MICHIGAN POLLINATOR PROTECTION PLAN

Strategies for Reducing Pesticide Risk for Pollinators in Michigan

2025 UPDATE

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Executive summary

In May 2015, the Environmental Protection Agency (EPA) released its Proposal to Mitigate Exposure to Bees from Acutely Toxic Pesticide Products. This proposal outlined a two-pronged approach for pollinator protection:

1. Change product labels for pesticides that are acutely toxic to honey bees to require additional restrictions.
2. Encourage states and tribes to develop plans that protect pollinators not covered by the new label restrictions.

The *Michigan Pollinator Protection Plan: Strategies for Reducing Pesticide Risk for Pollinators in Michigan* is a direct response to the EPA's second approach. It outlines the context and issues for pollinators in Michigan, explains the pollinator-related restrictions on pesticide labels, and presents a plan to reduce risks for pollinators from pesticides not covered under label restrictions. The Michigan Pollinator Protection Plan has three goals:

1. Encourage communication between beekeepers and pesticide applicators, including growers, farmers, and land managers.
2. Develop pollinator stewardship guidance to reduce pesticide risk to pollinators.
3. Promote pollinator health education to a broad range of stakeholders.

This plan is designed to discuss potential pesticide risks to pollinators in the state of Michigan in rural, urban, agriculture, and non-agriculture settings. It does not eliminate or ban the use of pesticides. Instead, it aims to raise awareness about the effects of pesticides on pollinators, provide education to relevant stakeholders, and to drive collaborative solutions to protect pollinators in Michigan. This plan was written with input from a broad range of stakeholders. With an open dialogue that promotes amendments and adjustments, the *Michigan Pollinator Protection Plan* will improve as the Steering Committee receives more input and finds better solutions.

For more information about the actions proposed, refer to the Strategy section on page 32. Information on the committee's progress can be found starting on page 44.

For more information on this plan, visit the following:

- Managed Pollinator Protection Plan webpage from Michigan Department of Agriculture and Rural Development (MDARD)
- Michigan Pollinator Protection Plan from Michigan State University
- Michigan Pollinator Protection Plan resources from Michigan State University Extension

Introduction

The importance of pollinators

Pollinators are essential for a diverse and abundant food supply (IPBES, 2016). Globally, the majority of human food crops rely on pollinators, representing over a third of all the plant-based food produced (Klein et al., 2007). Because these pollinated crops include fruits and vegetables, the supply of many important micronutrients in our food is highly dependent on pollinators (Ellis et al., 2015). Other foods such as milk and beef are not directly affected by pollination but are supported by the pollination of alfalfa and clover for animal forage. Pollinators are essential for our natural lands as well; over 85% of wild plant species are directly dependent on pollination to develop berries and seeds (Ollerton et al., 2011).

In Michigan, pollinators play a substantial role in our agricultural economy. Researchers estimate that pollinators account for $1 billion dollars of value annually from pollination services and honey production (Huang and Pett, 2010). Of the more than 300 crops grown in Michigan for food, seed, and forage, about 100 are pollinated by bees, including apples, blueberries, cherries, peppers, pumpkins, strawberries, tomatoes, cucumbers, alfalfa, clover, and many more. These crops are pollinated by both managed bees and wild pollinators that live in and around agricultural lands.

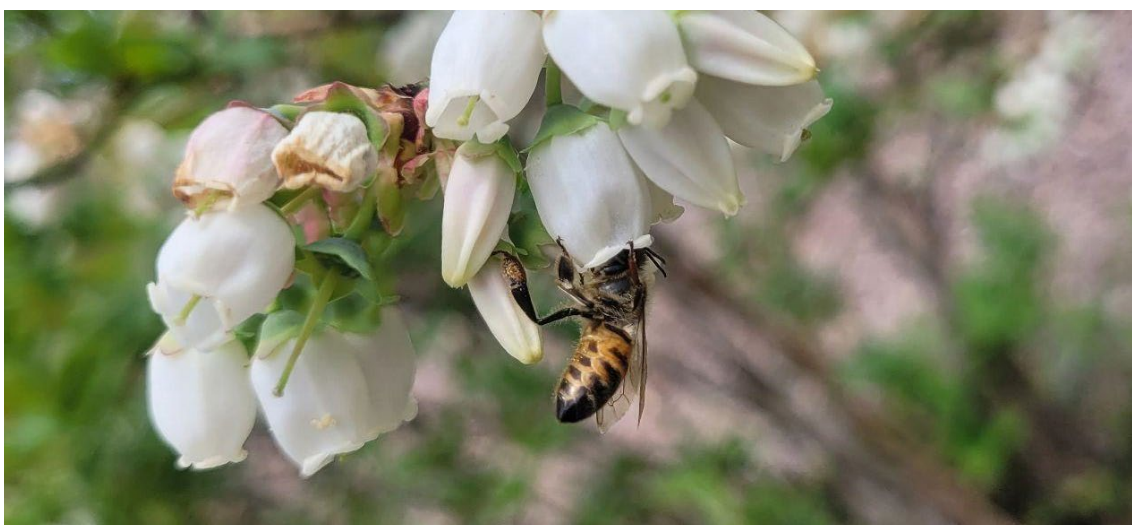

Figure 1: Photo of a honey bee (**Apis mellifera*****) on a blueberry flower. Photo courtesy of H. Chapman.***

Managed pollinators are any species of pollinator that is managed by humans, and they provide the majority of pollination required for crop production in Michigan. For example, managed pollinators provided almost 90% of the pollination value to Michigan's $120 million blueberry industry, with the remainder from wild pollinators (Isaacs and Kirk, 2010). The most common managed pollinator is the European honey bee (*Apis mellifera*), preferred for its highly social nature and honey-storing behavior. Honey bees are very efficient pollinators, and they can increase yields of some animal-pollinated crops (Klein et al., 2007). Several other species of pollinators are managed for pollination and other uses, including bumblebees (*Bombus* species), alfalfa leaf cutting bees (*Megachile rotundata*), and orchard and mason bees (*Osmia* species).

Managed pollinators in Michigan

Figure 2: Photos of managed bees in Michigan; a honey bee, bumble bee, and solitary bee, respectively. Photos courtesy of S. Scott.

Honey bees

The exact number of beekeepers and honey bee colonies in Michigan is unknown. Michigan has not had an apiary (honey bee yard) registration program since 1993. In 1992, Michigan registered approximately 2,500 apiaries for a total of just over 100,000 colonies. Most honey bee colonies in Michigan are kept by commercial beekeepers. Michigan has about 100 commercial beekeeping businesses, most of which are small family operations managing 500-5,000 colonies. Each spring, these beekeepers transport more than 70,000 honey bee colonies from overwintering locations in the southern U.S. back to Michigan. Most of these colonies have already traveled to pollinate almond orchards in California by the time they return to

Michigan to pollinate spring-blooming crops such as apples, blueberries, and cherries. Following spring pollination, Michigan beekeepers may move bees to pollinate summer-blooming crops such as pickling cucumbers, or they may be moved to locations where they can make a honey crop. In 2023, Michigan beekeepers produced around 3.85 million pounds of honey, with a value of around $10.9 million (USDA NASS, 2024). The combination of pollination contracts in spring and summer with the opportunity to make honey from the less intensively managed land makes Michigan an attractive location for beekeepers.

The number of smaller-scale beekeeping operations has been growing rapidly over the last decade. Conservatively, there are approximately 2,500 to 3,000 beekeepers in Michigan, though some estimate that as many as 10,000 Michigan citizens are keeping at least one honey bee colony. These smaller operations can be classified as sideliners (fewer than 500 colonies yet keeping bees for extra income), and hobby beekeepers (beekeepers with no expectation of significant income). Most of these smaller beekeeping operations keep their colonies in the state year-round or only migrate within the state though some with larger operations may send their bees south or to almond pollination.

Bumble bees

In Michigan, growers can purchase colonies of the common eastern bumble bee, *Bombus impatiens*, from two North American commercial producers. Bumble bees are used to pollinate crops because they work well in greenhouses and because they provide buzz pollination, a type of pollination that is more effective for releasing pollen from some crops, including blueberries and tomatoes. To use bumble bees for pollination, growers generally obtain colonies immediately before the crop blooms and keep them in their crop for their entire six-week lifespan of the colony. Colonies that are placed outdoors for field pollination of crops visit neighboring crops for up to 2 miles and are exposed to hazards within that area.

Solitary bees

A small number of growers manage solitary bees, such as orchard mason bees (*Osmia* species) and alfalfa leafcutter bees (*Megachile rotundata*) for crop pollination. Growers can purchase cocoons of these bees and hollow tubes that are used for nesting habitat during spring and summer. Following a relatively short period of adult activity, the tubes are moved to protected areas during the winter and brought back to the crop for pollination the next spring. Most solitary bees do not fly as far as honey bees or bumble bees; they fly just a few hundred feet. The more limited flight range compared to honey bees and bumble bees results in pesticide sprays near nests of solitary bees being relatively more impactful than those applied in the surrounding landscape.

Non-managed pollinators in Michigan

Figure 3: Photos of native non-managed bees used in Michigan; a squash bee, mining bee, and bumble bee, respectively. Photos courtesy of J. Gibbs, S. Scott, and J. MacFarlane, respectively.

Michigan has a diverse community of wild bees that live in different habitats, visit a wide range of host plants, and are active at different times of the season. This community has been described as having 464 distinct species (Gibbs et al., 2017). These species range from highly specialized bees that may visit only one type of flower to generalists that visit many types of plant species. Although the density of wild bees is not as high in agricultural landscapes as the managed bee species described above, wild bees can provide significant pollination service to agriculture and native ecosystems and should be protected and conserved to ensure they are available for this activity.

One important wild crop pollinator is the squash bee. Squash bees can be locally abundant and provide pollination of cucurbit crops. They are highly specialized bees that are active very early in the morning, moving pollen from male to female flowers. Squash bees nest in the soil around squash plants, so careful consideration of how much of a farm will be tilled each year is an important factor of conserving these bees. As soil nesting bees, they are also at risk from soil-applied insecticides. Other soil nesting bees with important roles for crop pollination include *Andrena* species of bees, or mining bees. Mining bees pollinate a wide range of spring blooming crops including apple, blueberry, and cherry. While many of these bees are generalists and work many flowers, some are specialized to only one crop. One example of a specialized pollinator is *Andrena vaccinii* which emerges from the soil during blueberry bloom, visits mostly blueberry flowers, and brings blueberry pollen to its soil nest. In small blueberry fields surrounded by wild habitat, these bees can provide a significant component of the pollination.

