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Department of Environmental Conservation

Agriculture and Markets

New York State Pollinator Protection Plan

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EXECUTIVE SUMMARY

Wild pollinators and managed bees, typically honeybees and bumblebees kept by beekeepers, are critically important to the health of New York's environment, as well as the strength of the state's agricultural economy. New York has more than seven-million acres in agricultural production, and many of the state's leading crops, such as apples, cabbage, berries, pumpkins and several other fruits, rely heavily on insect pollination. New York State is also home to more than 450 wild pollinator species, a native population that is important not only to the pollination of commercial crops, but also to biodiversity in our environment.

However, over the past several years, the loss of managed pollinator colonies in the state has exceeded 50%. Some commercial migratory pollinators have experienced colony losses in excess of 70%. This is coupled with losses in the native pollinator community and the habitat that sustains them.

Honeybees and other pollinators experience a multitude of stressors, including: parasites/pathogens; pesticide exposure from various sources; nutrient deficiencies, including forages affected by climate change; habitat loss and fragmentation; poor management practices; and lack of genetic diversity. Of these stressors, few have generated as much attention as a class of insecticides known as neonicotinoids. Over the last two decades, neonicotinoids have become the most widely used insecticide in the world due to their efficacy and comparatively low toxicity. The prevalence of neonicotinoids in most agricultural and ornamental settings has become the source of much debate focused on the connection between increased neonicotinoid use and recent pollinator decline. Although scientists do not yet know the specific cause(s) of pollinator loss and the phenomena of Colony Collapse Disorder, which is observed in managed honeybees, recent research indicates that the decline is likely the result of complex interactions among multiple stress factors.[1]

Regardless of cause, the upward trend in colony loss observed over the last decade is unsustainable. In response, Governor Andrew M. Cuomo formed the New York State Pollinator Task Force in 2015. Chaired by the Commissioners of the Departments of Environmental Conservation (DEC) and Agriculture and Markets (AGM), this group was charged with developing a plan for New York State to conserve and grow its pollinator population.

The Pollinator Task Force focused on four priority areas:

- Development of Best Management Practices for all pollinator stakeholders;
- Habitat enhancement efforts to protect and revive populations of all pollinators;
- Research and monitoring efforts to better understand, prevent and recover from pollinator losses; and
- Development of an outreach and education program to raise awareness of the importance of pollinators and engage the public as active participants in reversing pollinator decline.

Based on these priority areas, the Task Force developed actions to promote the health and recovery of pollinator populations in New York State in order to sustain the state's robust agricultural economy and unparalleled natural resources. To achieve this objective, state agencies will build upon practices already underway to cost-effectively protect natural

[1] Ellis, J., J.D. Evans, J.S. Pettis. 2010. "Colony losses, managed colony population decline, and Colony Collapse Disorder in the United States," *J. Apicultural Res*, 49(1) 134-136

resources; work with the apiary community; and continue support of green procurement processes. This report provides an assessment of the status of managed and native pollinators in New York, and describes current and future actions that New York State agencies will take to promote their health and recovery. The Task Force recognizes that sustaining healthy pollinator populations requires the commitment of all New Yorkers and, therefore, also includes recommendations in this report to encourage private industries, municipal governments and citizens to incorporate actions that benefit pollinators into everyday decision making.

Best Management Practices

Best management practices (BMPs) are methods and techniques used to achieve a desired outcome in an efficient and cost-effective manner. As defined in this plan, BMPs are voluntary actions protecting native and managed pollinators in a way that ensures both a healthy pollinator population and a thriving agriculture industry in New York State. The Plan outlines BMPs for beekeepers, contract beekeepers, landowners/growers, pesticide users and state agencies. Please refer to the appendices for all BMPs recommended by the Task Force.

The BMPs in this plan fall into six categories:

1) Beekeeper BMPs are designed to help all beekeepers – whether hobbyists, sideliner or commercial – in ways to keep hives clean, prevent pests and pathogens, and control for Varroa mites, Nosema and American/European Foulbrood. The BMPs also address reducing pesticide exposure and communicating the locations of hives to landowners.
2) Contract Beekeeper BMPs provide mechanisms to work with landowners on hive locations and reduce honeybee colony exposure to pesticides. The BMPs advise beekeepers and growers to coordinate their activities, including contract development. These BMPs are to be considered as measures undertaken by contract beekeepers in addition to the general beekeeper BMPs referred to above.
3) Landowner/Grower BMPs recommend ways to work in concert with beekeepers to ensure that hives are not in harm's way. These BMPs also encourage the use of Integrated Pest Management strategies (IPM) and planting of bee forage.
4) Pesticide User BMPs list tools, such as IPM, which seek to avoid or minimize pesticide use. Where pesticide use is necessary, the BMPs provide recommendations to protect the environment – including pollinators – from potentially harmful effects.
5) State Agency BMPs provide guidelines for agencies to improve and increase pollinator habitat. These BMPs also focus on how state agencies can raise awareness of the potential negative impacts on pollinators associated with pesticide applications.
6) Outreach and Education BMPs discuss ways to educate the public on the use of IPM, and actions to protect pollinators generally, including native pollinators and ensuring collaboration with the lawn and garden industries.

Habitat Enhancement Projects

Habitat quality and quantity are central to the health of pollinators and the ecosystem overall, as well as agricultural production. New York has the opportunity to lead by example in expanding and improving pollinator habitat through state-managed facilities and land, as well as providing leadership and guidance to localities and the private sector. The Plan outlines current land management practices and habitat conservation efforts by state entities and describes opportunities such as:

- Expanding pollinator habitat on rights-of-way;
- Strengthening state guidance documents and contracts as appropriate to improve pollinator health and increase their habitat; and
- Increasing habitat quantity and quality for pollinators on State-managed facilities.

Research

Recent research efforts indicate that no single factor is solely responsible for the decline of managed and native pollinators in New York State. Rather, current science is clear that this challenge is a complex interaction of many factors. Understanding the problems and formulating practical solutions will require the best scientific institutions and minds to conduct research in the following areas:

• Further development of BMPs for New York State beekeepers
• Habitat management strategies for managed bees, wild bees and other pollinator species
• The impact of pesticides and pathogens on New York's pollinators
• Monitoring of New York's wild pollinator populations
• Better identification of the most important plant species for pollinator plantings

Table 1

Outreach and Education

Public outreach and education are key to increasing awareness of the problems facing the native and managed pollinator populations in New York State. Expanding communication among all stakeholders, including government agencies, beekeepers, non-governmental organizations and the public at large, will be instrumental in improving pollinator health. Therefore, the following avenues of outreach and education are proposed:

- Conduct continuing education classes for pesticide applicators, Certified Crop Advisors and other consultants;
- Develop enhanced educational materials relating to biology and management;
- Promote the protection of wild and native pollinators through education, outreach and coordination with native pollinator experts;
- Create public service announcements, outside displays, or exhibits with information related to the importance of pollinators and opportunities to protect pollinators;
- Incorporate information on pollinator health in exhibits and displays for visitor education as appropriate; and
- Enhance New York State agency materials, websites and social media posts with information on pollinators, their value, and threats to their populations.

The 2016 New York State Pollinator Protection Plan identifies these areas as critical to reversing the trend of pollinator decline. It takes a significant first step in increasing the awareness among all parties that interface with pollinators regarding the health issues challenging the pollinator community. It outlines a better way of doing business for those entities engaged in activities that can affect pollinator viability, as well as ways to enhance and create habitats to support and grow New York's population of pollinators. The New York State Pollinator Protection Plan is a living document and will be subject to periodic review and updates as the science and strategies for improving pollinator health evolve.

Overview

There is growing concern about the health of bees and other pollinator species, both native and managed, that provide pollination services. Over the past several years, the loss of managed pollinator colonies in New York State has been in excess of 50% and, in some instances, the colony losses among commercial migratory pollinators has been in excess of 70%. Moreover, native pollinator populations have been negatively impacted by loss of habitat and a variety of other stressors. Pollinators are a vital natural resource in and of themselves; they enhance the state's natural resources and play a major role in its agricultural and agribusiness economy.

On April 23, 2015, Governor Andrew M. Cuomo announced that the state would develop a plan to protect and preserve pollinators. He formed the New York State Pollinator Task Force, composed of representatives from AGM, DEC, and the Office of Parks, Recreation and Historic Preservation (OPRHP). A group of other state agencies, the Apiary Industry Advisory Committee, New York Farm Bureau and a variety of other agriculture trade organizations, The Nature Conservancy, Audubon New York, the Natural Resources Defense Council, and representatives of the agro-chemical industry served as advisors. The Task Force was charged with developing a pollinator protection plan to conserve and grow pollinator populations across the state.

Importance of Pollinators

Managed bees and wild pollinators are extremely important to U.S. agriculture. Over 90 crops in the U.S., including almonds, tree fruits, cotton, berries, and many vegetables, are dependent on insect pollinators, such as the honeybee, for reproduction (USDA 2013). New York is a major agricultural state, with over seven million acres in agricultural production and 35,500 farms, many of which benefit or depend on insect pollination. New York ranks in the top ten nationally for the production of several crops, including vegetables and fruits such as apples and berries.

Recent work by Cornell University and other academic institutions indicates that the population of native pollinators is much more diverse than previously thought. These native pollinators include not only native bees and wasps, but a wide variety of insects such as butterflies and moths, certain beetles, tree bugs, and some fly species. Hummingbirds also serve as pollinators in New York. These native pollinators play a significant role in the pollination of commercial crops such as strawberries, pumpkins and apples, as well as native plants. Bee-pollinated crops account for 15% to 30% of the food we eat (USDA 2013). Although not completely dependent on insect pollination, crops such as apples, cherries, strawberries, onions and pumpkins greatly benefit from bee pollination, with higher yields and larger produce.

Status of Pollinators

To effectively address concerns surrounding all of New York's pollinating insects, the Pollinator Protection Plan focuses on two primary groups of pollinators: wild pollinators, such as bumblebees, butterflies, and beetles; and managed bees, including honeybees and certain bumblebee species used for honey and agricultural pollination.

The managed bee population in New York State consists of approximately 80,000 colonies, with the majority of these colonies operated by 45 commercial beekeepers. The remainder of the colonies are managed by hobbyist or sideliner beekeepers who do not rely on honey production

or contract pollination as their sole source of income. The BEE Informed partnership survey, which is completed each year through a collaboration of research labs and universities, indicates that New York State beekeepers have experienced about a 50% loss in colonies for the last two years, on average. The subset of commercial migratory bees based in New York State has experienced losses in excess of 70% for several years. The industry standard for sustainable losses is generally thought to be about 20%. The upward trend in colony loss observed over the last decade is unsustainable and puts a strain on the supply of healthy bees.

Apart from managed bees, New York is home to approximately 450 wild bee species and includes six of the seven families of bees recognized worldwide. The wild bee fauna of New York State consists of ground-nesting bees, stem-nesting bees and cavity-nesting bees, like the eastern bumblebee. Unlike the common honeybee, most of New York's native bees are solitary and ground-nesting, with only around 5% living in colonies.

The broad diversity, span, and variety of nesting and foraging habits of New York's native pollinators presents challenges for research efforts. For many years, native pollinators have been overlooked, with basic knowledge regarding their lifecycles, habitat requirements and economic and environmental value lacking. However, recent studies on native pollinator populations indicate their prevalence in agricultural fields as well as the benefits of their pollinating services.

Wild bee species like the squash bee, eastern bumblebee, and leaf cutter bee are now understood to be important crop pollinators. Surveys of New York apple orchards over the past five years have also revealed remarkably diverse wild bee fauna – over 106 species of wild, non-managed bees contribute to apple production in New York. Other crops that benefit from wild bee pollination include squash, pumpkin, strawberry, cherry and peach.

