives. Farmers want to make sure the beekeeper will not damage the land, perhaps by creating tire ruts in wet fields (Bishop, pers. comm.), and beekeepers want to make sure their bees are safe, perhaps by having a chemical-free environment for the bees (Lindsey, pers. comm.; Burns, pers. comm.).

Another source of concern is the possibility of a person with bee allergies getting stung. A sting for an allergic person could lead to severe health problems, and even death, without proper treatment. Bishop has a son with bee allergies who has gotten stung, so it is a realistic concern (Bishop, pers. comm.), although more people seem to be afraid of stings than allergic (Travis, pers. comm.). While education can help in avoiding stings, some types of bees are more aggressive and will sting more often, as illustrated by Travis' experience with his Buckfast bees that would chase him to the house (Travis, pers. comm.). While getting stung is simply a negative that comes from working with bees (Wenning, pers. comm.), there are ways to lower the risks of getting stung. People with bee allergies should not take chances, and the possibility of serious accidents necessitates the consideration of liability.

Colony Health

Beekeepers are always concerned about the health of their bee colonies, and the literature review discussed many possible health threats to honeybees. The beekeepers interviewed all said they were not having any significant problems at all with their colonies (Glennon, pers. comm.; Burns, pers. comm.; Travis, pers. comm.; Wenning, pers. comm.). The apiary inspector determined the honeybees of all interviewees to be healthy and free of mites and diseases (Lindsey, pers. comm.; Travis, pers. comm.). Josh Lindsey and other beekeepers at Sugar Grove Nature Center have had some struggles with getting bees to survive the winter, even though the bees have been deemed healthy (Lindsey, pers. comm.). This illustrates the complexity of successfully keeping bees. Some adversities bees face in the winter can include high winds blowing tops off of hives (Glennon, pers. comm.), or not having enough honey stored to last all the way to spring (Travis, pers. comm.). Making strong, healthy bees is important for winter survival. Cooperative members could help one another with different strategies in keeping bees healthy, mite-free, and survive the winter. Some methods for mite-resistance include a screen-board entrance, which causes bees to shake while walking across (shaking the mites off in the process), and sugar dusting, which involves dusting the bees with sugar to encourage grooming (grooming the mites off along with the sugar) (Glennon, pers. comm.; Couto, pers. comm.). While it could be possible to spread disease among hives through the sharing of certain kinds of equipment, if contaminated, that risk could be reduced through education and experience (Glennon, pers. comm.).

Enthusiasm Decline

A very common problem among new beekeepers is the initial enthusiasm disappearing after a short amount of time. People get involved initially, but do not have much lasting dedication (Couto, pers. comm.). Having beehives is something of a novelty, but the excitement wears off fairly quickly. It is difficult to know how many people will actually follow through (Burns, pers. comm.), and it takes a huge amount of personal energy to keep enthusiasm and interest going (Wenning, pers. comm.). Without much interest, the cooperative is very limited in potential (Couto, pers. comm.), and finding and cultivating that interest is the greatest barrier faced by cooperatives (Summers, pers. comm.). The need for dedicated people is the only way to get things done (Couto, pers. comm.; Summers, pers. comm.). A potentially great project started by the Toronto Beekeeper's Cooperative, the creation of the Honeybee Learning Center, fell through due to lack of dedication by members. Not enough members showed up to the meeting to vote, and since cooperatives are collective and decisions get made as a group, the project did not move forward (Couto, pers. comm.). Lack of dedication will cause a cooperative to fail in a short amount of time, and will only cause frustration in those who try (Wenning, pers. comm.). For this reason, substantial amounts of interest need to be assessed over time before the energy required to form a cooperative should be expended.