Over ten different species of native bumble bees can be found in Michigan. Bumble bee abundance ranges from very abundant species such as the common Eastern bumble bee, *Bombus impatiens*, to very rare species and even one that has become endangered and no longer found in Michigan. Some bumble bee species are found across the state, while others are more limited in range, such as *Bombus terricola*, which is most abundant in the Upper Peninsula (Wood et al., 2019). Mated bumble bee queens overwinter and build a new colony every year, reaching 200-400 worker bees in each colony. They are very efficient at transferring pollen, and they visit a very wide range of flowering plants. Many of our most economically important crops are visited by bumble bees, with queen bees being active in the spring when apple, blueberry, and cherry are in bloom, and worker bumble bees providing pollination to crops blooming in the warmer months later in the summer such as cucurbits, summer raspberries, blackberries, etc.

Other important pollinators in Michigan

Michigan is also comprised of many other types of pollinators beyond bees, including butterflies, beetles, wasps, flies, birds, and mammals. There are over 400 species of soldier beetles in North America (Walton, 2021), but the goldenrod soldier beetle (*Chauliognatha pennsylvanicus)* is one of the most seen in Michigan. These soldier beetles primarily feed on goldenrod's nectar and pollen, but also use these areas as mating sites (Cloyd, 2015). Pollination occurs during the abundance of time moving between goldenrod plants for feeding and mating.

Ruby-throated hummingbirds (*Archilochus colubris*) make their migration to the central and eastern United States in the spring. There are a wide variety of wildflowers that attract ruby-throated hummingbirds by their red/orange coloring, long, cylindrical flowers, and large amounts of nectar. This hummingbird forages on nectar while hovering very close to the flower. Due to the proximity to the flowers, the hummingbirds inadvertently collect pollen on their feathers and bill, which will then pollinate other flowers as they continue foraging (National Audubon Society, 2024).

The Eastern tiger swallowtail butterfly (*Papilio glaucus*) is one of the common butterflies in the eastern United States from spring to fall, though they are often mistaken for other species that closely resemble them due to similar colorations. They have large yellow wings with black edges and distinct blue and red scales at the tip of the hindwings. The female butterflies may have a much darker coloring in which black replaces all the yellowing on their wings. Eastern tiger swallowtail feeds on the nectar of a wide variety of exotic and garden plants (U.S. Forest Services, n.d.), making them important pollinators in many areas across many seasons.

Figure 4: Wild and managed pollinators of various species on a goldenrod plant. Photo courtesy of M. Milbrath.

Declines in bee health

While the cultivation of pollinator-dependent crops has been steadily increasing over the past 50 years, populations of some bee pollinators have been decreasing (Ashman et al., 2004; Cameron et al., 2011; Bartomeus et al., 2013), elevating the risk to our food supply. Pollinator declines impact both large and small-scale farmers, commercial and hobbyist beekeepers, the food processing industry, consumers of Michigan produce, and many others (Bianco et al., 2014) through a reduction of the number of commercial bee colonies, elevation of honey bee rental rates, and threatened national food security.

Honey bee colony annual losses

The number of managed honey bee colonies in the United States declined after the end of World War II. Following the introduction of varroa mites, *Varroa destructor*, which are honey bee parasites, in the late 1980's, beekeepers in Michigan suffered significant losses of honey bees, and Michigan's beekeeping industry changed dramatically. Still, the issues facing honey bees did not attract significant popular and media attention until 2006 when beekeepers reported losing unusually high numbers of colonies, with losses of 30-90% (USDA, 2012). Since 2006, honey bee colony losses have hovered around 30% every winter. Total losses (summer and winter), only nationally recorded since 2010, have generally been between 30-45% each year (Figure 5). These extreme loss rates are over twice the level considered acceptable by beekeepers (Bee Informed Partnership, 2017) and much higher than historic levels.

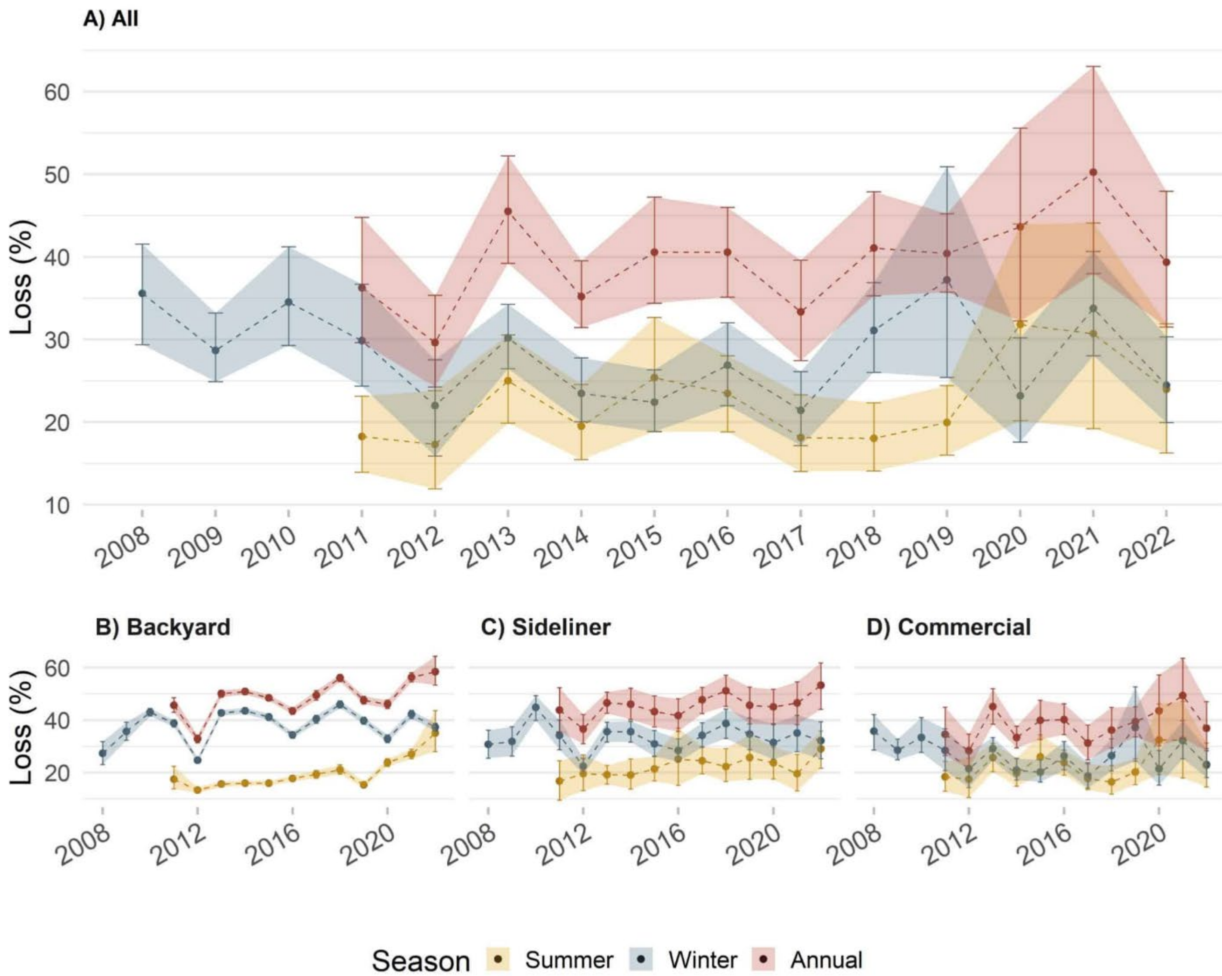

Figure 5: Seasonal managed honey bee colony loss rates in the United States from 2008-2022. ([Bee Informed Partnership, 2022](), accessed 2025)

Michigan beekeepers report some of the highest losses in the country. It is important to note that the loss surveys occur when most of the commercial beekeepers are in the south, so the reported winter loss statistics for Michigan mostly include non-commercial beekeeper reports. In winter, 2020-2021, Michigan beekeepers lost 50.9% of their colonies (Figure 6) as compared to the national average of 31.1%, well over the levels that can be tolerated by most operations (Bee Informed Partnership, 2022.)

These numbers only represent colonies that are lost and reported; most beekeepers do not participate in the survey. Even when colonies survive, they can be small in population or in poor health. Weak colonies require much more care and cost to maintain and may not be strong enough to meet a pollination contract or to make a crop of honey. Even if the colony is not lost, it may take considerable labor and cost to bring it back to health, and it may be too late for the beekeeper to gain any income from that colony that season.

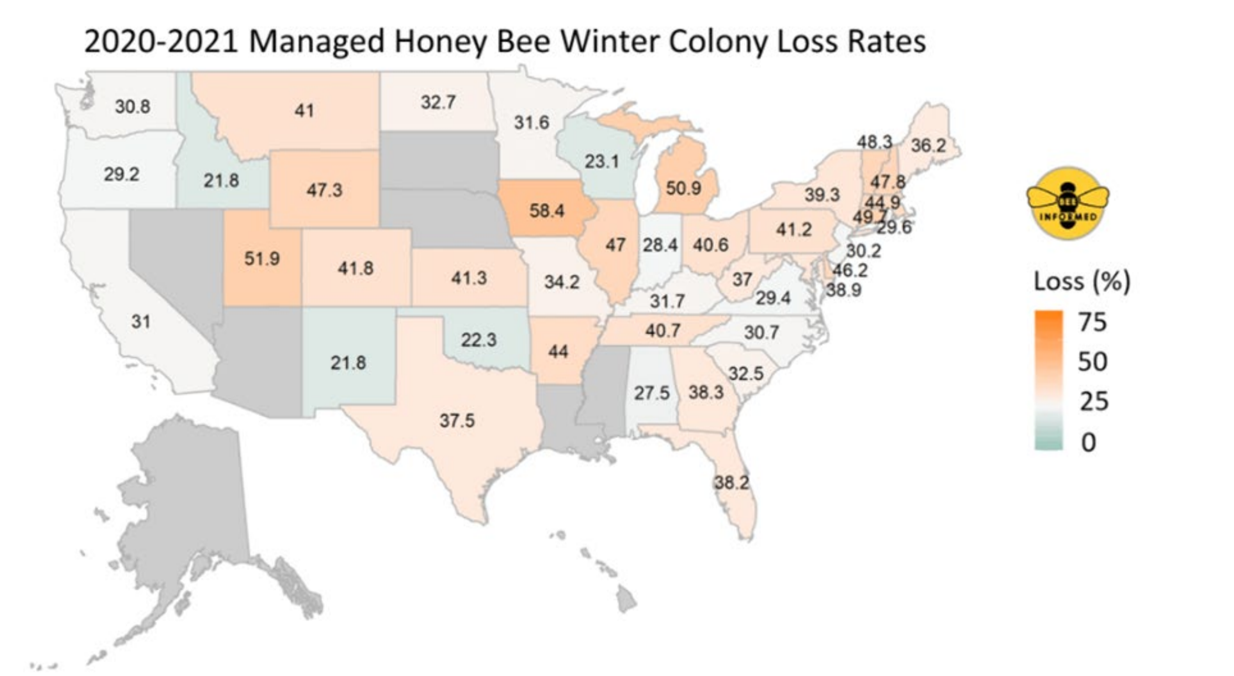

Figure 6: Managed honey bee colony loss rates in the United States for the Winter 2020-21 survey period. (Bee Informed Partnership, 2021, accessed 2025)

In response to honey bee declines, various beekeeping groups, farmer advocates, nonprofit and regional political organizations, academic research programs, and governmental entities began raising awareness and finding ways to address the challenges facing pollinators. In 2012, leaders met at the National Honey Bee Health Stakeholder Conference, and developed a report on the factors affecting honey bee health and decline. The group identified six key factors impacting pollinator health: pesticides, parasites, diseases, habitat loss, genetic diversity loss, and management practices (Figure 7). These factors each affect pollinator health directly, and they also are compounding and interconnected. Most pollinators face at least a few different environmental hazards, and the hazards can act together to cause even greater effects to pollinator health.