Though research is just now being conducted to reveal the diversity and abundance of the state's pollinator populations, concerns in New York and across the nation remain about the health and status of these critically important species. Nationally, the U.S. Fish and Wildlife Service has stepped up conservation actions to protect and track the distribution of the monarch butterfly in response to declining populations. In New York, as part of the recently revised State Wildlife Action Plan (SWAP), DEC listed seven species of bees as Species of Greatest Conservation Need (SGCN), six of which are considered high-priority SGCN. The SWAP also identifies 27 species of butterflies or moths as SGCN, 11 of which are high-priority species.

Situations/Threats Facing Pollinators in New York State

Although information on wild pollinators in New York State is limited, trends suggest that native pollinator population losses are a result of the interacting impacts of several environmental stressors. A strong body of evidence indicates that climate change is one of the leading factors affecting wild pollinator populations. In addition, habitat fragmentation due to urban development and mono-agriculture reduces the size of pollinator populations by increasing their isolation and making lands less than favorable to sustain them.

While managed bees experience similar environmental stressors to those affecting native species, they are also susceptible to health-impairing stimuli resulting from colony structure, low genetic variation, pests/pathogens and poor management practices. Although the factors affecting bee health and declines in New York are not yet fully understood, there are several stressors predicted to impair honeybee health within the U.S. and elsewhere. Scientific

evidence suggests that parasites/pathogens, pesticide exposure, and poor management practices are leading factors in the observed decline. Although honeybees may be able to survive each of these threats on their own, these factors overlap, evolve and interact with one another, creating a suite of pressures that together impair the health, abundance and performance of managed bees.

Disease, Parasites and Pathogens

Honeybees in New York are susceptible to a variety of parasites and pathogens. Of these, the *Varroa* mite is the most detrimental and widespread. In addition to killing bees directly by feeding on their hemolymph, or "bee blood," this parasite also acts as vector in the transmission of several viruses, which can build up to lethal levels if left unchecked. *Varroa* mite is ubiquitous in New York and difficult to control, having developed resistance to two of three registered synthetic miticides available for treatment. Several "softer" registered chemicals in the form of organic acids and essential oils vary in effectiveness, and current approaches suggest Integrated Pest Management (IPM) strategies that rotate these treatments may help delay the development of further resistance.

Honeybees are also susceptible to the fungal infections, chalkbrood and *Nosema,* and the bacterial infections, American foulbrood and European foulbrood. Of these, *Nosema* and American foulbrood pose the greatest threats to honeybees. For more than one-hundred years, *Nosema apis* was the only *Nosema* species known to infect honeybees. In the past few decades, another species, *Nosema Ceranae*, began infecting the western honeybee and can outcompete the historical species. A 2009 survey conducted by AGM's apiary inspectors reported 97% of *Nosema* spores detected in New York apiaries to be *Nosema Ceranae*. The symptoms and seasonal levels differ between pollinator species, making diagnosis and treatment difficult. There are reported synergistic effects between *Nosema Ceranae* and the black queen cell virus, and several studies suggest that infection with *Nosema Ceranae* can exacerbate the toxic effects of pesticides. Furthermore, fungicide treatments can adversely lead to increases in *Nosema* infection. These relationships further illustrate how interactions among stressors can compound their negative effects.

Nutrient and Habitat Deficiencies

Habitat loss and fragmentation are some of the biggest challenges to pollinators. Experts increasingly recognize the dependence of wild and managed pollinator populations on appropriate habitat, and have observed direct correlations between habitat availability and pollinator species diversity. Shifting agriculture practices and habitat loss are having impacts on the health of both honeybees and native pollinators. Monoculture farming reduces the diverse diet available and, therefore, results in poor nutrition and dehydration, increasing the vulnerability of pollinators to other stressors. Loss of buffer strips and landscape connectivity cause habitat isolation and increase energy use needed to gather food. Managed pollinators need adequate food and water within their normal three-mile-flight radius; a lack of either can lead to reduced health, susceptibility to pests/pathogens, and even colony death.

Agricultural and urban development pressures can also disrupt nesting or egg-laying requirements. For example, some caterpillars like the endangered Karner blue, *Lycaeides Melissa Samuelis*, feed only on wild lupine, and many wild bee species need bare soil or beetle-riddled snags for nesting. Land management practices and urbanization can decrease the

availability of host plants, remove suitable nesting grounds and fragment forage. The loss of habitat due to land use not only impacts localized pollinators but also migratory species like the monarch butterfly, which rely on suitable food and resting sites along migration routes.

Pesticides and Insecticides

Pesticides are a concern with regard to both managed and native pollinator health. Pesticides include insecticides, fungicides, antimicrobials, rodenticides and herbicides. They are designed to manage pests, including insects, weeds, fungi, bacteria, viruses and other organisms that are detrimental to the health of humans or livestock (including managed bees), or that cause damage to agricultural crops by decreasing yields and degrading quality. Herbicides are used to control weeds and fungicides are used to manage fungi. Insecticides are specifically used for insect control, and in agricultural and land care practices, are applied to crops and other plant life to preserve and increase productivity. Insecticides can be applied as sprays, drenches, granules, or tree injection or through seed coating. While insecticides are important for land management, public health, invasive species control and crop production, several classes have the potential to kill or otherwise harm non-target species, such as honeybees and butterflies, if improperly applied.

Neonicotinoids

Neonicotinoids are a class of insecticide that were introduced in the U.S. in 1994 as an alternative to organophosphate insecticides, which were found to be highly toxic to humans. Since their introduction, neonicotinoids have become a popular choice for pest control due to their water solubility and systemic characteristics, which make them easy to apply, effective, and long-lasting. As systemic insecticides, neonicotinoids are absorbed easily and transported throughout plant tissue, including the pollen and nectar in some cases. Neonicotinoids offer protection from boring, sucking, chewing, and root-feeding pests. The most commonly applied neonicotinoid active ingredients include the N-nitroguanidine group (imidacloprid, clothianidin, or thiamethoxam) and the N-cyanoamidine group (acetamiprid and thiacloprid).

The versatility of application options and favorable pest control properties has contributed to neonicotinoids becoming a widely used class of insecticide. Neonicotinoids present economic, ecological and environmental health advantages over other insecticides for the following reasons:

- Lower toxicity to mammals, birds, and fish;
- Reduced risk to agricultural workers and consumers;
- Improved crop yields in areas with high pest pressures;
- Protection from a broad range of insect pests due to the systemic properties of neonicotinoids, which protect all parts of the plant;
- Effectiveness reduces need for multiple applications;
- Reduced need for foliar spraying, which can be associated with non-target organism pesticide exposure and issues associated with drift; and
- Longevity and variety, which help prevent the buildup of resistance in pests.

While the benefits of neonicotinoids can easily be observed, whether in the reduced presence of harmful pests or locally improved crop yields, the ecological and long-term environmental impacts of their use are less clear. Despite the USDA's and EPA's careful review and regulatory process for authorizing chemical insecticides to reach the market, concerns have been raised

as to whether the properties that make neonicotinoids highly effective are also properties that are responsible for declining pollinator populations. The results of research, including research conducted by the USDA into whether neonicotinoids are a significant cause of pollinator losses, are unclear. A lack of field studies and other information gaps continue to result in conflicting conclusions, making it difficult to determine how neonicotinoid use affects pollinators on a large-scale and colony-wide level.

Researchers have documented several neonicotinoid products that are toxic to bees. Toxicity levels can vary, however, depending on the amount of exposure and the type of species, with effects ranging from lethal, to sub-lethal, to no impact. In many documented cases of acute toxicity, lethal exposure resulted from improper use through poor application practices, tank mixtures or interactions between neonicotinoids and other pesticides.[2] For that reason, the Task Force strongly urges commercial and hobbyist beekeepers, landowners/growers and pesticide applicators to adhere to the BMPs listed as appendices to this report.

What is less understood is how sub-lethal levels of exposure and persistent low levels of exposure impact pollinator performance over time. Sub-lethal effects do not result in death, but instead impair an organism's ability to function properly. Many of the studies surrounding sub-lethal exposure have conflicting conclusions. Some continue to find negative effects on honeybees, while others do not find any adverse health effects associated with neonicotinoid use. Conflicting research in this area may be attributable to varying settings and data collection methods. Lab studies often lack realistic exposure levels, while field studies are difficult to replicate and control during the data collection process. Despite these challenges, some research suggests the potential of persistent, low concentrations of neonicotinoids to pose the following risks to honeybees and other non-target organisms:

- Damage the central nervous system of insects;
- Impair learning behaviors and memory;
- Reduce fecundity, brood and larval development;
- mpair motor activities, such as navigating and orienting;
- Reduce foraging success;
- Increase susceptibility to parasites, such as *Varroa* mites, and diseases, such as *Nosema* infection.

The EPA is further evaluating the use of neonicotinoids and their labeling.

In addition to their potential direct toxic effects on bees, researchers have also documented similar issues with other pesticides, including herbicides, fungicides and even products used by beekeepers to control *Varroa* mites. Interactions between fungicides and *Nosema* infection levels, as well as increased toxicity of insecticides from fungicide interactions, are only in the early stages of being understood. However, recent field studies conducted by Cornell University have shown fungicide exposure to be more important than insecticide exposure in relation to declines in wild bee diversity. In addition, the use of certain types of fungicides is a strong predictor of pathogen prevalence and range contractions across 34 species of North American bumblebees, while other fungicides and insecticides are not related to bumblebee health or population trends.[3] Additionally, certain treatments for *Nosema* and *Varroa* (e.g., fluvalinate,

[2] See, for example, the EPA's January 2016 preliminary risk assessment for imidacloprid, which showed a threat to some pollinators.

[3] Park, M., et al. 2012. *Wild Pollinators of Eastern Apple Orchards and How to Conserve Them*. Cornell University, Penn State University, and The Xerces Society. URL: http://www.northeastipm.org/park2012

amitraz) are known to increase the toxicity of other pesticides (e.g., neonicotinoids, pyrethroids) to larval and adult honeybees, thus weakening the hive and paradoxically leaving them more susceptible to further *Nosema* and *Varroa* infestation.

The complexity of these interactions has led many researchers to conclude that pollinator decline is not the result of any one single factor but instead, a variety of stressors that, when taken together, can have a significant widespread and compounded negative impact. Replicable, large-scale, field-realistic studies are necessary to truly evaluate the synergistic impacts of prominent pollinator health stressors, including pesticides.

Poor Management

As with all agricultural commodities, there is a range of business models and management methods for the production of honey or the keeping of bees for pollination services. Wide variations in management exist among beekeepers in all three sub-groups (hobbyist, sideliner and commercial). Poor management by any of these groups can lead to insufficient nutrition, pests and pathogens, and over-exposure to pesticides.

Climate Change

Some preliminary data indicate that native and managed pollinators may be or will become out of sync with the flowering of important food plants due to climate change. Over thousands of years, flowering plants and pollinators have co-evolved, developing synchronized life cycles that are essential to the health of the pollinator and the fertility of most flowering plants. Although some research suggests that plant-pollinator pairs have similar reactions to the same environmental cues, others have shown differences in response indicators, with bees emerging in response to increased air temperature and flowering plants in response to snow melt.[4] This disruption of cycles can lead to missed pollination and reduced windows of nectar-specific forage, impacting not only the nutrition of pollinators but the fertility of most flowering plants, including nearly all fruits and vegetables. Adverse weather can also impact managed and wild pollinators' ability to obtain proper nutrition. As extreme weather like droughts, floods, and freezes become more common, essential plant life and habitat for pollinators become less reliable, resulting in nutrient deficiencies, burdens on nesting sites, and in cases of drought, dehydration.