Community Organizations

Community support of a beekeeping cooperative is vital for its success. Community organizations can provide great amounts of support through networking and connections. A cooperative can gain greater amounts of exposure through different supporting organizations,

and provide a wider network of people to draw interests from. Organizations in the Bloomington-Normal, IL area that could be involved with a beekeeping cooperative include the Land Connection, Illinois Stewardship Alliance, Illinois Beekeeper's Association (Brockman, pers. comm.; Record, pers. comm.), the Edible Economy, and Stewards of the Land, among others. Placing the cooperative underneath the heading of an existing organization would provide stability and experienced leadership for the cooperative. Lindsey Record, Executive Director of the Illinois Stewardship Alliance, was interested in the possibility of working with the formation of a beekeeping cooperative (Record, pers. comm.). Terra Brockman, director of the Land Connection, is willing to assist a beekeeping cooperative through education and outreach (Brockman, pers. comm.). Pairing the cooperative with community organizations will create stability and will help strengthen the cooperative's chance for success.

Feasibility Conclusion

After examining some of the issues that will need to be addressed in forming a cooperative, it is clear that there will be substantial obstacles in implementation. The issues of setting up relationships, structure, and liabilities can be solved with a lot of careful discussion and planning. The issues of stings and colony health can be alleviated through education and networking, two aspects of a cooperative. The greatest obstacle, therefore, is the declining enthusiasm and potential lack of dedication. It is a serious thing to consider when deciding whether or not to go through with implementation. Community organizations could also help to provide support so responsibility does not fall solely on a few dedicated individual members of a cooperative. Depending on the amount of interest, which was not adequately measured in the short time frame of this research project, the implementation of a beekeeping cooperative could be feasible, as long as the previously mentioned concerns were addressed.

Recommendations

From the information gathered, a beekeeping cooperative in the Bloomington-Normal area would be beneficial to both beekeepers and farmers, addressing the first research question of a cooperative being beneficial. The second question, whether or not there is enough interest to support the formation of a beekeeping cooperative, would need further research and more data to accurately determine interest levels. Recommendations for those actions are discussed below. Also included in the discussion below are additional needs the community would need to meet in order to make a beekeeping cooperative feasible and productive, to fully address the third and final research question of this report.

It is highly recommended that the interest of local farmers and beekeepers is assessed to a greater extent than what is in this report. One possible method of collecting quantitative data on local interest levels is creating a survey to distribute to members of local agricultural organizations (such as the ones listed below). This survey could provide information on whether enough local interest is present to create a viable cooperative. Interest levels are critical in the implementation of a cooperative because a decline in enthusiasm in beekeepers seems to be the biggest hurdle facing a beekeeping cooperative. A cooperative would not be viable for long without very dedicated members, but keeping interest and dedication strong can be a challenging

task.

Since the greatest risk to the cooperative would be failing interest, detailed planning of the cooperative's structure would be needed after affirming enough interest exists locally. Input from potential members is important because a cooperative is defined by the participation of all of its members in decision-making. One recommendation for structure is having informal organization because it could reduce high-pressure participation demands and lessen member responsibilities, a possible concern brought up by interviewees. One interviewee suggested having a website for people to make connections, rather than having an organized group (Capel, pers. comm.). Specific data is needed on how potential cooperative members would want to structure the cooperative.

A beekeeping cooperative would need a source of funding, and while some cooperatives have membership dues, dues can also create a barrier for potential new members. Thus, it is not recommended to have membership dues until the cooperative is firmly established. For initial funding, grants are a favorable source. The grant could be used for buying equipment, marketing for products and services, etc. A drawback to grant funding is the time and commitment needed from someone or a group of people in writing a grant. Grants can also be competitive and it could be a challenge finding appropriate grants to apply for.

Another need for the potential beekeeping cooperative is to establish a partnership with an existing community organization. The organization would provide experience, support, and an established list of contacts. There are many organizations in the Bloomington-Normal, IL area that could potentially have an interest in supporting a beekeeping cooperative. Lindsay Record, Executive Director of the Illinois Stewardship Alliance, was interested in a possible partnership between a beekeeping cooperative and the Illinois Stewardship Alliance (Record, pers. comm.). Further contact with her is recommended for implementation plans. In addition, Terra Brockman, Director of the Land Connection, has expressed an interest in assisting a beekeeping cooperative through beekeeping education and outreach, and creating further possible contacts (Brockman, pers. comm.). Other organizations that could also be contacted are the Edible Economy, Heartland Local Food Network, and the Illinois Beekeeper's Association.