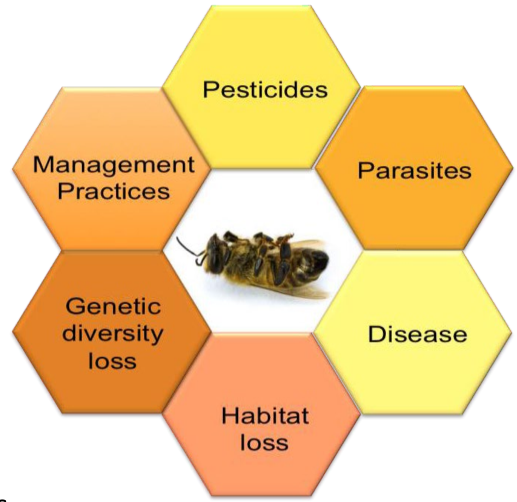

Figure 7 (right): Factors impacting honey bee colony health and survival.

Declines in other pollinator health

There is much less data on the state of wild bees and other pollinators. It has been estimated that globally, one in six bee species is regionally extinct, and more than 40 percent are vulnerable to extinction (Sánchez-Bayo and Wyckhuys, 2019). Because wild pollinators are so diverse, we can expect diverse effects and outcomes on them. For example, in Michigan, current bumble bee abundance ranges from very abundant species such as the common Eastern bumble bee, *Bombus impatiens*, to species that are very rare. One species of bumble bee, the rusty patched bumble bee, *Bombus affinis*, has become extirpated in Michigan and was added to the endangered species list.

It has been estimated that over 23 percent of U.S. native bees have declined, with bees in areas in dense crop production particularly hard hit due to habitat loss and pesticide exposure (Koh, 2016). Wild pollinators are affected by many of the same factors that affect honey bees (Figure 7) including habitat loss, pesticides, and diseases. However, their risks from each factor may be different from those to honey bees. Bees that are not managed are at much greater risk to loss of food and loss of nesting sites. Some bee species that are specialists depend on only a few plants and are at particular risk.

Pesticide risk assessment for bees and other pollinators

Pesticides play an important role in land management, public health protection, invasive species control, and crop production across Michigan. They are useful tools to manage pests that threaten crops, livestock, and human health, including weeds, insects, fungi, bacteria, and other organisms. Pesticides include insecticides, fungicides, herbicides, antimicrobials, rodenticides, miticides, and other products used to control pests.

While advances have been made to improve the chemistries, formulations, and applications of these compounds to protect human health and to reduce overall use, many pesticides still have negative impacts on pollinators and other non-target organisms.

The overall risk of pesticides to bees and other pollinators comes from three factors: the toxicity of the pesticide (the inherent ability to harm pollinators), the amount of exposure pollinators receive, and the context in which they are exposed (May et al., 2015). Protection from pesticide exposure is one of the most important ways we can provide a safer environment for pollinators in Michigan.

A pesticide is defined by the Federal Insecticide, Fungicide, and Rodenticide Act and by Michigan's Natural Resources and Environmental Protection Act, Public Act 451 of 1994, Part 83. In this state law, MCL 324.8305(4), "pesticide" means a substance or mixture of substances intended for preventing, destroying, repelling, or mitigating pests or intended for use as a plant regulator, defoliant, or desiccant.

In MCL 324.8305(3), "pest" means insect, rodent, nematode, fungus, weed, and other forms of terrestrial or aquatic plant or animal life or virus, bacteria, or other microorganism, or any other organism that the director declares to be a pest under section 8322, except virus, fungi, bacteria, nematodes or other microorganism in or living on animals.

The potential for pesticide exposure to bees and other pollinators

Understanding the effects of pesticide exposure on pollinators is challenging because pollinators can be exposed to many different pesticides at a time, through multiple pathways, and in different amounts. Pollinators can be exposed to pesticides through direct contact, off-target drift, residues in nectar, pollen and water, and in-hive pest control products. Honey bees, in particular, can fly up to 3 miles from the colony to locate food and water. This means that bees from a single colony can forage over an area of almost 20,000 acres. Bees from a single colony will gather food resources from a variety of crops and plants over the course of a day, meaning they can be simultaneously exposed to pesticides on or being applied to multiple crops.

The active ingredient in a pesticide is not the only determinant of the risk of an application to pollinators. Adjuvants, including surfactants, and other inactive ingredients can affect the rates of exposure and the health effects on bees of a particular pesticide application.

Different formulations of pesticides with the same active ingredient can create very different health risks. For example, dusts and powders are generally higher risk to bees than liquid concentrate formulations due to the greater risk of the pesticide being carried to the colony. Bumble bee colonies that are placed for field pollination of crops will also visit neighboring crops for up to two miles and are exposed to hazards within that area. The more limited flight range of solitary bees compared to honey bees and bumble bees results in pesticide sprays near the nests of solitary bees being relatively more impactful than those applied in the surrounding landscape.

Tank mixes (placing two or more pesticides in a sprayer for application at a single time) may increase the risk of pesticides to bees through synergistic or potentiating effects. These effects have been documented for a few combinations, including the combination of a pyrethroid and EBI fungicides (Pilling and Jepson, 1993), although it is worth mentioning that pyrethroids cannot be applied during crop bloom when honey bees are present. For growers, there are logistical and economic benefits of using tank mixes. Pesticide applicators use tank mixes to address multiple pest problems at once, save on fuel costs, maximize labor efficiency, and limit exposure to themselves and their workers by reducing the number of applications. Another source of potential combined exposure is when honey bees are exposed to a miticide in the colony due to a treatment for varroa mite control and are subsequently exposed to pesticides while foraging.

Small exposures can become lethal or detrimental when they occur over a long time (chronic exposure), especially for honey bees. The conditions of the hive put honey bees at particular risk for chronic exposure; the wax used by bees is highly lipophilic (absorbs lipids, and has a marked attraction to), and is known to hold on to a host of pesticides that can build up over many years when frames are reused (Mullin et al., 2010).

Pesticides can affect wild bees differently than they affect honey bees. If an adult honey bee dies in the field after an exposure to a toxic pesticide, the colony may be far away, unexposed, and continue to survive, whereas if a female adult native bee is killed by a pesticide exposure, all potential offspring would be lost.

Effects of pesticides on pollinator health

Lethal effects

Some pesticides are lethal, meaning that exposure results in death. Potential lethality is measured using the LD_{50} - the dose needed to kill 50% of exposed individuals. This dose is usually reported in micrograms per bee, and a low LD_{50} value indicates that a chemical is highly toxic.

Acute toxicity

Pesticides are described as acutely toxic if negative effects result either from a single exposure or from a series of exposures in a short amount of time.

Insecticides in the carbamate, organophosphate, pyrethroid, chlorinated cyclodiene, and neonicotinoid classes are typically acutely toxic to bees, and very small amounts are sufficient to kill them. The EPA categorizes pesticides that have a contact LD_{50} of 11 micrograms per gram or less as acutely toxic to adult worker honey bees and requires applicators of these pesticides to follow specific pesticide label restrictions pertaining to crop bloom and flowering plants. These pesticides may be toxic to other life stages of the honey bee or to other species of bees, so it is imperative that the applicator follows pesticide label directions.

Figure 8: Honey bees that have been killed by pesticide exposure. Photo courtesy of D. Wyns.

Sublethal effects

Pesticides that are less than deadly but are still harmful are considered to have sublethal effects. Examples of sublethal effects include behavioral changes such as reduced olfactory learning capacity, lower foraging efficiency, impaired communication, or compromised memory. They may also include reproductive changes such as reduced sperm counts and lowered fecundity, or developmental effects such as smaller size, larval deformity, and lower rate of emergence. Finally, there may be immunological changes that limit the insect's ability to resist diseases.

Sublethal effects are harder to measure than acute effects, but they can have significant negative effects on bee health and can severely weaken a honey bee colony or result in colony loss over a long period of time. The effects of sublethal exposure to pesticides may not be immediately apparent. For example, honey bee queens exposed to small doses of imidacloprid through shared food had reduced egg laying and locomotor activity, and worker bees had modified foraging and hygienic behaviors (Wu-Smart, 2016). These effects may not immediately kill the bees or the colony, but may cause the colony to dwindle over time as fewer young are raised and less food is brought in. These subtle and slow effects make it harder for beekeepers to identify the cause of colony decline caused by pesticides.

In addition to the direct effects of the chemicals, sublethal exposures to pesticides may make a colony more susceptible to other threats such as diseases or pests. Some fungicides, for example, have been found to make honey bees more susceptible to the microsporidial pathogen *Nosema ceranae*, and can affect the way that bees store their food (Pettis et al., 2013). **Currently, there are no pollinator-protective label requirements for pesticides that cause sublethal effects on bees.**

Pesticide label restrictions are intended to protect adult worker honey bees from exposure. Though the EPA continues to gather data on additional exposure routes, the label restrictions do not consider toxicity to other life stages of bees, other species of bees, or lethality through other exposure routes. **Products may be lethal to bees, even if they are not labeled as such.** For example, insect growth regulators (IGRs) are acutely toxic to the larval stage of honey bees but will not have label restrictions because they do not affect adult honey bees through contact.

Types of chemical interactions

Synergistic effects: Synergistic effects occur when exposure to two or more products has more than an additive effect. When pesticides are combined, this can result in more toxicity than the additive effects of both pesticides.