Genetic Diversity in Colonies

The high rate of hive failures among commercial beekeepers and the increased demand for bees by new hobbyist beekeepers over the past several years have reduced the supply of available bees, resulting in limited genetic diversity among managed bees. Because different genetic lines have unique levels of adaptation to environmental and management stressors, studies should be performed on increasing genetic diversity in bees and the developing bee genetic lines that tolerate various environmental conditions and resist disease. This area of investigation is needed to improve the chances for the survival of European honeybees.

[4] Hegland, S.J., Nielsen, A., Lázaro, A., Bjerknes, A.L. & Totland, Ø. 2009. "How does climate warming affect plant-pollinator interactions?" *Ecol Letters*, 12: 184-195.

Challenges Facing Stakeholders

Farmers, beekeepers, pesticide applicators, government entities, conservationists, and the general public all have a stake in finding solutions to the pollinator losses that have been observed over the past 10 years. Each of these groups has unique business interests, mandates and perspectives, but ultimately all rely on or benefit from native and managed pollinators.

Farmers and other agricultural producers strive year in and year out to produce the best possible crops despite a seemingly endless array of obstacles, including poor weather, plant diseases, insect pests, and weeds. To contend with such challenges, producers rely on an assortment of pest control systems, including IPM, insecticides and herbicides.

Chemical applications, however, must be done at times when weather and other variables are optimal for control, which presents a challenge for growers faced with the need to treat their crops at the same time pollination occurs. Moreover, in addition to looking out for the health of pollinators, growers must ensure that chemical treatments are harmful to neither the applicator nor the consumer.

Because agricultural producers rely on pollinators to increase yields on many high-value, nutritious crops, farmers are especially interested in providing enhanced forage for pollinators. Some tools currently available to farmers are the Federal Conservation Reserve Program, which helps offset the cost of removing environmentally sensitive lands from agricultural production, making them more hospitable to beneficial insects. Unfortunately, this program is underutilized in New York State because of relatively low rental rates that do not adequately incentivize participation. The use of pollinator enhancement strips with diverse vegetation interspersed with crops is under research. However, early studies conducted by Cornell University, Penn State University and the Xerces Society on strawberry production show a positive correlation between bloom diversification and enhanced strawberry growth due to the presence of pollinators.[5] As information on best management practice for forage strips becomes more widespread, this practice will provide diversified nutrition for native and managed pollinators and, if implemented correctly, can increase crop yields while simultaneously reducing destructive pests.

As with growers, ***pesticide applicators*** must be cognizant of weather conditions and other variables, including pest infestation levels and the presence of pollinators, when applying chemical pest controls. A complicating factor for pesticide applicators is the difficulty in ascertaining the exact location of hives.

Currently, there is no formal practice for pesticide applicators to follow to determine the location of apiaries and, in the case of commercial applications, the landowner often is unaware of apiary locations. Additionally, the ideal time to apply some chemicals may coincide with the time at which pollinators are most active, putting pesticide applicators in the difficult position of balancing pest management needs and protecting pollinators.

Similarly, ***commercial, sideliner or hobbyist*** beekeepers face myriad challenges to keep their hives healthy, including Colony Collapse Disorder, *Varroa* mites, tracheal mites, *Nosema* and other parasites, as well as viral and bacterial diseases. All of these factors, coupled with the loss

[5] Park, M., et al. 2012. *Wild Pollinators of Eastern Apple Orchards and How to Conserve Them*. Cornell University, Penn State University, and The Xerces Society. URL: http://www.northeastipm.org/park2012

of forage and habitat for pollinators, have created a situation where yearly average colony losses of managed honeybees in New York State have risen to a level in excess of 54%.[6]

Additionally, in some instances, beekeepers have difficulty sourcing replacement bees to maintain the colony strength necessary for effective pollination and healthy colonies.

Recognizing the challenges faced by growers, beekeepers and pesticide applicators in maintaining the health of pollinators, ***State agencies*** are considering pollinator health in their decision-making processes. State agencies have specific statutory mandates that must be met. While these mandates do not specifically include conservation of pollinators, State agencies that manage land may be able to implement simple changes in how those lands are maintained to improve habitat for native and managed pollinators.

New York State agencies have a wide variety of mandates and missions. DEC is the stewardship agency for natural resources and is primarily responsible for conservation of wild pollinators. It is also a regulatory agency with responsibility for pesticide regulation. AGM is the lead agency for promoting sound agricultural practices and ensuring a sound agricultural environment for the state. In recognition of the plight of pollinators, both agencies are already including activities to conserve pollinators and to advocate for good husbandry of honeybees. Other agencies may have missions that align with those goals. OPRHP, for example, conserves open spaces on lands within its jurisdiction; considers habitat conservation in land management practices; and conducts many other pollinator conservation activities in its work. For other agencies, conservation elements may not be included in their mission, but they may incorporate pollinator-sensitive practices in the implementation of specific activities. For example, the New York State Department of Transportation (NYSDOT) is tasked with providing the public with safe and efficient transportation systems. In maintaining rights of way (ROW), NYSDOT has the ability to provide suitable habitat and landscape connectivity for pollinators.

Still, when it comes to improving land management and habitat restoration practices for the purpose of pollinator health, State agencies continue to struggle to identify where efforts are most needed and what practices provide the greatest benefit. The need for baseline data on the many species of native pollinators is essential to understanding how to conserve their populations. Baseline data are also needed on pests and pathogens and on how management practices influence honeybee health. Quantifying the current condition of managed and native pollinators is crucially important to the evaluation and measurement of the impact of any of the BMPs that are appended to this plan. This information is also crucial in determining the effectiveness of any change in agency policies or practices to be recommended in the future.

Regardless of their particular role, all stakeholders share several universal challenges, which contribute to the common ground on which this plan is built.

Best Management Practices

BMPs are key to the implementation of the New York Pollinator Protection Plan. The outlined actions are cost-effective and generally simple to implement. The Task Force would like to emphasize the importance of these practices. For example, without communication among beekeepers, growers and pesticide applicators, bees may inadvertently be exposed to pesticides. Similarly, keeping hives clean and controlling pests such as *Varroa* mites is essential

[6] *Bee Informed Partnership Survey of Colony Loss for 2014-2015*.

to the health of the hive. Adherence to these and other BMPs and enhancing both pollinator health and habitat based on good scientific research will assist in the recovery of pollinators in New York State.

In addition to effective communication, good management practices are also essential to protect pollinator colonies. Using BMPs also reduces or eliminates the sources of stress on pollinators and is, therefore, the most effective solution to them. Please refer to the appendices for all BMPs recommended by the Task Force.

The BMPs in this plan fall into six categories:

1) Beekeeper BMPs are designed to help all beekeepers – whether hobbyists, sideliner or commercial – in ways to keep hives clean, prevent pests and pathogens, and control for *Varroa* mites, *Nosema* and American/European Foulbrood. The BMPs also address reducing pesticide exposure and communicating the locations of hives to landowners.
2) Contract Beekeeper BMPs provide mechanisms to work with landowners on hive locations and reduce honeybee colony exposure to pesticides. The BMPs advise beekeepers and growers to coordinate their activities, including contract development. These BMPs are to be considered as measures undertaken by contract beekeepers in addition to the general beekeeper BMPs referred to above.
3) Landowner/Grower BMPs recommend ways to work in concert with beekeepers to ensure that hives are not in harm's way. These BMPs also encourage the use of IPM strategies and planting of bee forage.
4) Pesticide User BMPs list tools, such as IPM, which seek to avoid or minimize pesticide use. Where pesticide use is necessary, the BMPs provide recommendations to protect the environment – including pollinators – from potentially harmful effects.
5) State agency BMPs provide guidelines for agencies to improve and increase pollinator habitat. These BMPs also focus on how state agencies can raise awareness of the potential negative impacts on pollinators associated with pesticide applications.
6) Outreach and Education BMPs discuss ways to educate the public on the use of IPM, actions to protect pollinators generally, including native pollinators, and how to ensure collaboration with the lawn and garden industries.

State Agency Actions Underway in New York

There are several areas where the state, non-governmental organizations and academia have already made significant investments in pollinator health and have shown progress.

Apiary Program (Survey and Certification)

AGM inspects honeybee colonies and equipment that have the potential to spread disease.[7] In 2015, over 36,000 colonies were certified as being free of American foulbrood and received certificates, which allowed these colonies to be transported to other states to provide pollination services for crops such as almonds, blueberries, apples and citrus. AGM has also participated for several years in the National Honey Bee Survey which collects data on honeybee health issues such as *Nosema*, *Varroa* mites and pesticide residues in pollen. This work has concentrated on commercial migratory beekeepers who manage the largest number of colonies and have suffered the greatest loss of bees over the past five years. One challenge to implementing a more comprehensive study of honeybee health in New York is the lack of a hive/beekeeper registry in the state. The Apiary Industry Advisory Committee (AIAC), a group of advisors to the Commissioner of Agriculture and Markets,[8] will have a significant role in identifying next steps for the managed pollinator community and advising the Commissioner on the ways to locate and identify colonies in New York State.

Integrated Pest Management

The adoption of Article 11 of the New York State Agriculture and Markets Law in 1986 recognized IPM as a scientifically legitimate pest control system for the agricultural industry. IPM emphasizes the relationships between organisms in the environment and seeks ways to enhance natural pest management.

IPM is undertaken through control methods, such as selection of resistant varieties that are well-suited to the local climate, biological controls, and housekeeping steps, to limit pest infestations and increase awareness of which pests have an impact on the economy. This system allows the use of control measures, including synthetic pesticides, where safe and efficacious.

In 1999, the New York State IPM program was expanded to community-based non-production agricultural settings such as landscape, turf, home grounds and structural pest management. State support is provided for IPM for agriculture as well as the Community IPM Program.

Over the past 30 years, the New York State IPM Program has funded over 1,000 research, demonstration and implementation projects involving a wide variety of agricultural commodities and community settings, including schools, golf courses and other institutions. These projects have significantly increased knowledge and acceptance by farmers and pest management professionals of alternative methods of pest management such as biological control, resistant varieties and use of cultural and mechanical controls.

Land Management

State agencies and authorities own or lease a significant percentage of the 31.1-million acres in New York State. Under the leadership of Governor Andrew M. Cuomo, New York has continued to implement an ambitious Green Procurement and Agency Sustainability program, commonly known as Executive Order No. 4 (EO 4). Approximately 75 State agencies are covered by the program, which requires them to incorporate sustainability into all aspects of their operations. EO 4 calls for the development of green specifications and lists of green products available on

[7] See Article 15 of the Agriculture and Markets Law.
[8] Established pursuant to Article 14, sec.169-d of the Agriculture and Markets Law

State contracts. To date, 40 green specifications have been adopted, including several that directly benefit pollinators as well as the environment.

Specifically, two of the green specifications provide requirements and recommendations for how pesticides should be used on state lands. The first requires state entities covered by EO 4 to manage pests on turf and ornamental plants solely through mechanical, sanitary, cultural or biological means to the maximum extent practicable. The specification applies to all state-owned or managed properties, with the exception of golf courses, land in agricultural production, active habitat management areas, utility or transportation rights-of-way, invasive species control areas, and actions taken specifically to address a threat to public health or safety.