Once the needs of assessed interest, structural planning, funding, and local partnership are met, a beekeeping cooperative in the Bloomington-Normal area could realistically be established and provide benefits to local beekeepers and small-scale produce farmers. Enough initial interest exists in the idea of creating a local beekeeping cooperative to pursue the steps listed above.

Conclusion

The purpose of this study was to determine the feasibility of implementing a beekeeping cooperative in the Bloomington-Normal, Illinois area. Through the literature review, it is exhibited that honeybees play a very important role in the pollination of certain crops. Due to the highly agricultural area surrounding Bloomington-Normal, pollination is crucial for fruit and vegetable production. The literature review also displays a decline in honeybee population and

predicts crop reduction resulting from pollination limitation. It is important to support bee populations, and creating a beekeeping cooperative is a way to do that, as shown by the literature. My research was gauging interest in the formation beekeeping cooperative while identifying possible benefits and barriers. Through conducting interviews with beekeepers, farmers, cooperatives, and agricultural organizations, I have determined that there are significant benefits to be gained from the presence of a cooperative, although there are substantial barriers that could prevent the cooperative from being successful. I would recommend future study in gauging interest to determine if the biggest barrier of lack of sustained dedication could be avoided.

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Appendix A – Interview Guides for the Different Target Groups

Interview Guide for Beekeepers

1. How did you get started beekeeping?
2. How many hives do you have?
3. Where do you keep them?
4. What are the benefits of having bees?
5. What are some obstacles you face as a beekeeper?
6. How is the health of your hive?
7. Do you treat your bees? With what?
8. What would be the biggest help to your beekeeping?
9. Are you in any beekeeping associations? What are the benefits of it?
10. What benefits do you see from the presence of a beekeeping cooperative?
11. What drawbacks do you see?
12. Do you think the presence of a cooperative would encourage more people to start beekeeping? Why or why not?
13. Would you be interested in the formation of a beekeeping cooperative in the Bloomington-Normal area?
14. What issues do you think would need to be addressed in the formation or running of a cooperative?
15. Do you have any additional comments or questions?

Interview Guide for Farmers

1. Can you tell me a little bit about your farm?
2. Why did you decide to have someone else manage the hives?
3. How many hives are on your property?
4. How long have they been there?
5. What benefits have you seen from having bees on your farm?
6. What negatives have you experienced from having bees on your farm?
7. Would you recommend having bees to other farmers? Why or why not?
8. How do you think you would be affected by having someone else manage hives on your property?
9. Would you be interested in the formation of a beekeeping cooperative?
10. What do you think would be the benefits from a beekeeping cooperative?
11. And the drawbacks?
12. Would you be interested in the formation of a beekeeping cooperative in the Bloomington-Normal area?
13. What issues do you think would need to be addressed in the formation or running of a cooperative?
14. Do you have any additional comments or questions?

Interview Guide for Beekeeping Cooperative Representatives

1. When and how did your cooperative get started?
2. What were the roles of the people who initiated the formation of the cooperative?
3. What are the functions of the cooperative today?
4. How have they changed since the formation of the cooperative?
5. What benefits does the cooperative provide to its members?
6. What are the drawbacks to a beekeeping cooperative?
7. How would you differentiate a cooperative from a club or other kind of organization?
8. How would you recommend getting one started?
9. What were the biggest barriers in getting it started?
10. What is the structure of your cooperative?
    a. Where does it get its funds?
    b. Is it paired with any community organizations?
    c. Does it have its own equipment for member use?
11. What are important factors in a cooperative's success?
12. Do you have any additional comments or questions?

Interview Guide for Community Organization Representatives

1. Could you tell me a little bit about your organization?
    a. How is it structured?
    b. What is its goal?
2. What are the benefits that you could see arising from the presence of a beekeeping cooperative?
3. And the negatives?
4. What issues do you think need to be addressed in the formation of a cooperative?
5. Do you think your organization would be able/interested in working with a beekeeping cooperative?
6. In what way?