The use of multiple pyrethroids can cause synergistic effects because they are all detoxified through the same pathway (Johnson et al., 2006). Synergistic effects have also been observed between different classes of pesticides, including fungicides and insecticides applied in crops and in-hive miticides applied by beekeepers. Several fungicides have been shown to interact synergistically with pyrethroid insecticides, increasing their toxicity for both honey bees and bumble bees (Sanchez-Bayo, 2014). **There are no label restrictions on mixing pesticides that could produce adverse synergistic effects on pollinators.**

Potentiating effects: Potentiation occurs when one pesticide alone does not normally cause problems but has an adverse effect in the presence of another chemical or can make another chemical more toxic.

Some chemicals do not cause harm to bees on their own but can tie up detoxification pathways so that an exposure to a second chemical is much more harmful. Pesticides and other chemicals have the potential to also potentiate the effect of infectious diseases. For example, adjuvants that are typically regarded as biologically inert can increase susceptibility of honey bees to viruses (Fine et al., 2017). Similar to the synergistic effects described above, **there are no label restrictions to prevent potentiation.**

Routes for colony exposure to pesticides

Abrupt bee kills from acutely toxic pesticides are dramatic but are not the most common way that pesticides affect bee health. When a honey bee contacts a highly toxic pesticide outside of the hive, it will likely die in the field and not return to the colony. A bee that is exposed to a pesticide with sublethal effects will likely return to the hive, bringing back the chemicals that it was exposed to in the field. The remainder of the colony can then become exposed; the highly lipophilic wax comb acts as a sponge to store pesticides. Pesticides with sublethal toxic effects can persist and combine with other pesticides brought back to the colony to produce highly complex exposure scenarios. Contaminated food can also affect the developing brood for weeks, slowly weakening and potentially killing the colony over time.

The use of insecticides as seed treatments has received a high amount of attention as a source of pesticide exposure to bees (Krupke, et al., 2012). In Michigan, seed treatments have more of a chance to affect stationary beekeepers than migratory beekeepers because of the timing of planting. Most commercial beehives are placed in spring fruit crops in distinct regions of the state during field crop planting time. Michigan fruit farm landscapes are generally interspersed with high proportions of natural habitat that provide alternative forage sources for bees at the time of planting. There is a significant effort within the seed crop industry to reduce the loss of insecticide treated dust from planters, and this technology is being adopted across the industry.

Pesticide risk management for bees

Risk assessment and risk management can be used together to effectively protect pollinators from pesticides. A risk assessment is a scientific approach used to assess the situation and to understand and quantify the risks associated with a particular hazard. Risk management, on the other hand, includes the actions taken to manage the risk, based on the information from the risk assessment process. Strategies for risk management not only include the scientific information from the risk assessment process, but also consider real world concerns including the costs and benefits of practices, feasibility, and other practical considerations.

In 2012, the EPA developed a new risk assessment framework for bees that relies on a tiered process, focuses on direct contact and dietary exposure, and differentiates between different types of pesticide treatments. The EPA has many guides that outline the new risk assessment process for assessing pesticide risks for bees:

- White Paper in Support of the Proposed Risk Assessment Process for Bees
- Guidance for Assessing Pesticide Risks to Bees

- Tools and Strategies for Pollinator Protection

The EPA continues gathering evidence on the pesticide issues associated with pollinators and actively works to develop solutions. However, despite ongoing risk assessments of new and existing pesticides, the full effects of most pesticides and combinations of pesticides are not currently known due to the volume of new products being developed and all the potential of combinations of these products. Furthermore, it is expected that the risk of all pesticides to pollinators will never be fully understood, because of the enormity of conducting such a high number of risk assessments. Pesticides exist in multiple formulations, new pesticides are constantly being developed, and the scientific risk assessment process is slow. There will always be a gap in knowledge as scientists work to understand all possible health effects to all pollinators.

The EPA risk assessment's goal is to understand the effects that pesticides have on bees. It is an important tool for determining toxicity of pesticides to bees, but the process is long and complicated. Bees are exposed to a myriad of pesticides at once because as a colony forages over its range, dozens of pesticides and other chemicals can be transported back to the hive. Studies examining the overall pesticide burden in honey bee hives demonstrate that a wide variety of pesticide residues are found within the wax, stored food, and bees (Traynor, 2016). The interactions between these compounds can be complex, and synergistic or potentiating.

Determining risk to bees from pesticides is complex and intensive. The EPA risk assessment tests consist of a series of tiers that intend to serve as a screening tool. It employs conservative assumptions regarding exposure (assumptions that are likely to overestimate exposure) and uses the most sensitive toxicity estimates from laboratory studies of individual bees to calculate risk estimates. Despite this, it is difficult to provide a complete or accurate picture of real world risks. The risk of a pesticide application depends highly on the environment; the specific crop, weather, soil conditions, etc. can all affect the rate that a chemical moves through a plant or through the environment which influences exposure rates. It is difficult to assess the wide variety of different health outcomes for each unique pollinator species, in various environmental systems. While the full effects of pesticide exposures in real world contexts are effectively impossible to estimate, the risk assessment process is the best tool that we have available to compare potential hazards and to guide policies that can be used to protect pollinators from pesticide risk.

Management strategies to address pesticide risks to pollinators may include regulatory approaches and/or voluntary approaches (through education and training). In the United States, the EPA has outlined a risk management strategy that includes both regulatory and non-regulatory guidelines for protecting pollinators from pesticide risks. As a regulatory measure, the EPA has added label restrictions to pesticide products carrying one or more of 71 active ingredients that are known to be acutely toxic to pollinators. As a non-regulatory measure, the EPA strategy includes guidelines for the creation of Pollinator Protection Plans for situations that are not covered by the label restrictions.

This document outlines the current label restrictions related to pollinators, and acts as a plan to protect pollinators from pesticides in the state of Michigan.

Pesticide labeling for pollinators

Pesticide labels are the law. Under federal and state pesticides laws, applicators of any pesticide must follow restrictions that are described in the label. It is important to understand and follow all pollinator-related label restrictions, whether they are general, specific to a particular class of pesticides, or specific to a particular use or situation. Not only is this the law, but it is also an important part of reducing risk of pesticides to pollinators. It is the responsibility of all growers, home gardeners, commercial applicators and other pesticide users to follow the label restrictions designed to minimize risk to pollinators.

The absence of a warning label does not mean that a pesticide is safe for honey bees or other types of bees. It may mean that the ***full risk has yet been determined.***

The EPA continues to develop label language and label requirements for pollinator protection. These requirements may restrict use for both crops under contracted pollination service and for food crops and commercially grown ornamentals that are not under contract for pollination services but are attractive to pollinators. The newest updates for the requirements to protect pollinators from pesticide exposure, including exposure to neonicotinoids, can be found on EPA Actions to Protect Pollinators.

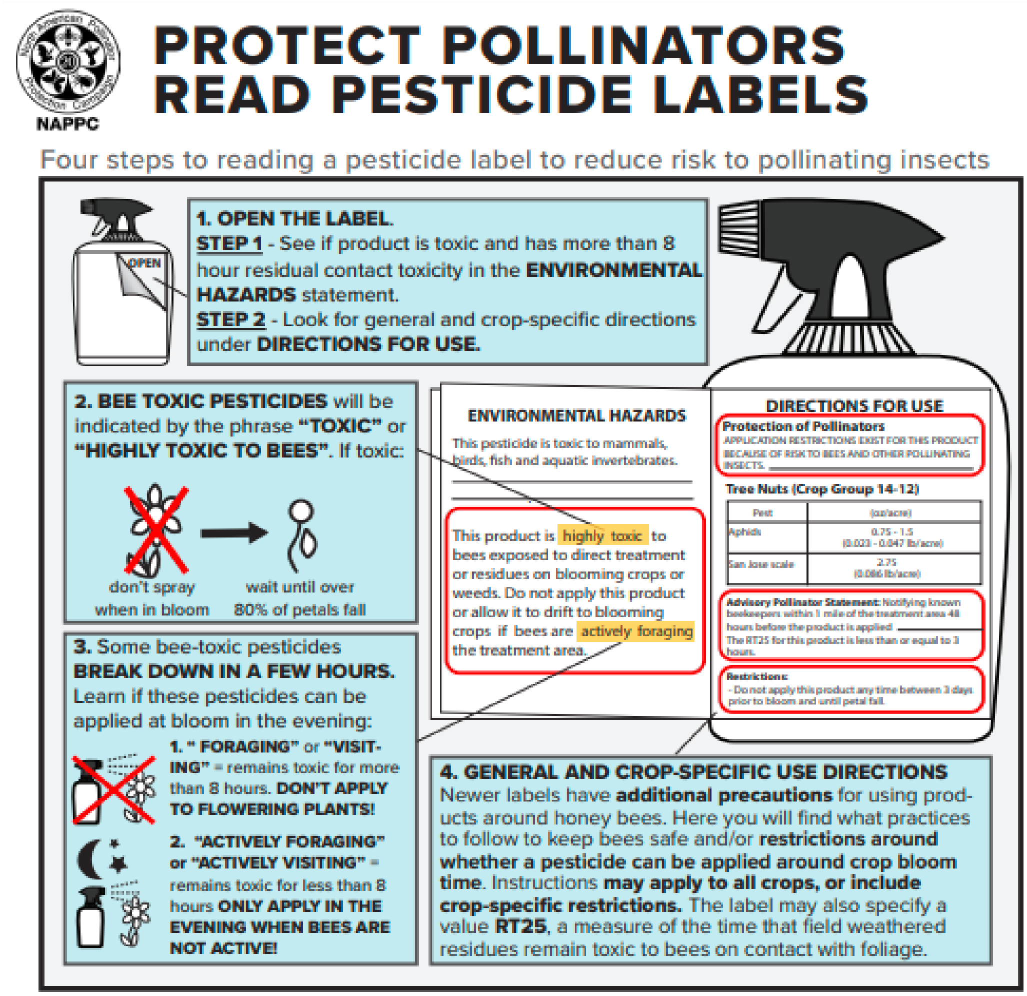

Figure 9: Steps to properly read pesticide labels to reduce the risk to pollinators. Graphic courtesy of North American Pollinator Protection Campaign, accessed 2025.

Label changes for other highly toxic pesticides

In May of 2015, the EPA released the [Proposal to Mitigate Exposure to Bees from Acutely Toxic Pesticide Products]. These restrictions, which were [updated and became policy in January 2017], were designed to protect bees under very specific high risk circumstances:

- Liquid or dust formulations,
- Outdoor foliar use on crops that may use contract pollination services,
- Maximum application rate(s) that result in risk estimates that exceed the acute risk Level of Concern (LOC) for bees of 0.4 based on contact exposure.