In FY 2013-14, 70% of agencies reported that they use non-chemical means of pest control on turf and ornamentals all or most of the time, a significant increase from the 43% who reported doing so in FY 2009-10. For example, the Office of General Services (OGS) has had excellent results managing the grounds of the Empire State Plaza and State Capitol for over 10 years without the use of chemical pesticides. In addition, many agencies and authorities that manage lands exempt from the specification, such as OPRHP, the Thruway Authority (NYSTA) and NYSDOT, are utilizing IPM in the management of their green spaces.

The second green specification, "Sustainable Landscaping," includes an Addendum on "Supporting the Health of Honeybees and Other Pollinators." The Addendum cautions that chemical controls that can adversely affect pollinators, including herbicides, broad spectrum contact and systemic insecticides, and some fungicides, should not be applied in pollinator habitats. It endorses the use of IPM with reliance on physical, cultural, and biological controls as opposed to chemical controls, and Integrated Vegetation Management (IVM) to reduce herbicide use in controlling unwanted plants. Among other best practices, the Addendum recommends that:

> "Care should be taken to source plant material from suppliers that can verify no insecticide treatments to their nursery stock. Insecticides can persist in plant material (leaves, flowers, nectar, and pollen) and lead to disruptions in a pollinator lifecycle once planted in the pollinator habitat." (pp. 22)

Although the agencies' goals are to reduce or eliminate pesticide use wherever possible, this policy recognizes that there are circumstances where pesticide use is necessary. In such instances, agencies utilize the lowest toxicity, least persistent product available.

Habitat Conservation and Enhancement

New York State agencies manage habitat for a variety of purposes and in many ways. Whereas creating or maintaining pollinator habitat may not be the primary focus of habitat conservation work, a healthy and diverse landscape is beneficial to a wide range of species, including pollinators.

For example, DEC's Young Forest Initiative restores young forests primarily for game species, such as wild turkey and at-risk species, such as golden winged warblers; however, the creation of this habitat type generates flowering plants, such as raspberries and viburnums, which are also highly desirable habitats for pollinators. By maintaining grasslands and wetlands for wildlife, DEC also provides thousands of acres of pollen-rich, insecticide-free habitat for honeybees and native pollinators. In addition, DEC strives to manage State Forests in a way that contributes to healthy pollinator populations. For example, red maples, a common component of our State

Forests, are an important flowering tree in the spring, when other sources of nectar and pollen are scarce. DEC manages diverse forest systems and also works to control non-native invasive species on state lands, which can erode natural ecosystems and harm native plants.

OPRHP's mission includes protection and stewardship of natural areas and native biodiversity in State Parks. OPRHP maintains over 350,000 acres of State Parkland, 80% of which is in natural cover, supporting native flora that is critical to the survival of our pollinators. Approximately 15,000 acres are in non-forested habitat that supports key pollinator host plants such as native milkweeds, goldenrods, asters and flowering shrubs. The remaining land is dominated by forests, which produce flowers that are important to native pollinators, including bees, moths, butterflies and birds.

OPRHP uses multiple mechanisms to protect, restore and enhance these habitats. Protection of natural areas is provided primarily through formal designations, including Park Preserves and Preservation Areas, Natural Heritage Areas and Bird Conservation Areas. OPRHP partners with the New York Natural Heritage Program to survey and monitor for rare species, including bees and other pollinator species and their required habitats. The agency is restoring and enhancing pollinator habitat through active management of invasive species, removing threats to native habitats and flora and replanting native species when necessary. Currently, State Parks are home to 30 pollinator gardens and OPRHP Environmental Educators have focused on pollinator health by hosting over 40 pollinator education programs in State Parks in 2015.

Both DEC and OPRHP follow native plant guidelines for restorative projects.[9] OPRHP's Policy on Native Plants specifically advises that "to the extent feasible, utilize native plants in all landscaping, re-vegetation, erosion control, and habitat restoration projects. The planting or introduction of invasive plant or tree species is prohibited."[10] These state agency efforts, combined with effective public education, make significant and cost-effective contributions to the restoration, enhancement and protection of pollinator habitat.

ROW along roads, powerlines and canals also account for a significant portion of the land owned by the State. For example NYSDOT owns 15,000 miles of highways (centerline mileage) outside New York City and another 140 miles within New York City. NYSTA and the New York State Canal Corporation (NYSCC) collectively manage over 1,000 miles of ROW. The green spaces as well as the federally required "clear zones" (low-growth areas along roadways maintained for safety and visibility) vary greatly across the State. Despite the patchwork of varied ROW widths, New York maintains consistent land management practices that not only follow safety specifications but also enhance natural habitat.

While safety of the public and staff is paramount, one of the guiding principles for ROW management is environmental stewardship, which includes promoting environmental compliance and instituting environmental enhancements. These policies encompass specifications on mowing practices, planting guides, pesticide application, tree cutting, drainage management and more. As an example of NYSTA's and NYSDOT's environmental stewardship efforts, both entities utilize IPM strategies, avoiding insecticide and herbicide application to the maximum extent possible. Currently no neonicotinoids are used in ROW; however, their use may be considered for treatment of invasive species like Emerald Ash Borer on ash trees.

[9] See, for example, the DEC Division of Environmental Remediation's Program Policy DER-31/Green Remediation; DEC's Hudson River Estuary Program's Habitat and Biodiversity Program or DEC's *Stormwater Management Guidance Manual for Local Officials*.
[10] *OPRHP Policy On Native Plants In State Parks And Historic Sites*

Limited locations use herbicides as plant growth regulators to reduce mowing in unsafe locations. When application is necessary, the agencies have best management practices in place as well as federal and state guidance that requires herbicide use specifically for species, sites and optimum control, with as minimal an impact on the environment as possible.

ROWs are also managed to encourage native flora. For example, since 1987, state entities managing ROWs have utilized wildflowers to the maximum extent possible when conducting landscaping projects. Current practices also include reduced mowing schedules and seed selections such as milkweed, which benefit pollinators. Since October 2012, NYSDOT alone has included 65.3 acres of wildflower seedings in its contracts. Furthermore, both NYSTA and NYSDOT have the ability to make adjustments to managed roadsides for pollinators where safety considerations can still be met. In southern Rochester, NYSDOT made an adjustment by alternating roadside mowing on a segment of Interstate 390 to protect Monarch butterflies in the larval stage and as they migrate through the area. NYSTA's Syracuse Division is also piloting a Pollinator Protection Program, which will restore parts of the ROW to a natural regeneration area. As part of these efforts, NYSTA and NYSDOT are improving upon their already successful "living snow fence" program, now using flowering shrubs for snow drift prevention along roadways prone to heavy snow. If successful, these types of blooming shrubs can be incorporated into future installations of new living snow fences along state ROWs, providing additional forage for native and migratory pollinators.

Pesticide Regulations, Restrictions and Actions

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)[11] regulates pesticide distribution, sale, and use. All pesticides distributed or sold in the United States must be registered by the EPA under FIFRA, which requires the EPA to review the stipulations for pesticide registration every 15 years and to re-register all pesticides registered before 1984. The last re-registration was completed in 2008.

Since 2008, the EPA has conducted numerous reregistration actions and Special Reviews. In 2011, it began expanding the risk assessment process for bees to quantify or measure exposures and relate them to effects at the individual and colony level. In 2013, the EPA outlined required label changes, including a federally enforced "Pollinator Protection Box" for certain foliar applied neonicotinoid products, which includes specific application limits such as "Do not apply this product while bees are foraging," to protect pollinators from pesticide exposure. In 2014, the EPA also released a document titled *Guidance for Assessing Pesticide Risks to Bees* as part of this assessment. The EPA is currently developing new bee-exposure-and-effect testing priorities for the registration of new pesticides, new pesticide uses, and registration review of existing pesticides. It expects to issue its implementation plan for new pollinator data later this year.

Further, the EPA has identified a number of active ingredients in high-use insecticides and some herbicides, including most neonicotinoids, many organophosphates, carbamates, and pyrethrins, which appear to be acutely toxic to bees, and has proposed additional label language prohibiting application of those products during bloom for sites at which bees are present.[12] Once the EPA finalizes its review and requires additional label changes, DEC will ensure that new labels for products registered in New York comply with those requirements.

[11] 7 U.S.C. §136 et seq.

[12] USEPA. (May 28, 2015). *EPA's Proposal to Mitigate Exposure to Bees from Acutely Toxic Pesticide Products*. Washington, DC, page 17.

DEC registers all pesticides used, distributed, sold, offered for sale or transported within New York[13]. It does not have the authority to require a pesticide product registrant to change a pesticide label in order to register a product in New York State. Conversely, DEC is not required to register a product if concerns identified in the registration review process have not been mitigated. A product registrant may pursue a label change through the EPA in order to mitigate specific concerns. Because of various concerns, DEC restricts the use of several specific neonicotinoid-containing pesticide products in New York State and prohibits the sale and use of others which are deemed to be harmful to people, property and wildlife.

Insecticides such as imidacloprid are registered for use in New York State because of their effectiveness in controlling certain insects and their relatively low risk to humans. Products containing imidacloprid also help to control Asian Longhorned Beetle and Emerald Ash Borer, two invasive insects that threaten New York tree species. Other imidacloprid products are registered for use on dogs and cats, or have critical agricultural uses.

While neonicotinoids, like clothianidin, imidacloprid and thiamethoxam are registered for use in New York, DEC narrows their use to protect pollinators and ecologically sensitive areas. For example, recognizing the potential groundwater impacts of imidacloprid, DEC reached an agreement with the registrant to add a statement which prohibited the sale, use or distribution of outdoor imidacloprid homeowner products in Nassau, Suffolk, Kings or Queens counties due to potential negative impacts on the underlying sole-source aquifer. In addition, all outdoor agricultural and commercial products were reclassified as restricted use. DEC also denied the registration of clothianidin for outdoor use due to the concerns regarding the potential for impacts to New York State's groundwater resources.

Dinotefuran, a neonicotinoid which is the active ingredient identified as causing a massive bee kill in Oregon, is not registered for outdoor use in New York State. It is registered for very limited indoor greenhouse use, or limited use as a bark treatment for the control of invasive insects. Thiamethoxam, another neonicotinoid, is not allowed to be used outdoors on Long Island but may be used in limited amounts elsewhere in the state. In all of these instances, DEC's requirements go beyond EPA specifications for the use of these products.

Additionally, DEC works closely with the EPA and states on label instructions to mitigate the effect of a pesticide on non-target organisms for insecticides which are acutely toxic to bees and other pollinators. DEC routinely conducts marketplace inspections of home and garden centers and other sales or distribution locations and conducts targeted inspections at random or as necessary to follow up on a complaint. During both marketplace and other inspections, DEC checks pesticide labeling. As a result of Governor Cuomo's commitment to pollinator protection, DEC will use these inspections to verify that pesticide labels in the channels of trade have pollinator protection language, as approved through the federal and state pesticide product registration process.

Research

In recent years, New York State has provided funding through the New York Farm Viability Institute for a multi-year research project entitled "Assessing the Impact of Pesticides on Honey Bee Health," a project which aims to study the causes of the losses experienced by commercial beekeepers in the state over the past several years. This research, coupled with NYS AGM's participation in the National Honey Bee Survey, has allowed the agency to get a broader picture

[13] See Article 33 of the Environmental Conservation Law.

of issues impacting New York's honeybee populations. New York State has also provided funding through the Farm Viability Institute to educate apple growers to better quantify the role of native bees in apple pollination, and to develop methods to conserve and better utilize this resource.

Additionally, Cornell's IPM Program in partnership with OPRHP has conducted long-term research projects at Bethpage's Green Course[14] since 2001. Their 2009 publication, *Reducing Chemical Use on Golf Course Turf: Redefining IPM*, summarizes the best practices gleaned from this research and is being used to teach and promote IPM to golf courses throughout New York State. OPRHP continues to work with the IPM Program to adapt and review practices implemented across all of its 29 golf courses.

[14] OPRHP's Bethpage State Park contains five golf courses which are named after different colors (Black, Red, Blue, Green and Yellow). The research projects cited herein are only conducted on the Green golf course.

The New York State Pollinator Protection Plan

The New York State Pollinator Protection Plan identifies individuals or entities that interface directly with pollinators, or participate in activities that affect their health, and identifies steps they can take to enhance living conditions for pollinators. In identifying actions, consideration is given to the potential factors contributing to the recent decline in pollinators. The dialog among the members of the pollinator task force and their advisors resulted in the identification of four critical areas that the group believes government can influence to improve the status of native and managed pollinators in the state. These four critical areas include:

- Best Management Practices for all pollinator stakeholders;
- Habitat enhancement efforts to protect and revive populations of all pollinators;
- Research and monitoring efforts to better understand, prevent and recover from pollinator losses; and
- Development of an outreach and education program to raise awareness of the importance of pollinators and engage the public as active participants in reversing pollinator decline.

Recognizing the importance of pollinators to New York's agriculture and natural resources, Governor Cuomo included an appropriation of $500,000 in the state's Environmental Protection Fund (EPF) for Fiscal Year 2016-17 for projects to implement the plan. The newly dedicated funds will support initiatives such as those outlined below. Additionally, the state's historic $300 million total EPF appropriation will help support and expand existing programs that provide direct benefits to pollinators, such as land acquisition, biodiversity stewardship, farmland protection, and invasive species prevention and eradication. The Task Force thanks the New York State Legislature for its approval of these appropriations, as well as its decision to include Cornell's Agricultural Integrated Pest Management programs in this year's EPF.

Best Management Practices (See appendices)

Habitat Enhancement Projects

Habitat quality and quantity are central to the health of pollinator populations, ecosystems and agricultural production. The state's efforts to expand and improve wildlife habitat benefits pollinators as well as other species. State agencies improve wildlife habitat directly through the operation of state-managed facilities and lands, and indirectly through leadership and guidance that influence localities and the private sector. New York State agencies and authorities have shared information on current land management practices and habitat protection efforts with the Task Force. The actions below establish the state's pollinator habitat goals to be incorporated into existing wildlife habitat efforts to enhance New York's natural environment, connectivity, and quality of pollinator forage.

As the largest land manager in the state, New York's agencies and authorities are charged with optimizing the use of existing acreage, and staff and budgetary resources to implement strategies that benefit both the public and environment in an efficient and cost-effective way. These habitat opportunities are categorized below under specific topics.

Expanding Pollinator Habitat on ROWs

ROWs are of particular interest for pollinator habitat because they constitute large land acreage, are generally maintained in sunny areas with low vegetation height (ideal pollinator habitat), and often extend for considerable distances, thereby potentially acting as corridors for species movement.

NYSDOT, NYSTA, NYSCC and the New York Public Service Commission will review their existing vegetation management guidelines to determine if further opportunities exist to provide valuable habitat for pollinators. The Pollinator Task Force has identified specific actions to be considered and, as appropriate, implemented by these agencies, including:

- Use native plant guidance in appropriate restoration and habitat enhancement projects where safety and operational consideration permit. The Pollinator Task Force recommends selecting plants that include at least 15 species and have a high percentage of forbs (30-60% by seed count), as well as vegetation that provides nesting, egg-laying and overwintering locations. Grasses and shrubs are important for community structure and nesting sites. When planting conditions allow, the Task Force recommends including at least three flowering species in each bloom period so there is a continuous food source throughout the season (few early-blooming species are typically included in mixes).

- Work with appropriate partners to develop seed mix packages that can withstand roadside stressors, like erosion, sun exposure and drought, as well as mixes that can be distributed without ground preparation or continued maintenance. The Pollinator Task Force suggests the development of seed mixes with an awareness of ROW issues, such as the need for low-growing, low-maintenance vegetation which is tolerant of roadside stressors like salt, as well as being non-invasive and not particularly attractive to deer.

- As appropriate, work with DEC to better understand species of concern and habitat requirements when identifying habitat goals for restoration plans.

- Minimize mowing to the greatest extent practicable, without compromising roadside safety and time, to offer plants the ability to bloom and provide sufficient forage for pollinators.

- Identify alternate mowing plans or schedules where resource, safety and operational concerns permit and where there is a clear benefit to pollinators or other native species. The Task Force believes that, with the use of DEC's habitat restoration goals, priority areas for restoration or alternate mowing can be devised. Alternative mowing plans will depend on transportation and conservation needs for pollinators and other critical species such as grassland birds.

- Identify locations at NYSDOT and NYSTA rest areas and travel plazas where mowing practices can be changed to help pollinators, or plantings can be done to help educate the public.

- Work with the Federal Highway Administration (FHWA) on Operation Wild Flower**.**

- When possible, use Integrated Vegetation Management to manage roadsides to prevent or control invasive plants.

- Incorporate new pollinator protection BMPs into ROW maintenance staff training as they are developed.

- Use FHWA's book, *Vegetation Management: An Eco-regional Approach* as a resource in reviewing and updating vegetation management guidance.

- Encourage wildlife habitat on municipal or privately owned and operated roadsides through grant funding or regulations.

- Incorporate pollinator-friendly considerations into Rail-to-Trail Corridor planning.

- Work with utilities and private land owners to encourage pollinator-friendly land management practices along utility lines.

- Consider practices to support and improve the health of wild pollinators and honeybees in future capital and maintenance transportation contracts.

Strengthening State Guidance Documents and Contracts to Increase Pollinator Habitat

The Pollinator Task Force recommends modifying state guidance documents for planting, site restoration and/or revegetation efforts to encourage long-term and cost-neutral changes that state entities can adopt and implement as general business routines. Working closely with the Pollinator Task Force, the Office of General Services, which provides general support services to state agencies on procurement and construction management, will commence the tasks outlined below in State Fiscal Year 2016-17, except where otherwise indicated:

- Develop guidelines for native vegetation establishment and enhancement. The guidelines will assist with plant selection and source considerations for seed and plant material across the state. Once a list of appropriate seeds and plant sources has been identified, the Interagency Committee on Green Procurement and Sustainability will make these native plant sources available on state contract.

- Develop standards to be incorporated into contract language if applicable for planting and site restoration that will complement and accompany existing native plant policies, pesticide restrictions, and invasive species guidance.

- Develop with Cornell's IPM Program a recommended list of appropriate alternative pesticides to be inserted into standard contract and guidance language for planting and site-restoration efforts.

- Identify recommendations for Green Procurement Specifications. These specifications can be mandatory for state agencies, authorities and public benefit corporations or be put into a centralized state contract for a product/group of products.

    - Additional questions will be added to the 2017 "green procurement" survey regarding pollinators, including questions on pesticide use, type of vegetation planted and amount of pollinator-friendly seeds and vegetation planted. The annual survey and Progress Report will help the state track the pollinator-friendly practices that are deployed, their cost and their effectiveness.

Increasing Habitat Quantity and Quality on State Lands and State-managed Facilities

New York State owns and manages large expanses of lands beyond buildings and grounds, including forests, conservation lands, parks, powerlines, wetlands and conservation easements. For all agencies cited in this report, the Task Force recommends that current and future guidelines to benefit habitats – and, therefore, all native species, including pollinators – should include plans to:

- Manage state natural areas for ecologically diverse and structurally complex habitats to benefit a wide variety of wildlife, including pollinators. These diverse habitats will then meet the foraging, nesting, and overwintering conditions for the broad array of pollinators that exist across the state and that also support domestic bee colonies.

- Encourage highly diverse plantings in smaller plots located in areas away from pesticide use to provide floral-rich pollinator habitat. These plantings will be located in areas that are sufficiently buffered from pesticides and other impacts. Additional cost-share funding will be needed to expand these efforts.

- Work with the New York State Invasive Species Council and Partnerships for Regional Invasive Species Management (PRISMs) to continually expand efforts focused on habitat improvement through invasive species control and eradication.

- Restore native grassland communities on degraded open-field habitats.

- Place a high priority on pollinator enhancement projects through annual programmatic natural resource stewardship funding.

- Investigate the feasibility of using seeds and plants that are locally sourced and free of neonicotinoid pesticides for planting projects at state-owned lands.

- Identify state lands where pollinator habitat is feasible. Pollinators need a wide variety of habitat. Basic management of wildlife habitat will provide good habitat for pollinators as well.

    - For example, at least 1,000 acres of parkland are mapped as mowed lawn. A reduced mowing program is underway to shift some of this lawn to productive pollinator habitat. OPRHP will reduce turf and mulch area and replace it with appropriate native plantings. Because these fields and roadside edge meadows are visible to the public, interpretive signage illustrates the benefits of this program.

Additional actions that the Task Force recommends for specific agencies to undertake in State Fiscal Year 2016-17 and beyond are:

- Continue the use of IPM on state-managed golf courses as well as highly diverse plantings in smaller plots located in unutilized areas on golf courses to provide floral-rich pollinator habitat.

    OPRHP, in partnership with Cornell and the IPM Program, will develop an evolved statewide guidance on *Reducing Chemical Use on Golf Course Turf: Redefining IPM* (NYS IPM Publication No. 617) as well as rating and course

inspection to which will better define relevant and achievable standards and practices to meet realistic IPM goals specific to each golf course.

- Incorporate pollinator habitat restoration efforts into volunteer and service corps programing.
    - As part of the effort to support pollinator habitat restoration efforts, the Task Force will work with I Love My Park Day organizers and OPRHP staff to identify pollinator projects to undertake on I Love My Park Day.
    - DEC and OPRHP will also work with the Student Conservation Association to incorporate pollinator-focused stewardship projects and education outreach into existing AmeriCorps programs.
    - Educational materials on pollinators will also be made available at events to increase awareness about such efforts.

- Encouraging the Department of Education and the State Universities of New York to create pollinator gardens in appropriate areas on owned or operated lands.

- Expanding pollinator-friendly practices at NYS Department of Corrections and Community Supervision facilities.

Research

Despite active research into the interactions and factors affecting wild and managed bee declines, knowledge gaps persist, impacting our ability to fully understand the precise causes of widespread pollinator losses. The majority of research is primarily centered on honeybee health, while the stresses affecting wild bees are only beginning to be uncovered. As noted, New York is home to 450 wild bee species that are necessary for crop and wild plant pollination, yet the impacts of habitat loss, climate change, pathogens/parasites, and pesticides are largely unknown. Similarly, research on other managed species aside from honeybees is also lacking. Studies conducted by Cornell University measured toxicities of different pesticides on four managed species (honeybees, managed bumblebees, alfalfa leafcutter bees, and managed blue orchard bees). The results showed that bee species vary widely in their tolerance to pesticides, highlighting the importance of researching agrochemical impacts across different species.

Working closely with Cornell University's research and extension experts, and the Pollinator Protection Advisory Group, the Task Force has prioritized and expanded upon the research recommendations outlined in Table 1,[15] selecting three key areas for funding through this year's EPF appropriation. Prioritization was based on advancing research most critical to pollinator conservation and management, which may lead to measurable impacts on New York agriculture and pollinator health.

The Task Force will advance the following research efforts this year:

1. **The status and distribution of native pollinators** – Researchers are just beginning to understand the ecosystem benefits of native pollinators and what role they might play in the pollination of commercial crops. The need for baseline data on many species of native pollinators is essential to understanding how to conserve their populations.