For more information on how the EPA currently assesses risks to pollinators, see their pollinator protection page: www.epa.gov/pollinator-protection/how-we-assess-risks-pollinators#overview

Limitations to label protections

Label restrictions do not protect pollinators from all pesticide risk. Regulations on pesticide use are limited in scope, covering only a small subset of scenarios where pesticide use can be hazardous to pollinators. There are only two scenarios where pesticide use is restricted: 1) when highly toxic insecticides are used outdoors on pollinator attractive crops, or 2) when managed pollinators are under contract for pollination services on that crop, the pesticide has a dust or liquid application formulation, and a high risk quotient. There are many situations outside of the above scenarios where pollinators may be negatively affected by pesticides: regulations do not cover combinations of pesticide exposures, inert and inactive ingredients, or pesticides for which data is unavailable.

Pesticide risk assessments are directed to active ingredients. Historically, risk assessments for inert or inactive ingredients have not been conducted; we have come to understand that these ingredients may cause harm to pollinators. Each pesticide has at least one active ingredient and other intentionally added inert and inactive ingredients. Inert ingredients are chemicals, compounds, and other substances that are added to improve effectiveness of pesticides and product performance. Inerts serve roles such as acting as a solvent to help the active ingredient penetrate the intended recipient surface, improve the ease of application, extend the product's shelf life, or protect the pesticide from degradation due to sunlight. **The name "inert" does not mean non-toxic to pollinators.** Research has found that symptoms found in colonies on pollination contracts that eventually lead to colony loss can be produced by chronically exposing brood to an organosilicone surfactant adjuvant (OSS) commonly used in many agricultural crops. The results demonstrated that OSS that are considered to be biologically inert potentiate viral pathogenicity in honey bee larvae and suggest that guidelines may be warranted (Fine et al., 2017). The pesticide label will show the percentage of inert ingredients in a product, but the manufacturer is not required to identify the name of the inert ingredients in their product.

While the EPA now has a framework for estimating pesticide risk to pollinators, there is still much more research required to identify all the harmful effects of pesticides on bees. The EPA's list of 71 active ingredients with restrictions for pollinator protection is limited to those products that pose an acute toxicity to bees; that is, products with an LD_{50} of 11 micrograms per bee or less. Products that do not meet this requirement are not addressed by the updated pollinator protection language on pesticide labels. However, applicators should be aware that many pesticides have sublethal effects on bees. The pesticide risk analysis does not consider sublethal effects, such as changes in behavior, navigation ability, or the acute effects on eggs, larvae, or other life stages. In addition, the regulatory framework did not address hazard to, or differences in sensitivity and behavior of, different species of native pollinators. In order to fully characterize risk from a particular active ingredient, many studies must be performed to examine each potential outcome, in every life stage, through each exposure route, and for every species. Enormous data gaps remain in our understanding of pesticide risks to pollinators, and there is a significant lag in the time between when the studies are performed and the labels are updated to indicate risk. The speed at which the EPA can make changes in pollinator label language is informed and dependent on research and politics.

Not all of the potentially harmful pesticides are labeled as toxic to bees. Lack of a label does not mean that the product is 'bee safe'. It is best to always treat agrochemicals as if they have the potential to harm bees and other beneficial insects.

Label language that restricts applications during bloom for highly toxic pesticides does not completely remove potential for exposure to pollinators. Some poisonings occur when a toxic pesticide is applied to a crop during bloom; however, pollinators can also be poisoned through non-contact exposure.

Poisoning of pollinators can result from off-site drift of pesticides onto nearby hives and/or forage, contamination of flowering ground cover plants sprayed by pesticides, pesticide residues, particles, or dust being picked up by foraging pollinators and taken back to the colony, and from pollinators drinking or touching contaminated water sources or dew on recently treated plants.

Some label restrictions are very specific, referring only to an application of a pesticide to a crop for which honey bees are currently present under contract. This language does not protect colonies that 1) are not under contract, 2) are under contract for a different crop, 3) are in your area that you may not know about. Honey bees can fly for miles, and it is impossible to know how many pollinators are within flight distance of the crop that will be sprayed. While this restriction will help protect a grower's investment in pollination services, it does very little to protect the health of pollinators in the surrounding landscape.

The regulatory label restrictions for pesticides are an important part of pollinator protection. As the EPA continues to perform risk assessments for pollinators and update labels, it is necessary for applicators to follow these directions to reduce exposure and prevent high-risk scenarios. However, the risk assessment process is slow by nature and updates to label restrictions will always be behind the state of the science. Furthermore, these label restrictions do not cover all scenarios where bees will be at risk from pesticides. For these reasons, we need a strategy that will complement the regulatory framework to protect pollinators from pesticide risk.

The guidelines set forth in this Pollinator Protection Plan do not take precedence over pesticide label language, but they act as recommendations in addition to the existing label language.

The Protection Plan for Pollinators in Michigan

Given the high value of Michigan's honey bee industry to the state and the importance of pollinator-dependent crops to our economy, it is critical for Michigan to have a plan for maintaining the health of honey bees and other pollinators while also supporting the ability of growers to protect their crops. Michigan is different from many other states because it has a very high density of honey bee colonies on farms during spring and summer pollination, and it has colonies across the state for summer honey production. Additionally, Michigan producers grow roughly 300 agricultural commodities, making Michigan the second-most diverse agricultural industry in the United States, second only to California (MDARD, 2024). The high density of honey bee colonies and the diversity of crops (and pesticides that are used to protect them), make the risk of pesticides to honey bees in Michigan particularly complex.

The plan outlined here is focused heavily on honey bees, but many of the practices described are expected to benefit other pollinators due to the overlap of challenges facing all pollinators. The strategy and guidelines in this plan will be updated regularly to ensure that Michigan pollinators are protected from pesticide risk.

This plan follows federal guidelines for state pollinator protection plans developed by the State Federal Insecticide, Fungicide, and Rodenticide Act Issues, Research, and Evaluation Group. The guidelines indicate a reduction of pesticide exposure to bees through **open communication and coordination among key stakeholders, including beekeepers, growers, pesticide applicators, and landowners.** The recommendations include the following critical elements:

1. Stakeholder participation in the plan's development.
2. Means for growers and applicators to know if there are managed pollinators near treatment sites.
3. Methods for growers and applicators to identify and contact beekeepers prior to pesticide applications.
4. Inclusion of best management practices to minimize the risk of pesticides to bees.
5. Public outreach to promote adoption of the plan.
6. A process to periodically review and modify the plan.
7. Measures to determine the plan's effectiveness.

For more information on the guidelines for state pollinator protection plans visit the website maintained by the Association of American Pest Control Officials.

For more information on the development of this plan in Michigan, and to read other state plans, please visit the Michigan Pollinator Protection Plan site maintained by Michigan State University. This Protection Plan for Pollinators in Michigan is intended to protect bees where pesticide label restrictions do not prevent harm. **The label changes to protect pollinators only apply to bee colonies that are managed under contract to pollinate the specific crop to which the pesticide will be applied.**

The EPA promotes the development of state and tribal managed pollinator protection plans that cover use of acutely toxic pesticides at sites where bees are located at or near the target crop but are not under contract pollination services for this crop at the target site. These plans are designed to protect bees that are on site to pollinate a different crop, are on site but not under contract, or are off site from the target crop. The protection of these bees will not occur through label restrictions, but through improved communication strategies and best management strategies.

Communication strategies to mitigate pesticide risk

The new pesticide restrictions indicate that a communication strategy may be used prior to application to reduce risk to honey bees not under contract to pollinate. Pesticide labels that now include the directions for the protection of pollinators because of acute toxicity provide applicators with the option to make an application when:

> "The application is made in accordance with an active state- administered apiary registry program where beekeepers are notified no less than 48 hours prior to the time of the planned application so that the bees can be removed, covered, or otherwise protected prior to the spraying."

This exemption is only applicable for states that have a registry showing where all honey bee colonies are located and provides communication information for all beekeepers that may have hives in the area. Michigan does not currently have a registry that shows applicators the location of colonies that are near target crops. MDARD adopted the DriftWatch program as a sensitive crop registry for Michigan and adopted its BeeCheck program when label changes were developed for neonicotinoids to provide a platform for beekeepers and specialty crop growers to register sensitive areas. These tools are available to growers and beekeepers in Michigan. To date, there has not been wide use of these communication tools or acceptance of the program by Michigan beekeepers. During discussions with stakeholders, beekeepers raised concerns that these tools do not fulfill all their needs. Consequently, applicators in Michigan do not have an all-inclusive method to find which beekeepers are in their area, nor can they identify where there are nearby colonies that may be at risk.

Moving colonies prior to pesticide applications is not always a feasible or realistic option to protect honey bees. Our surveys of stakeholders during the winter of 2016-2017 highlighted the logistical challenges of moving colonies to escape exposure to the application of an acutely toxic pesticide. It can be logistically impossible for large beekeepers to move multiple colonies, and it can be difficult for growers to plan applications far in advance given the unpredictability of weather conditions. Furthermore, contacting all beekeepers in an applicator's area is challenging when there is no state registry of bee colonies.

Figure 10: A yard within a commercial operation. Photo courtesy of M. Milbrath.

Small-scale beekeepers may be able to remove or cover their colonies fairly easily if given sufficient notice before an application. These activities, however, are not without labor costs or risk to bees. Honey bees cool the colony by fanning air through the hive and by evaporating drops of water. Colonies that are closed or covered to prevent pesticide exposure can easily overheat as air cannot flow, and foragers are prevented from gathering water to regulate the hive temperature. There will also be a loss of honey crops for the days that the colony is not able to forage, and foragers must instead consume resources from within the hive.

Covering or removing colonies may not be logistically feasible for beekeepers with larger operations. The bees may be on a contract to pollinate another crop, and the beekeeper may not be able to move them without breaking that contract. Secondly, it may be impractical to cover all the hives. The beekeeper may not be in the area, the colonies may be too large to move safely, there may be too many colonies to move before the planned application, or it may be difficult to find alternative locations that are safe from other sprays during that time. Colonies must be moved when all the bees are back from foraging, such as at night or during cold or wet weather, and beekeepers need enough notice to make the arrangements for an alternative location, and secure vehicles required for transporting the colonies, and arrange labor required to move them.