[15] See page 3.

DEC, therefore, will begin a multi-year evaluation of New York's myriad native pollinator species. This assessment will show the current status and distribution of native pollinators and serve as the foundation for developing and implementing future conservation practices. Information on population dynamics will also allow the state to determine the effectiveness of the BMPs that are appended to this plan.

2. **Impact of pesticides and pathogens on New York's wild pollinators** – For wild pollinators, research is needed to understand how interactions between pesticide exposure and pathogen pressure contribute to pollinator population health and viability. Currently, two Cornell research programs are investigating how wild bees are impacted by pesticide and pathogen stress during New York apple pollination and in other habitats across North America, and a third research program is investigating how Monarch butterflies may be impacted by pesticides during migration between the eastern United States and Mexico. These studies have provided ground-breaking information. However, little is yet known about how pesticides and pathogens interact to influence pollinator health in the field, and no study to date has investigated interactions between these factors across habitat, cropping system and land management style.

   To support further research into this area, New York State will provide Cornell University with additional funding for a large-scale field study to investigate how pathogens and pesticides in two of New York's most common wild bees (eastern bumblebee and leafcutter bee) are influenced by landscapes (urban, natural and agricultural) and farming practices (conventional vs. organic). The eastern bumblebee and leafcutter bee serve as excellent models for this research, as both represent common behavioral qualities found among pollinator species. Information collected through this research will provide insight on how pollinators with very different life histories and foraging behaviors are impacted by habitat, crops and land management practices.

3. **Impact of pesticides, pathogens/parasites and BMPs on managed honeybees** Currently, little is known about interactions between pesticides, pathogens/parasites and management practices among beekeepers, such as those between hobbyist and commercial operations, and whether these interactions are important drivers of declining honeybee health in New York. State apiary inspection data is only collected for commercial beekeeping operations, leaving a gap with respect to the stressors impacting managed bees, or the management practices of hobbyists, who comprise 96% of New York's beekeepers.

   In an effort to bridge this gap and determine the breadth of pesticide exposure, parasites/pathogen prevalence and management practices among beekeepers and whether specific combinations have greater or lesser impact on the health and productivity of honeybees, the state will allocate funds to Cornell University to collect and assess data from apiary operations representing hobbyist, sideliner and commercial operations. As part of the study, participating operations will receive a parasite and pathogen prevalence assessment, pollen pesticide residue analyses and a survey regarding management practices for *Nosema* and *Varroa*, and any other treatments applied for parasites/pathogens. The beekeeper survey will assess how various beekeepers monitor colonies, and how they decided to implement particular management practices.

All data will be analyzed for relationships between pesticides (compound abundance, identity, diversity), pathogens and *Varroa* (prevalence, severity), and management practices (type, frequency, amount of residue in hives if applicable). If particular pesticide-management practice combinations are found to be negatively related to bee health and/or performance, future studies could test experimentally whether specific pesticide exposure-management practice combinations have greater or lesser impact on the health and productivity of honeybees in New York. If health and performance are negatively impacted, the NYS IPM Program will subsequently test the use of alternative practices and products. Information on the pesticides to be avoided, as well as viable alternative practices, including newly developed Beekeeper BMPs, will be communicated to growers and the public via the Apiary Advisory Committee, New York's new Tech Team for Beekeepers (outlined below), Cornell Honey Bee Extension Program, NYS IPM Program, Pesticide Management Education Program (PMEP) at Cornell, and the Cornell Cooperative Extension system.

The Task Force also recognizes that the state has provided $50,000 in Local Assistance Funding to Cornell University in each of the last two fiscal years to support research on honeybee health. Funding for this program greatly assists in the transmission of knowledge, particularly as it relates to training hobbyist beekeepers whose education and increased technical skills will be vital to ensuring greater pollinator health in the future.

Looking forward, the Task Force will work with the advisory group to reassess and select priority research efforts, and identify funding needs. Based on the recommendations provided by the advisory group, and public comment, future research efforts may focus on the following:

- **BMPs for New York State beekeepers** – determine whether queens obtained from New York genetic stock are better suited to environmental conditions in the state than queens obtained elsewhere. Research on better management strategies for *Nosema* parasite levels.

- **Habitat management strategies for managed bees, wild bees and other pollinators** – a study on how different land-use modifications impact pollinator forage, habitat and nesting sites needs to be conducted to determine which large-scale efforts will have the greatest impact on pollinators. A thorough examination of optimal mowing regimes and other habitat modifications along roadsides to maximize pollinator forage should occur. Habitat management strategies on how state parklands can be best used for pollinator forage and nesting sites, and whether habitat modifications on farms in the state can enhance pollination services without increasing pests, need to be completed.

- **Impact of pesticides and pathogens on New York's pollinators** – the complexity of these interactions, coupled with variations in exposure impacts on differing pollinator species, likely indicates the need for additional research. The next step in this area of research could focus on different New York State crops, determining whether pollinators are impacted by specific pesticides regardless of cropping system. In addition, farm management practices (e.g., organic vs. conventional) need to be assessed to understand whether general farm practices are an important consideration in terms of pollinator populations and health. Continued research into the importance of several factors, including neonicotinoid, herbicide, fungicide and miticide presences and

pathogen prevalence in New York's diverse pollinator population, is needed to determine how less familiar species are impacted by pesticide exposure.

- **Important plant species** – identify plant species most important for pollinator plantings and effective seed mixes for habitat restoration projects.

Outreach and Education

Public outreach and education are key to increasing awareness of the problems facing the native and managed pollinator populations in New York State. Expanding the opportunities for communication among stakeholders, including government agencies, beekeepers, non-governmental organizations and the public is key to improving pollinator health. Therefore, the Task Force has identified the following avenues of outreach and education, many of which already exist and can be enhanced to provide specific information on pollinators:

- Applicator Certification and Re-Certification Training Education Courses
- Pesticide Training Materials produced by the Pesticide Management Education Program (PMEP) at Cornell
- Certified Crop Advisor Program - inclusion of pollinator-specific education

The Task Force recognizes that the state's role with respect to applicator certification/re-certification training education is limited to topics required by state law and regulation.[16] While most eligibility courses for the agriculture and lawn care industries already discuss pollinator issues to some extent, DEC will encourage course sponsors to include pollinator protection in their training. In addition, state agencies in general can expand upon public outreach and education efforts in manners consistent with their missions and appropriation levels. For example, as possible:

- NYSTA and NYSDOT will provide pollinator brochures to the public at its 38 Service Areas.
- DEC and OPRHP will incorporate information on pollinator health in exhibits and displays for visitor education as appropriate.
- DEC currently has information on its website regarding pollinators and imidacloprid-based pesticides, and will enhance the website with substantive information on the value of pollinators and how the public can help protect them.
- DEC will also include articles on pollinators in its widely circulated *Conservationist* magazine, and will incorporate pollinator information into its social media outreach efforts.

Finally, the Task Force has identified additional areas for outreach and education that should be explored further:

- Coordinate with Cornell University and Cornell Cooperative Extension experts on education and outreach materials on bee biology and management.
- Promote the protection of wild and native pollinators through education, outreach and coordination with native pollinator experts.

[16] See, for example, 6 NYCRR Part 325.18.

- Create an enhanced checklist for pesticide treatment crews that includes a pollinator awareness section.
- Create public service announcements, outside displays or exhibits with information related to the importance of pollinators and opportunities to protect pollinators.

Other State Actions

With historic funding provided under the state's Environmental Protection Fund, the Task Force has identified several additional opportunities for state agencies to take action in protecting and encouraging pollinator health. This additional funding for Fiscal Year 2016-17 will support a host of programs and agency operations, including those critical to managing and preserving natural resources, greenspaces, and biodiversity. For example, programs in the EPF receiving additional funding that benefit pollinators include:

- $20 million for Farmland Protection, a $5 million increase from FY 2015-16
- $12 million for Invasive Species Prevention and Eradication, a $6.15 million increase from FY 2015-16
- $40 million for Land Acquisition, a $13.45 million increase from FY 2015-16

New programs funded through the EPF that benefit pollinators include:

- **Cornell Integrated Pest Management**: $1 million dedicated to providing farmers with the expertise and support needed to manage nuisance pests in an environmentally sustainable way. Supporting Agricultural IPM was of particular importance to the stakeholders involved in the state's pollinator protection process. Recognizing the invaluable services this program offers to farmers, Governor Cuomo and the State Legislature agreed to double the program's funding from last year.

- **New Pollinator Protection Funding**: $500,000 allocated under Biodiversity Stewardship will be used for the implementation of the protection plan. New initiatives will include:

  A. RESEARCH: $300,000 to conduct three research efforts:

     i. Impact of pesticides, pathogens/parasites and best management practices on managed honeybees
     ii. Impact of pesticides and pathogens on New York's wild pollinators
     iii. Status and distribution of native pollinators

  B. NEW YORK'S TECH TEAM FOR BEEKEEPERS:
     To support the apiary industry and build on the sampling and data collection Cornell will undertake as part of its managed pollinator research, AGM will use $150,000 from the Pollinator Protection Fund to form New York's Tech Team for Beekeepers. The Tech Team for Beekeepers will be an interdisciplinary team of agricultural experts who will sample and analyze participating beekeeping operations and recommend, implement and evaluate best management practices specific to those operations. The overall goal of the program is to reduce beekeeper losses and increase profitability.

The tech team will work in conjunction with Cornell and the existing apiary inspection program to survey and sample a broader cross section of New York State beekeepers, with a focus on pollinator management, including but not limited to, health issues such as *Nosema*, *Varroa* mites, nutrient and habitat deficiencies, pesticide exposure and hive management practices. The tech team will focus its efforts in two pilot locations of the state, western New York and the North Country, providing hands on technical advice to operations within the regions.

C. POLLINATOR GARDENS AND INTERPRETIVE SIGNS:
OPRHP will receive $50,000 to enhance existing natural habitat efforts across the state. Included in OPRHP's efforts will be pollinator gardens which will offer migratory and native pollinators habitat for nesting and foraging while providing visitors with the opportunity to learn about the importance of these species. To enhance research efforts into the status of native pollinators in the state, OPRHP and DEC will work together to determine the effectiveness of these native plantings in attracting and supporting native pollinator populations.

In addition, the Pollinator Task Force encourages the revival of the AIAC, a group of advisors to the Commissioner of Agriculture and Markets,[17] and recommends that AGM expand data collection efforts under its existing authority, as well as help promote the restoration of pollinator habitats in agricultural landscapes.

- The Apiary Industry Advisory Council (AIAC) will have a more significant role in ensuring that the Commissioner has the best information available from the beekeeping community. The AIAC will have a significant role in developing plan updates.

- To bolster research efforts and curb disease in the managed pollinator population in New York State, it is critical to have information regarding the location and condition of managed apiaries. To facilitate such access, AGM will consider a rulemaking to obtain information on managed hives; until this recommendation takes effect, FieldWatch.com[18] should be used to identify, map and communicate where high-value, pesticide-sensitive crops are being grown. The Commissioner will call upon the AIAC for advice on the potential requirements of the proposed rule.

- AGM will communicate to the federal government the need to increase the rate of funding under the Conservation Reserve Program to make it a viable option for farmers interested in setting aside lands for pollinator habitat.

Periodic Review and Measuring Success of the Plan

This Plan takes a significant step forward in increasing awareness among all parties that interface with pollinators of the health issues facing the pollinator community. In addition, the plan outlines a "better way of doing business" for those entities that can affect pollinator viability, as well as ways to enhance and create habitats to support and grow New York's population of pollinators. Throughout the development of this plan, it was apparent that there are many unknowns with respect to the factors related to pollinator health, the interplay among the factors

[17] See Article 14, sec.169-d of the Agriculture and Markets Law.
[18] http://www.fieldwatch.com/

and the status of pollinators in New York State. As such, the New York State Pollinator Protection Plan was developed with the recognition that the plan is a living document, subject to periodic review and updates as the science and strategies for improving pollinator health evolve. As new research and monitoring data become available, the Task Force will reconvene with its advisors to update the Plan accordingly to incorporate new research findings and provide additional and improved actions.

Conclusion

The actions proposed in the Pollinator Protection Plan support a comprehensive approach to tackle and reduce the impacts of known stressors on pollinator health. Building on the current state of the science, and with a renewed emphasis on expanding our understanding of the complex interactions among various factors impacting pollinator health, the state will improve its ability to identify sound solutions and actions to conserve and enhance pollinator health and distribution. Together, these actions will lead to measurable impacts on New York agriculture and biodiversity.

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Best Management Practices

Best management practices (BMPs) are methods and techniques used to achieve a desired outcome in an efficient and cost-effective manner. As defined in this plan, BMPs are voluntary actions protecting native and managed pollinators in a way that ensures both a healthy pollinator population and a thriving agriculture industry in New York State. The Plan outlines best management practices for beekeepers, contract beekeepers, landowners/growers, pesticide users, and state agencies. Successful implementation of BMPs requires regular, positive communication and is the responsibility of all stakeholders. Please refer to the appendices below for all BMPs recommended by the Task Force.[19]

APPENDIX A: Beekeeper BMPs

- **Ensure hives have access to food and water sources.**
  - Bees should be in locations with abundant and diverse floral resources, including natural pollen.
  - Locate colonies near accessible clean water, and account for pesticide and fertilizer drift when selecting sites near water.

- **Prepare for times of limited forage and drought.** Feed bees sugar syrup and pollen substitutes by placing pollen patties between brood boxes or on top of hive frames for supplemental feeding. Identify backup water sources near colonies; artificial water sources like birdbaths are appropriate substitutes if natural watering holes are dry.

- **Use registered pesticides according to the label**. State and federal law require that pesticides be used in accordance with their labels. Failure to do so is a violation. Contact the DEC Pest Management Program with any questions on pesticide labeling or to determine whether a pesticide is registered in the state. Also, the application of restricted-use pesticides must be done by or under the direct supervision of a certified applicator.

  - Miticides such as those used for varroa control are pesticides too. Use care in applying them and be aware of their impact on colonies when the colonies are exposed to other agro-chemicals.

- **Prevent bee exposure to pests and pathogens**. Beekeepers should be extremely cautious and vigilant with hives, practicing good hygiene, maintenance, regular inspection and proper management of parasitic mites and other pests.

  - Practice good hygiene with hands, gloves and other equipment to reduce transmission of pathogens between colonies.
  - Replace comb with new foundation to minimize residual chemicals in old wax.
  - Develop a comb replacement schedule.
  - Purchase equipment only if it has a history of clean health.

- **Inspect bee hives regularly**. Monitor every month to ensure that parasites and diseases are below the economic threshold—no more than 3.0 mites/100 bees.

[19] In developing the BMPs, the Task Force drew upon the best available information, not only here in New York State, but also in other states, including North Dakota, California and Florida.

- Check with the Cornell Honey Bee Extension Associate for assistance with BMPs for monitoring and detecting pests.
- Corex Sheets and Sugar Shake methods for detection are minimally invasive and can be done at the bee yard with convenient and inexpensive items.
- Each disease has a specific treatment and treatment time. When treating colonies with medications, always follow the manufacturer's directions on doses and times to avoid problems.

Varroa Mite Control:

- Use IPM methods working with the behavior and biology of the target pest to aid in its control. Contact Cornell's Honey Bee Extension Associate and IPM program for assistance in developing a site-specific pest management plan.

- Cultural Controls: Although it may reduce colony strength, it is recommended to remove and destroy infested bee brood—especially drone brood—through trapping and queen isolation to reduce varroa problems. Cultural Control methods include:

    - A screened bottom board which allows the mites to fall out of the hive.
    - Drone trapping/varroa trapping using a drone frame or drone foundation. (*Remove frame after cells have been capped and freeze for 48 hours. Reinstall frames after thawing).*
    - Work with your beekeeper neighbors to be sure that all beekeepers are keeping varroa at low levels.

- Chemical Control: Beekeepers should use only pesticides which are registered for use in New York for varroa mite control. Follow the recommended label instructions and exercise judicious use.

    - Rotate treatment products to prevent resistance.
    - Avoid treating bees with varroacides when they are likely to be exposed to crop pest control chemicals.

***Nosema* Control:**

- Protect water from fecal contamination.

- Treat infected hives with the antibiotic Fumadil-B (fumagillin). Fumadil-B should be mixed in cool sugar syrup at label rates and fed as early in the spring as possible, and again as late in the fall as possible.

- Clean comb.

- Clean or replace contaminated equipment.

American Foulbrood (AFB) and European Foulbrood (EFB) Control:

- Do not introduce diseased brood to a colony when adding brood to strengthen the colony.

- Sanitize tools with alcohol after use.

- Never use honey as supplemental feeding.

- Treat early in spring before supers are put on to avoid drug contamination of honey. Drugs should be provided to a colony prior to the start of the honey crop and any time after the harvest of the honey crop. If an outbreak is discovered, New York State law requires destruction of the colony.[20]

- Recognize diseased colonies and deal with them before they become so weakened that they are susceptible to robbing.

- Work with neighboring beekeepers to be sure that all beekeepers are aware of and properly managing foulbrood presence.

- **Reduce honeybee colony exposure to chemicals (insecticides, herbicides, fungicides, and miticides).**

    - Notify and work with neighboring landowners on hive location, establishing a "pollinator awareness zone" and requesting that landowners provide two-day notification to their neighbors before insecticide, fungicide or herbicide application occurs.
    - Do not leave unmarked colonies of bees near orchards or fields. Post the beekeeper's name, address, and phone number on apiaries in lettering large enough to be read at a distance.
    - Prevent drift exposure by placing colonies on raised parcels of land; avoid valleys or dropoffs where chemical drift can collect.
    - Keep hives ready to relocate quickly and have a plan that includes how and where to move them if unexpected pesticide application occurs.
    - Establish holding yards for colonies at least four miles from intensive insecticide application.
    - Do not return hives to fields treated with insecticides that are highly toxic to bees until at least 48 to 72 hours after application.
    - If moving is impossible, cover colonies with a well-ventilated screen or large wet burlap sacks to restrict honeybee flight during peak foraging hours. When covering hives, be sure to provide water inside the screen which will allow the bees to regulate hive temperature. Do not cover colonies for more than two days.
    - Avoid treating bees with miticides or other apiary treatment chemicals when they are likely to be exposed to crop pest control chemicals. Honeybees have a limited capacity to metabolize toxins, including beekeeper-applied varroacides, and some toxins can accumulate in beeswax combs.
    - Renew beeswax combs by replacing a few combs from each hive annually.

- **Communicate apiary (hive) locations.** In order to adequately coordinate and communicate with beekeepers, growers and pesticide applicators need accurate and timely information on the location of nearby colonies that could affect application decisions. Therefore, a critical element of pollinator protection is the ability of a pesticide applicator to contact beekeepers with colonies near the pesticide application area to alert them of a pending treatment.

[20] Ag & Markets Law. Article 15

- Continue to provide current hive locations throughout the season. This ensures that all locations are accurate when applicators attempt to locate them.
- Clearly post contact information at all hive locations.
- Use the voluntary online registration tool on FieldWatch.com to support communication among crop producers, beekeepers and pesticide applicators, using a mapping and notification system.

- **Notify landowners and applicators when arriving and when moving hives.** Notify nearby pesticide applicators and landowners when placing or moving beehives. This will ensure they are aware of current hive locations and can provide notification before making pesticide applications. Contact information for nearby pesticide applicators can usually be obtained from landowners.

- **Complete and submit the New York State Department of Agriculture and Markets Honey Bee Health Information Form**

    - Annually submit the form to the New York State Department of Agriculture and Markets: http://www.agriculture.ny.gov/PI/PI-134.pdf

- **Report all suspected pesticide-related bee kills to DEC's Pesticide Program and the Apiary Program at the NYS Department of Agriculture and Markets immediately.** DEC is the lead pesticide regulatory agency in the state and will collect samples and analyze them for pesticide residue if deemed appropriate. The Department of Agriculture and Markets' Apiary Inspector will evaluate the condition of the hive to determine whether parasites or disease may be the cause of the bee kill. Beekeepers, and others can report suspected pesticide incidents to the DEC Pesticide Control Specialist who serves your county (a list is available at http://www.dec.ny.gov/about/558.html), or contact the Central Office by email at PesticideCompliance@dec.ny.gov or call 518-402-8727. Contact the Department of Agriculture and Markets' Apiary Program at 518-485-8760.

APPENDIX B: Contract Beekeepers BMPs

- **Work with landowners to choose hive locations and placement timing.** Ideal hive locations will have minimal impact on agricultural and other activities but will still have adequate access to forage and water. Avoid low spots to minimize impacts from drift or temperature inversions on hives. Give consideration to timing after rain events when determining which roads to travel. Discuss with landowners preferred roads/trails to use. Beekeepers should also request contact information for applicators, renters, and neighbors (if applicable). Communicate clearly to the grower or applicator when hives will arrive and when they will be removed.

- **Be cognizant of neighboring landowners when placing and moving hives.** Neighboring landowners often use the same roads and trails. Do not block these rights-of-way or place hives so close that they may cause problems for other land users. Take appropriate steps to ensure that bees do not negatively affect operations of neighboring landowners, such as considering the proximity of hives to neighbors' yards, bins, equipment, or storage sites.

- **Notify landowners and applicators when placing and moving hives.** Notify nearby pesticide applicators and landowners when placing or moving beehives. This will ensure they are aware of current hive locations and can notify you before making pesticide applications. Contact information for nearby pesticide applicators can usually be obtained from landowners.

- **Reduce honeybee colony exposure to pesticides.**

    - Maximize the number of months during the normal bee season when bees are not exposed to pesticides**.** Reduce the months of potential exposure to pesticides to be less than the number of months of non-exposure.
    - Choose hive locations that have appropriate buffers between pesticide-treated areas and colonies.
    - Remove bees from orchards when 90% of flowers on the latest blooms are at petal fall. Past this point, no pollination is taking place, and bees that forage in the area near the orchard will have a higher risk of contacting insecticide-treated crops.
    - Work with growers to establish a pesticide application schedule, learning what will be applied, when and where so proper accommodations can be made.
    - Establish a notification process in the event of an unexpected pest problem–who to contact, 48–hours' notice to move hives, and secondary hive location sites.

- **Ensure hives are readily visible to applicators.** Hives should be visible so applicators can locate them before spraying.

- **Maintain Reserves.** Don't commit all colonies to contract and refrain from putting juvenile colonies into pollination; provide healthy colonies to withstand the rigors of pollination.

- **Moving Bee Colonies**

    - Avoid moving bee colonies during peak flight times when bees are away from the hives. When possible, restrict hive movement to times when it is more likely that bees will be in their hives.
    - Moving can also induce stress, which can lower colonies' ability to withstand pests, diseases, and chemical exposures. When transporting colonies, be sure to provide bees with supplemental feeding, access to a water source (damp burlap) and relief from sun exposure.