Even if provided with sufficient time, and the beekeeper has alternative locations, there are considerable fuel and labor costs, and additional stress to the bees when colonies are moved. Because the flight range of a colony is so large, it may encompass many types of crops, fields of the same crop that are blooming at different times, and crops managed by different growers. If the beekeeper were expected to move their colonies every time a grower was to spray within their flight range, they may always have pressure to relocate their yards, and the beekeeper may not be able to cover the costs of constant movement. Many commercial beekeepers have expressed they understand there is some risk of taking their colonies into commercial agricultural areas, and they generally move them from pollination locations once the bloom is complete to relocate them to an area without such a high risk of pesticide exposure.

Growers must contend with a wide array of obstacles and constraints that dictate when they can apply a pesticide. Weather conditions can make it difficult to plan ahead for scheduling pesticide applications. Wind, rain, humidity, and temperature can all limit the window of application for spraying, as well as influencing what pesticides are needed. For example, a previously unplanned fungicide application may need to be applied to fruit crops during bloom in response to a rain event. Certain crops have a relatively small window during the growing cycle in which they may need to be sprayed to protect from pests, and the ideal time to apply certain pesticides may overlap with when bees are most active. Even if growers knew how to contact all the beekeepers who have colonies in their area, they may not be able to notify them with sufficient time for the beekeepers to safely move their hives.

Results from a Michigan stakeholder questionnaire given to growers, beekeepers, and applicators in 2016 illuminated a disparity between how far in advance beekeepers would like to be informed of planned pesticide applications and when applicators can realistically inform beekeepers of a planned spray event. Beekeepers prefer to be informed at the beginning of the growing season, or at minimum, 48 hours in advance of the application, while applicators report that they can realistically provide 12-hours advance notification of many of their applications, especially those driven by unpredictable weather events.

State-administered apiary registration program in Michigan

Since 1993, Michigan's Apiary Law has not required beekeepers to register apiary locations. In Michigan, it is not possible for growers and applicators to know if there are managed pollinators near treatment sites, nor is it possible for growers and applicators to identify and contact beekeepers prior to pesticide applications.

There are many benefits to a state registry system, and many stakeholders indicate they feel a state registry would be useful. Feedback surveys administered by the protection plan steering committee during stakeholder meetings in 2016 reported that 86% of respondents (112 of 158) would participate in a hive reporting system, and out of the 96 beekeepers who participated in the survey, 78% (75 of 96) reported they would participate in a reporting system. However, there were serious concerns about how such a registry would be implemented.

First, beekeepers are concerned that providing apiary location information can lead to theft of colonies. Honey bee colonies are highly valuable, are placed in remote/unmonitored locations, and are designed to be easily transportable (set on pallets at places with truck access). Honey bee colonies are at risk of being stolen every year in Michigan, at considerable costs to beekeepers.

Beekeepers raised concerns related to a registration system; an open registry would serve to disclose high honey-producing areas, resulting in increased competition for resources, and competing beekeepers could move additional colonies into those regions, putting existing colonies at risk. High density of colonies reduces food availability, lowers honey crop production, and can lead to increased disease spread.

Finally, there are concerns about how use of the registry would be enforced. Considerable cost and effort of creating and maintaining a reporting system with personnel providing work and support would be required to get beekeepers registered, to keep the system updated as they move colonies, to train growers on its use, and to consistently ensure that beekeepers are, in fact, contacted using the registry with sufficient time to protect their bees from pesticide exposure.

Best Management Practices (BMPs)

Best management practices (BMPs) are methods and techniques used to achieve a desired outcome in an efficient and cost-effective manner and that are determined to be the most effective and practicable means in achieving an objective. As defined in this plan, BMPs are voluntary actions that complement regulatory label restrictions to ensure the protection of pollinators within a thriving agricultural industry in Michigan.

This Best Management Practice section of the pollinator protection plan includes general actions that can be applied in most situations to reduce pesticide risk to pollinators. These BMPs for protecting pollinators from pesticide risk include improving communication, lowering stress to bees, and taking action to reduce exposure.

Best management practices for communication

- **Find who is in your area.** It is important for growers and beekeepers to know who is in their area, and to communicate well with each other. Honey bees can fly up to 3 miles from their colonies to forage for food, so beekeepers should make an effort to connect with growers and applicators in this radius, and growers should make an effort to find beekeepers working within 3 miles of their fields.

- **Talk to each other.** Share contact information. Growers and applicators should talk to beekeepers to let them know the planned spray schedules, no matter how tentative. Beekeepers should ask growers about what chemicals will be used and when, to allow them to prepare accordingly. We recommend that growers and beekeepers continue to stay in contact over the season.

- **Notify beekeepers in the area prior to pesticide applications.** When using one of the 71 recently relabeled active ingredients, it is mandatory to notify beekeepers within a 3-mile radius of the application site at least 48 hours in advance of pesticide applications, or as soon as possible, to give adequate time for beekeepers to take action to protect their colonies. Let them know the name of the formulation, the application rate, and location of the application before it is applied. If planning on using a combination of pesticide products, be sure to communicate with beekeepers about the risks and steps to prepare for the application.

  **Note: Notifying a beekeeper about a planned application does not exempt applicators from obeying label instructions. The label is still law, and communication* *with a beekeeper does not change the requirement to follow the pesticide label. Labels that prohibit the application of the product when bees are foraging must still be followed regardless of prior notification.*

- **Use signage in fields where bees are located.** Placing signs in the fields where bees are located will alert applicators and growers that there are bees in the area. Posted contact information on colonies makes it easy for applicators to identify who needs to be notified in the event of an application, and for landowners to quickly follow up if there are any issues.

- **Communicate with renters about bee issues.** Landowners often rent their land to others for agricultural use. There should be adequate communication between the landowner and renters concerning the location of the colonies, who is responsible for contacting the beekeeper, how long bees are allowed on the property, and the beekeeper's contact information. Pesticide users are required to follow any pollinator-protective labeling.

- **Notify landowners and applicators when moving colonies.** Be sure to have clear communication and a set agreement concerning the use of apiary locations for summer honey production. It should be clear when colonies will be placed, removed, and likely returned. Make sure that these agreements are revisited and renewed often.

- **Be cognizant of neighboring landowners when placing and moving colonies.** Discuss the needs of the landowner concerning access to roads, trails, and property lines. Keep in mind that requirements might change due to weather.

- **Have a plan in place before applications occur.** Make sure you know who needs to be contacted, and the best way to reach them. Be prepared for notices of spray events and work actively to protect your bees by blocking, netting, or moving colonies when possible.

- **Communicate with pesticide applicators on whose responsibility it is to look for colonies, notify neighbors, etc.** If pesticide application is contracted, clarify who is responsible for locating apiaries and notifying nearby beekeepers of an upcoming application.

- **Establish a contract or agreement for communication.** Formal contracts, handshake agreements, or any other contract should be established to clarify expectations of hive placement locations, timeline for pollination contract (including when the colonies will be placed on the property and removed after pollination), and who to contact in the case of a pesticide application or any other issue. Elements of good pollination contracts include:
  - Explicit language for the timing of when the bees will arrive and will be expected to leave the property.
  - Where exactly the bees will be placed (with a map).
  - Which chemicals may be used during the contract period, or which chemicals may have been used immediately before the contract period.
  - Appropriate compensation arrangements.
  - Contact information for all parties.

  The University of Florida created a sample pollination agreement.

Best management practices for reducing colony stress

- **Landowners, land managers, and beekeepers should work together to choose a safe location for bees.** Bees should be placed in a location sheltered from wind, and out of the way of human activities and direct pesticide spray or drift. Proper placement of bees in areas where they are protected from extreme weather and pesticides can lead to healthier colonies and better pollination services.

- **Place colonies in fewer, larger drops.** Place colonies in larger groups strategically placed for recognition by the grower. Remember that the bees fly for long distances, and do not need to be spread through the crop fields. It is easier for the beekeeper (and less stressful for the bees) if colonies are positioned so they can be moved in and out of the location as quickly as possible. Whenever possible, locating bees at the upwind side of a crop will provide more protection from drift or direct application of pesticides.

Figure 11: Hives placed in a large drop close to the crop field. Photo courtesy of H. Chapman.

- **Ensure that consistent clean water resources are available to bees** to prevent bees from foraging for water from locations that may have been contaminated by pesticides or other dangerous chemicals. Honey bees are attracted to water with scents, and contaminated water can be a significant adverse exposure for the hive.

- **Ensure that bees remain healthy by having access to diverse and abundant food sources.** Plant or allow native vegetation to grow in areas that aren't used for crops, including cropland margins, roadsides, and personal gardens. When choosing what to plant, consider bloom times for what time of day and season plants bloom. Reduce mowing and herbicide use in field perimeters and roadsides. Allowing non-crop species to flower in field margins provides pollen and nectar resources for bees.

Best management practices for pesticide use

- **Use registered pesticides, according to the label directions.** The label is the law. The pesticide label is designed to protect the applicator, human health, the environment, and non-target organisms such as honey bees. Failure to comply with the label can put humans and the environment at risk and can lead to improper use or pest resistance to the chemicals. Many pesticides have restrictions on when the product can be used, and all applicators are bound to follow all directions, precautions, and restrictions listed on the pesticide label, even when following best management practices. Contact MDARD or MSU Extension with questions concerning pesticide use, BMPs, or label language.

- **Use Integrated Pest Management (IPM) and economic thresholds to determine if pesticides are required to manage pests.** Do not apply a pesticide unless risk models or scouting indicate that it is necessary, and the biological, cultural, and mechanical pest control options have already been implemented. When possible, select the products that are least toxic to pollinators that will complete the purpose of the application.

- **Treat any application as potentially hazardous to bees and other pollinators.** Do not go by the label alone to identify chemicals that are risky to pollinators. Many inert ingredients or chemicals without pollinator warnings (like fungicides) are known to have detrimental effects on bees but may not have any label restrictions. Treat all applications with caution to avoid any unnecessary damage to pollinators and beneficial insects.

- **Apply pesticides when bees are the least active.** When possible, apply pesticides at night, in the early morning, in the evening, or below 55° F. Bees are the most active during the daytime hours and when the temperature is over 55° F. For states that do not have a Pollinator Protection Plan in place, following this guideline is a label requirement.

- **Minimize pesticide drift.** Only apply pesticides during optimal weather conditions. Be aware of wind speed and direction, and be prepared to modify or stop applications when environmental conditions change. Use the lowest sprayer head heights possible, or direct injection to avoid drift. Be aware of temperature inversions (where the air is colder closer to the ground and warm above, opposite what usually happens) that may increase the likelihood of off-site pesticide movement.

- **Avoid applications on blooms.** Bees are more likely to be in areas with flowering plants. When possible, wait until complete petal fall to apply pesticides onto a crop. If weeds are in bloom during the time of application, mow flowering plants in fields 48 hours prior to a pesticide application. Be aware of blooms in field edges, and treat these as sensitive areas to avoid drift.