- **Beekeeper and Grower Coordination.** Communicate and develop a mutually acceptable strategy for managing crops and pollinators prior to hive placement to ensure expectations between beekeepers and growers/owners are fully understood.

- **Consider developing a Pollination Contract between grower and beekeeper**. Contract items to consider:

    - Timing of apiary arrival and departure
    - Agreement on the type of pesticides allowed for use during bloom, and potential pest control materials that might be used during pollinator services
    - An established line of communication through all parties involved, including a notification process with responsibilities outlined
    - Details of the grower's responsibility to safeguard bees from poisoning
    - Buffers between treated areas and apiaries
    - Outline roads/trails that can be problematic when wet and any preferred traffic routes. Landowners may also want to provide contact information for applicators, renters, and neighbors.

- **Work constructively with applicators on notification of upcoming pesticide applications.**

    - Identify a reasonable timeframe within which the grower/applicator must notify the beekeeper (48 hours before application).
    - Block, move, or net hives when applicators inform you they are going to apply pesticides, or find other strategies to allow pesticide applicators to manage pests while minimizing pesticide exposure to bees.

- **Obtain landowner permission for hive placement every year and keep in contact.** As landowner information changes, it is important to ensure everybody is aware and bees are not placed without permission. This step is imperative to ensure hives do not become a nuisance.

APPENDIX C: Landowner/Grower BMPs

- **Work with beekeepers to choose hive locations and placement timing.** While hives should be placed in an area that will have minimal impact on farming operations, it is important that the placement still enables bees to access forage and potable water.

    - Hives should not be placed near areas treated in the previous 48 hours with pesticides.
    - Locate hives near buffer zones, maintained roads, and on elevated ground.
    - When possible, help beekeepers locate flowering forage prior to hive delivery and after crop bloom to offset dearth.
    - Inform neighboring growers and applicators of apiary locations.
    - Consider your spray schedule and establish a no-spray buffer zone when identifying the location of hives.
    - Tell the beekeeper what was sprayed before the scheduled arrival of the bees and what pesticides if any, will be applied while bees are present.
    - For orchards or fields 40 acres or fewer, hives should be placed outside of planting zone.
    - For orchards larger than 40 acres, hives should be placed at no more than quarter-mile intervals.

- **Communicate with renters about bee issues**. Renting land for agricultural production is a common practice. Landowners and renters should discuss bee issues, such as who has authority to allow the placement of hives on the rental property, how long they will be allowed, and where hives can be located.

- **Use IPM.** Determining an "economic threshold"—the pest density at which management action should be taken to prevent an increasing pest population from reaching an economically damaging level—is one of the key concepts of Integrated Pest Management. For example, if insect pressure is low, then the cost of the neonic-treated seeds may not be worth paying for. If insect pressure is high, then the money saved by investing in the treated seeds will probably be well worth it. When insecticides are required, try to choose insecticides with low toxicity to bees, short residual toxicity, or repellent properties toward bees.

    - Work with your Certified Crop Advisor or local Cornell Cooperative Extension office to select the most appropriate control methods.
    - Avoid tank-mixing insecticides with bloom-time fungicides, which have been linked to large bee kills.
    - Scout for pest insects and use economic thresholds for routine insect pests.

- **Agronomists, crop consultants, and other pest control professionals should consider pollinator impacts when making pesticide recommendations.**

- **Plant bee forage.** Plant flowering plants, trees, and shrubs to improve bee forage, especially in non-farmable or non-crop areas. Doing so may also concentrate bees away from fields to be treated with pesticides, thereby minimizing impacts to pollinators.

- Check pesticide label to see whether untreated vegetative buffer strips are required around sensitive sites. If so, plant flowering plants in those buffer strips to provide additional bee forage.
- If planting cover crops, add flowering plants into the mix. Even a small percentage of flowering plants can provide a considerable amount of forage for pollinators. If the cover crop is to be turned under, flowers included in the cover crop seed mix should be those that will bloom prior to the crop being turned under.
- Establish a field border in accordance with the United States Department of Agriculture Natural Resource Conservation Service (NRCS) Field Border 386 Standard.[21] Landowners should contact their local NRCS office or Soil and Water Conservation District (SWCD) for assistance in implementing a field border. Landowners also should consider applying for Environmental Quality Incentives Program funds for financial assistance in implementing pollinator BMPs.
- In addition, landowners should consider enrolling land in the Conservation Reserve Program through the Farm Service Agency and in consultation with their local NRCS or SWCD offices.

- **Maintain pollinator forage and habitat.** In non-production areas, leave pollinator-friendly plants and enhance their species and temporal diversity with planting and overseeding. Increase availability of nesting sites by loosening soil and leaving some land fallow. Plant and encourage pollinator-friendly hedgerows. Establish a buffer zone between pesticide-treated areas and pollinator habitat; the extent of the buffer zone will differ when applied to native vs. managed pollinators.

- **Use alternatives to talc/graphite in planters.** When planting seeds treated with insecticides, use alternatives to talc/graphite as they become available.

- **Dust suppression during planting.** Growers that plant seed treated with pesticides should use methods that minimize or eliminate dust and drift. Avoid application on windy days, and ensure that wind will not carry the product in the direction of beehives, flowering weeds, adjacent habitat, or non-target crops.

- **Use the online registration tool on FieldWatch.com.** This is a mapping and notification system to support communications between crop growers, beekeepers and pesticide applicators.

[21] www.nrcs.usda.gov/wps/portal/nrcs/detail/ny/programs/?cid=nrcs144p2_027143

APPENDIX D: Pesticide User BMPs

- **Use IPM.** Use economic thresholds and integrated pest management (IPM) to determine whether insecticides are required to manage pests. When insecticides are required, try to choose insecticides with low toxicity to bees, short residual toxicity, or repellent properties toward bees.

- **Use registered pesticides according to the label.** Failure to comply with the label not only puts humans and the environment at risk, it is also illegal, with the exception that registered pesticides may be used for agricultural purposes in a dosage, concentration or frequency less than that specified on the label unless the label specifically prohibits such use. Many pesticides, especially insecticides, have use restrictions prohibiting applications when bees are foraging in the treatment area. Some labels prohibit applications when crops are blooming and require that the applicator notify beekeepers in the area prior to application. Also, the application of restricted-use pesticides must be done by or under the direct supervision of a certified applicator.

- **Reduce non-target species exposure to pesticides.**

    - Consider the bloom periods of the crop and nearby weeds, and avoid pesticide applications at those times.
    - Avoid pesticides with cautions on the label that read “highly toxic to bees” or “toxic to bees.”
    - Avoid tank mixing insecticides with fungicides.
    - Apply pesticides early in the morning or in the evening when bees are less active to reduce the chances that bees will be foraging in or near the treatment site.
    - Be cognizant of temperature and high winds when choosing pesticides and time of application.
    - Control blooming weeds and other blossoms before applying insecticides.
    - Protect natural water sources from spray and cover or remove artificial water sources during application.
    - Keep all parties informed of agricultural sprays according to the communication chain agreed upon so that beekeepers are aware of impending applications.

- **Avoid drift.** Pesticide drift involves the off-site movement of pesticides through the air from the treatment site to adjacent areas in the form of mist, particles, or vapor. Drifting chemicals pose a risk to non-target organisms that come in contact with the off-target residues. Insecticides can negatively affect bees and other beneficial insects by direct contact or by contaminating their forage and habitat. Drifting herbicides have the potential to reduce quality forage available to pollinators.

    - Avoid spraying on windy days.
    - Use granular formulations, soil treatments or equipment that confines the spray to the intended target.
    - Contact Cornell Cooperative Extension or DEC for more information on how to reduce pesticide drift.

- **Identify and notify beekeepers in the area prior to pesticide applications.** Pesticide applicators should identify and notify beekeepers within two miles of a site to be treated

at least 48 hours prior to application or as soon as possible. This offers the opportunity to cover hives, move hives, or choose the time of day to apply.

- **Choose products with lower risk to bees.** Avoid dusts and wettable powder insecticide formulations.

- **Agronomists, crop consultants, and other pest-control professionals should consider pollinator impacts when making pesticide recommendations.**

- **Use the voluntary online registration tool on FieldWatch.com**. Improve communication among crop producers, beekeepers and pesticide applicators using a mapping and notification system.

- **Use IPM in buildings**. Consult the New York State IPM Program at Cornell University for best IPM practices for Buildings and Schools (http://nysipm.cornell.edu/community).

- **Non-Agricultural Land:**

    - Use IPM. Consult the New York State IPM Program at Cornell University for Best IPM Practices (http://nysipm.cornell.edu/community) and the *Cornell Pest Management Guidelines for Landscapes, Gardens and Lands IPM* (http://nysipm.cornell.edu/guidelines.asp).
    - For non-agricultural lands, refer to DEC's Green Lawns and Gardens webpage, (http://www.dec.ny.gov/public/44290.html), choose products with lower risks to the environment, and follow label requirements.
    - Mow or remove blooms before application to reduce pollinator contact with treated nectar.
    - Avoid the use of herbicides that may impact native floral resources.
    - Plant native green strips for pollinator forage, selecting flowering plants with three seasons of bloom and without seed treatment.

APPENDIX E: State Agency BMPs

- **Improve pollinator habitat on state lands, roadsides and rights-of-way.** Create continuous pollinator corridors when possible by implementing reduced mowing protocols. Expand the state's green specification on turf and ornamental pest management to require the use of IPM and Integrated Vegetation Management (IVM) on formerly exempt areas, such as utility rights-of-way, and discourage the purchase of nursery stock treated with insecticides. IVM practices can include chemical, biological, cultural, mechanical, and/or manual treatments to control problem plants and promote low-growing, desirable vegetation in an environmentally sound manner.

- **Increase quality bee forage areas.** NYSDOT and local municipalities should plant native pollinator-friendly plants in highway rights-of-way whenever possible, and state and local parks should promote native pollinator-friendly plantings whenever possible.

- **Identify specific pollinator habitat goals for restoration plans**. Prioritize habitat enhancement in areas which provide the most benefit to pollinators, such as adjacent to large, undeveloped tracts of land.

- **Where appropriate, State contracts should consider pollinator protection.** Include pollinator-protection language in state procurement contracts for revegetation efforts by developing standard contract language for plantings and site restoration.

- **State development, restoration and revitalization projects should consider pollinator protection.** Grant programs, like the Department of State's Waterfront Revitalization, should include project-deliverable language that encourages pollinator-friendly landscapes and pest management practices.

- **Add questions on pollinator protection to the annual agency reports on green procurement and agency sustainability in order to encourage and track actions taken to protect pollinators and enhance pollinator habitat.**

- **Identify where bee hives are located.**

    - Develop a registry for documenting beehive locations and for making beehive-operator contact information available for applicators/growers and an interactive New York State mapper that enables applicators to determine hive locations prior to applications. The registry and map could be managed by AGM, Cornell or a beekeeper association.

- **Raise awareness of pesticide applicators regarding pollinator protection issues.** Provide pollinator protection information in Pesticide Applicator basic and recertification training, and include questions on this topic in Applicator License exams.

APPENDIX F: Education and Outreach BMPs

- **Understand and adopt Integrated Pest Management.** Continue to reach out to beekeepers, farmers, and land managers on IPM BMPs. Continue and enhance funding levels for the NYS IPM Program. Practitioners should establish a balanced IPM management plan using all the tools in the toolbox, including pesticides as well as alternative pest management tools.

- **Include the public at large in the effort to improve pollinator health, including native pollinators.** Provide guidance for homeowners on landscape BMPs and ways to create better pollinator habitat.

- **Engage lawn care, home gardening and landscaping industries**. Promote homeowner planting of bee/pollinator forage material.