- **Simplify tank mixes.** Some chemicals can have synergistic effects when mixed together. When feasible, apply pesticides separately.

- **Utilize alternatives to talc/graphite in planters when planting coated seeds.** The talc and graphite seed lubricants can erode the insecticide from treated seeds, creating insecticide-impregnated dust that can drift onto flowering plants and colonies. If using talc or graphite planters, clean planters as far from bee colonies and/or flowering plants as possible.

- **Choose the appropriate formulation of pesticide for the required application.** Solutions, emulsifiable concentrates, and granules are more pollinator friendly because they dry quickly and do not leave large amounts of residues. Dusts and powders are more likely to be picked up by bees while they are foraging and can then be taken back to the hive and fed to larvae.

Stakeholder participation

The protection plan for pollinators in Michigan affects and is influenced by many different stakeholder groups. Beekeepers, growers, applicators, land managers, and others provided input on how pollinators can be protected from pesticide risk in Michigan. In 2015, a steering committee was established comprising of members from Michigan Department of Agriculture and Rural Development, Michigan State University Extension, and Michigan Farm Bureau. In early 2016, this steering committee organized a meeting where leaders from 78 relevant stakeholder groups were invited to learn about and participate in the development of the plan. Throughout 2016, the steering committee held seven regional stakeholder listening sessions across the state of Michigan to initiate the stakeholder participation process for feedback on what should be included in the plan. Members of the committee presented information at targeted stakeholder events including the Great Lakes Fruit, Vegetable, and Farm Market Expo; Michigan Beekeepers Association; the Michigan Commercial Beekeepers Association; multiple local beekeeping clubs; Blueberry Extension Field Day; the Michigan Tribal Environmental Group meeting; the Michigan Agricultural Aviation Association, Michigan Mosquito Control Association; and the Michigan Agri-Business Association.

For future updates on the plan, please sign up to the “pollinators & pollination” MSU Extension newsletter.

If you would like to schedule an informational meeting with your group or organization, or would like more information on the plan, please contact us at mpi@msu.edu.

Strategy

This strategy is still in development. The plan committee will be adding to it. If you or your organization has ideas of ways to reduce pesticide risk to pollinators, please include strategy elements in your comments.

The Michigan Pollinator Protection Plan is a strategy to reduce the risk of pesticides to pollinators in Michigan. The goal is to reach as many relevant stakeholders as possible and provide the necessary education, research, and resources that can help improve pollinator health. This strategy includes projects that are already in progress as well as activities that have been identified as high priority but are currently lacking resources. This document is designed to catalog and coordinate ongoing efforts as well as act as an outline to drive future work. The plan has been developed with direct input from stakeholders such as beekeepers, growers, pesticide applicators, and other related individuals and is designed to be a living document that will be reviewed and updated by the steering committee. Recommendations for activities should be emailed to the Michigan Pollinator Initiative at mpi@msu.edu.

The Michigan Pollinator Protection Plan Steering Committee proposes the following approach and outreach plan to reduce pesticide risk to pollinators in Michigan:

Proposed plans:

Action: Continue providing pollinator stewardship education and resources.

Target Population: Growers, pesticide applicators, home gardeners, and the public.

Collaborators: MSU Extension, MDARD

Specific Activities:

- Provide strategies to protect pollinators from pesticides through presentations at meetings, field days, and/or conferences
- Provide ways to support pollinator health through increasing forage
- Provide information on non-managed pollinators
- Messaging to growers about pollinator consideration with pesticide applications

Timeline: Pending funding

Expected Outcomes:

- Increased awareness of how to support/help pollinators.
- More knowledge on how growers impact pollinators.

Measurement of Effectiveness:

- Number of pamphlets/resources distributed at events.
- Number of listeners/attendees.

Funding Amount Needed: ***

Budget Justification:

Contact Person: ***

Status/Comments: ***

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Expected Outcomes:

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- More knowledge on how growers impact pollinators.

Measurement of Effectiveness:

- Number of pamphlets/resources distributed at events.
- Number of listeners/attendees.

Funding Amount Needed: ***

Budget Justification:

Contact Person: ***

Status/Comments: ***

Action: Provide information on how to keep honey bees healthy

Target Population: Beekeepers

Collaborators: MSU Extension, MDARD

Specific Activities:

- Deliver education to beekeepers on colony management and health.
- Provide resources on proper use of pesticides and medication applied to hives.

Timeline: Pending funding

Expected Outcomes:

- More knowledge is provided to beekeepers on honey bee health.
- Increased awareness of proper use of pesticides/hive medications.

Measurement of Effectiveness:

- Number of attendees/listeners.
- Number of clicks on MSU Extension articles and links.

Funding Amount Needed: ***

Budget Justification: Support for extension and trainers.

Contact Person: ***

Status/Comments: ***

Action: Help investigate honey bee colony health issues

Target Population: Beekeepers

Collaborators: MSU Extension, MDARD

Specific Activities:

- MSU trips to visit beekeepers who are concerned about pesticide kills or other colony health issues.
- Provide pesticide testing for cases of suspected pesticide kills/exposure.

Timeline: Pending funding

Expected Outcomes:

Measurement of Effectiveness:

- Number of requests from beekeepers for hive health issue concerns.
- Number of pesticide tests performed.

Funding Amount Needed: ***

Budget Justification: Support for Extension and testing.

Contact Person: ***

Status/Comments: ***

Ongoing plans:

Action: Incorporate pollinator protection language in state pesticide certification study manuals and certification exams. Because these exams are required for all initially certified pesticide applicators, this would help ensure that each applicator has at least a minimum of knowledge regarding pesticide risk to pollinators.

Target Population: Certified pesticide applicators

Collaborators: Michigan State University Pesticide Education office, MDARD Certification Exam Committee

Specific Activities:

- Establish a baseline for data to be collected prior to implementation.
- Identify individuals responsible for study manual updates.
- Identify reprinting/updating timeline.
- Develop questions /specific language for manuals.
- Edit and revise information.
- Review at reprinting.
- Create and incorporate pollinator protection-related questions into pesticide certification exams.
- Identify mechanism for following up with exam responses.

Timeline: Pending funding

Expected Outcomes:

*** All initially certified pesticide applicators would read information about pollinators.

- Proportion of pollinator-related questions that are answered correctly.

Measurement of Effectiveness:

- Measure number of individuals who are certified with new information.
- Monitor responses to pollinator protection related question on exams.

Funding Amount Needed: ***

Budget Justification: Hourly support for development of questions and logistics for implementation

Contact Person: Pesticide Applicator Certification Program Specialist

Status/Comments: Relevant manuals (reprinted about every two years) for pollinator protection inserts include:

- 1A- Field crop pest management
- 1B – Vegetable pest management
- 1C – Fruit pest management
- 3A – Turfgrass pest management
- 3B – Ornamental pest management
- 6 - Right of way pest management

Action: Incorporate pollinator protection education into training programs offered to pesticide applicators.

Target Population: Commercial pesticide applicators

Collaborators: Pesticide educators, MSU Extension, MDARD

Specific Activities:

- Establish a baseline for data to be collected prior to implementation.
- Develop educational materials for distribution at educational training programs.
- Provide online resources and training for extended availability of materials.
- Train extension officers to give presentations at applicator training programs.

Timeline: Pending funding

Expected Outcomes:

- Increased awareness of pollinator pesticide risk reducing methods
- Broader reach for pesticide applicator trainings

Measurement of Effectiveness:

- Results for pollinator questions on certification exams

Funding Amount Needed: ***

Budget Justification: Hourly support for education extension officers and trainers

Contact Person: MDARD: Recertification by Seminar Program Specialist. MSUE:

Status/Comments:

Action: Incorporate information related to pesticide toxicity, pollinator protection, and pollinator habit into crop production manuals and industry training activities.

Target Population: Commercial pesticide applicators

Collaborators: MSU Extension, the MSU Pesticide Education

Specific Activities:

- Develop materials to incorporate into manuals and training activities
- Implement materials into handouts and training session handouts

Timeline: Pending funding

Expected Outcomes:

- Broader scope for pesticide risk awareness materials
- Deeper understanding of pesticide use and availability of management options

Measurement of Effectiveness:

- Number of link clicks and downloads of information off of extension websites
- Number of pamphlets distributed at training activities

Funding Amount Needed: ***

Budget Justification: Hourly support for education and extension officers and trainers

Contact Person: ***

Status/Comments:

Action: Develop and maintain presentations and webinars on pesticides and pollinators that can be applied to for applicator credits.

Target Population: Commercial applicators

Collaborators: MSU extension, MDARD

Specific Activities:

- Develop and maintain zoom webinars for informational reference and make available on IPM and MSU websites
- Identify websites that could host pollinator and pesticide awareness information with high audience
    - DriftWatch
- MSU IPM Program
- Organize pollinator awareness talks for credits

Timeline: Pending funding

Expected Outcomes:

- More information accessible to applicators not able to make meetings
- Increased participation of applicators in pollinator awareness courses

Measurement of Effectiveness:

- Number of credits given for pollinator trainings

Funding Amount Needed: ***

Budget Justification: Support for trainers and extension

Contact Person: MDARD: Recertification by Seminar Program Specialist. MSUE:

Status/Comments:

Action: Create outreach material and newsletters to be distributed through social media to educate on proper use of pesticides and management options.

Target Population: Non-commercial applicators, homeowners, landowners

Specific Activities:

- Develop articles as needed to publish and send out via:
    - MSU extension newsletters

    - Listservs
    - MSU IPM and Agriculture websites
    - Magazines and newspapers
        - Michigan Nature Conservancy

Timeline: Pending funding

Expected Outcomes:

- Increased awareness of pesticide use and alternative options

Measurement of Effectiveness:

- Number of website clicks/ downloads
- Number of website visits

Funding Amount Needed: ***

Budget Justification: Support hourly extension efforts

Contact Person: ***

Status/Comments:

Action: Provide training short courses for general public at garden centers and pesticide distribution locations.

Target Population: Homeowners, landowners, beekeepers, non-commercial applicators

Collaborators: MSU Extension Consumer Horticulture Team, home centers,

Specific Activities:

- Provide informational sessions/ classes at garden centers for customers
    - e.g., Fruit Basket Flower Land in GR (radio show)
    - English Gardens (east side of state)
- Develop/ participate in radio talks
    - Farm Radio Network
    - Morning news

Timeline: Pending funding

Expected Outcomes:

- Higher exposure

- Increased awareness of pesticides and pollinator habitats

Measurement of Effectiveness:

- Number of listeners/ attendees

Funding Amount Needed: ***

Budget Justification: Support for extension and outreach

Contact Person: ***

Status/Comments:

Action: Collaborate with Master Gardeners for pesticide use trainings.

Target Population: Gardeners, homeowners

Collaborators: MSU Extension, Master Gardeners

Specific Activities:

- Present at Landscaping conferences
- Offer Continuing education credits
    - Kent, Genesee, Kalamazoo apprentice programs
- Host workshops through the master gardeners

Timeline: Pending funding

Expected Outcomes:

- Resources available to home gardeners

Measurement of Effectiveness: *

Funding Amount Needed: ***

Budget Justification: Support for trainers

Contact Person: ***

Status/Comments:

Action: Develop a certification program for pollinator educators.

Target Population: Homeowners, gardeners

Collaborators: MAEAP, train the pollinator-educator program, SMART gardening program

Specific Activities:

- Develop a series of training modules that cover the main points of this Pollinator Protection Plan, and information on pollinators and pollinator health issues. Align it for a gardener/general public audience.

Timeline: Pending funding

Expected Outcomes:

- Greater ability to disseminate messages about pollinator management and conservation to a broad range of Michigan citizens.

Measurement of Effectiveness:

- Number of trained educators, number of people receiving this information

Funding Amount Needed: Full time pollinator outreach coordinator

Budget Justification: $60k per year for 3 years

Contact Person: ***

Status/Comments:

A. Roadsides, right of ways. Develop standard management protocols and share these with the road commissions. Adoption would be enhanced by a mandate to state and county road commissions to incorporate pollinator health and health management into their activity plans
   a. Field margins. Need information on how to establish and maintain plantings. Need economic data to show the cost of using field edges and marginal lands for pollinator habitat, and the return on investment.
   b. Urban environments. Need to work through master gardeners and urban offices (City foresters, parks commissions) to address the opportunity to incorporate community owned lands into a pollinator habitat strategy.
   c. State lands/ natural areas. Same as a. and c. above but on state owned property.

B. Crop BMP's
   a. Develop information specific to crops with a historic risk of pesticide exposure/ require pollination via honey bees
      i. Specific management techniques and recommendations for reducing risk
      ii. Extension specialists information listed to provide support
         1. Vegetable seed

        2. Berries
        3. Orchard crops
        4. Nursery and Christmas trees
        5. Clover seed
    b. Identify extension/ steering committee members/ specialists for each crop (DATE). Meet to develop a plan for developing and then implementing their BMP.
        i. Develop BMPs for each crop (DATE)
        ii. Obtain stakeholder review (DATE)
        iii. Release informational booklets for public use (DATE)

Action: Increase usage of educational materials on MP3 related websites.

Target Population: Beekeepers, growers, pesticide applicators, landowners/ managers, public

Collaborators: MSU MPI, MDARD

Specific Activities:

- Track use of educational materials provided in the various available formats.
- Delivering information through the web (opposed to in person at trainings) would allow the number of usages to be tracked

Timeline: Pending funding

Expected Outcomes:

- Increased awareness of resources available

Measurement of Effectiveness:

- # publications
- # attending trainings
- # visiting web or social media sites

Funding Amount Needed: ***

Budget Justification: Support for Extension and trainers

Contact Person: ***

Status/Comments:

Action: Work on outreach through the Michigan Farm News, Fruit Grower News, and Vegetable Grower News, by developing articles that speak to this topic, and at the end of the article, give resources to contact, i.e. trainers, MDARD reps, etc.

Target Population: Landscapers, landscape workers, untrained pesticide applicators, farm laborers, homeowners

Collaborators: MSU, MDARD, Pesticide Trainers

Specific Activities:

- Reach out to Amy Frankmann, Michigan Nursery Lawn and Landscape Association for outreach
- Create outreach materials including pamphlets and websites with info
- Develop signage and information packets for distribution
- Commercial, billboards, ads, etc.

Timeline: Pending funding

Expected Outcomes:

- Increased awareness of pesticide laws, rules, and proper technique
- Broader reach to previously uninformed

Measurement of Effectiveness:

- Pre and post surveys on awareness of pesticide impact on pollinators and correct use

Funding Amount Needed: Hourly support for trainers and Extension workers

Budget Justification: Support for trainers

Contact Person: *

Status/Comments:

Action: Develop a trifold brochure on Pesticide Risk to Bees to be positioned at areas where crop protection materials are purchased.

Target Population: Untrained pesticide applicators, farm laborers, landscape workers, homeowners

Collaborators: MSU, MDARD, Commodity group executives, chemical distributers, Michigan CCA group, Agribusiness- MABA, Conservation Districts, Master Gardeners

Specific Activities:

- Develop trifold brochures to distribute at Big Box stores
- Identify locations that sell pesticides to homeowners
- Translate the training materials into Spanish to reach under- represented groups on pesticides and pollinators and reach out to them using MSU Extension.

Timeline: Pending funding

Expected Outcomes:

- Resources available to home gardeners
- Wider reach for materials

Measurement of Effectiveness: ***

Funding Amount Needed: ***

Possible funding option:

- Explore potential for FFAR funding
- SCBG funding

Budget Justification: Support for trainers

Contact Person: ***

Status/Comments:

Element 7. Assessment

As the Michigan Pollinator Protection Plan is released and disseminated to the broad range of stakeholders across Michigan, it will be important to measure the impact of this plan. We will conduct annual surveys of stakeholders using a specific survey (see below) and will track some additional metrics to determine adoption of practices to support improved pollinator health.

Dissemination of the plan

This document is posted at MDARD and MSU websites. Traffic at those websites and downloads of the PDF of this document will be recorded and reported annually. Additionally, members of the steering committee will record the number of attendees at events where the plan is discussed and distributed.

Grower surveys

A survey of Michigan blueberry growers was conducted in 2013 by USDA-NASS in collaboration with the Integrated Crop Pollination project to better understand grower activities related to bee protection and conservation and results are posted online in the The Michigan Blueberry Grower Survey Report. A total of 240 responses were obtained for this survey. These help form baseline measurements for grower adoption of practices related to bees and their perception of different options. Future surveys like this can be run in a range of crops that are dependent on pollinators.

Appendix I: Progress made on the Michigan Pollinator Protection Plan

Pollinator education for home gardeners and the public

MSU supports efforts of gardeners and the public who work to improve pollinator health by learning about pollinators, planting flowers for pollinators, and minimizing pesticide exposure.

Pollinator Champions online course

MSU provides information to pollinator enthusiasts, home gardeners, and the public through its Pollinator Champions online course. In this free, self-paced course, individuals learn about the pollinators in Michigan, why pollinators are important, and what you can do to help pollinators. There is also an option where individuals can become Certified Pollinator Champions, and receive PowerPoint slides and handouts so they can provide education to others in their area.

Webinars and videos on supporting pollinators

MSU recorded several live webinars on pollinator diversity and planting for pollinators, which can be found on the Michigan State University Beekeeping YouTube Channel:

- Large-scale Pollinator Habitat: Seed a Legacy Program
- Flowering Bee Lawns with James Wolfin
- Michigan Bee Plants with Dr. Zachary Huang
- The buzz about native bees with Dr. Michelle Fearon
- Native bees of Michigan with Dr. Rebecca Tonietto
- Pollinator Habitat: Making Every Acre the Best it can be

Case study articles on establishing large-scale pollinator habitat

Many people are interested in establishing large-scale pollinator habitats but don't know where to start. MSU published case articles that provide examples of experiences and funding to incorporate pollinator habitat on multiple acres.

- A refuge for pollinators: A case study of establishing large-scale pollinator habitat on marginal farmland using federal funds
- Pocket of paradise: A second case study of establishing large-scale prairie plantingv
- Somewhere for the pollinators to go: A case study of establishing large-scale pollinator habitat
- USDA funds available to establish pollinator habitat on your land

Pollinator handouts and resources

More information on planting for pollinators is available from Michigan Pollinator Initiative resources on pollinator plantings. Home gardeners can learn how to interpret pollinator information on pesticide labels in the Bee Aware brochure. MSU also maintains a website with local contacts and resources for implementing and maintaining pollinator habitat.

MSU printed handouts about supporting pollinators for in-person events and fairs in collaboration with the Michigan State University Extension Master Gardener Smart Gardening program. MSU also printed educational signs for pollinator gardens, including a new sign on pollinator protection in home gardens.

Pollinator stewardship information for growers

MSU provides crop-specific recommendations to growers about pollinator stewardship and pesticide use.

Pollinator stewardship guides

As part of the Michigan Managed Pollinator Protection Plan, MSU collected input from stakeholders to develop the Blueberry Pollinator Stewardship Guide and Vegetable Pollinator Stewardship Guide (also available in Spanish: Guia del Cuidado de Polinizadores de Arándano and Guía para la Gestión de Polinizadores de Hortalizas). Printed copies of the pollinator stewardship guides, along with other handouts on supporting pollinator health, were made available to growers at the Great Lakes Fruit, Vegetable, and Farm Market Expo.

MSU Extension also wrote an article for growers to consider pollinator supportive trees and shrubs for farm and orchard windbreaks to increase pollinator habitat on their farms.

Honey Bee Health Coalition Bee Integrated Demonstration Project videos

The Honey Bee Health Coalition's Bee Integrated Demonstration Project featured Michigan beekeepers and growers in videos highlighting good communication to support pollination and pollinator health.

Honey Bee Health Coalition steering committee member

Michigan State University Extension is a member of the Honey Bee Health Coalition. In spring 2022, the coalition's steering committee meeting was held in Traverse City, Michigan. Members discussed resources and initiatives to improve honey bee health.

Pollinator protection education for pesticide applicators

Presentations at pesticide recertification credit clinics

MSU has provided pollinator education at certified pesticide education clinics since 2015, both independently and with collaboration with Michigan Nursery and Landscape Association.

Pollinator appendix in the Michigan Core Applicator Manual

MSU wrote an appendix for the Michigan Commercial Applicator Core Manual in 2019 so that people preparing for pesticide applicator certification can learn about pollinators, pollinator health, and ways to reduce pesticide exposure. MSU shared this chapter with other states so that they can incorporate similar information into their training programs for pesticide applicators.

National Managed Pollinator Protection Plans Working Group

MSU received annual grants 2020-2023 from the North Central Integrated Pest Management Center to coordinate the national Managed Pollinator Protection Plans Working Group of individuals working on managed pollinator protection plans (MP3s) and related pollinator stewardship initiatives. This group contains members from 20 states and aims to share resources, support states that are drafting or implementing managed pollinator protection plans, and develop pollinator protection educational materials for certified pesticide applicators.

The working group developed a presentation called Getting Tough on Pests and Going Soft on Pollinators to give to pesticide applicators. Educators who train pesticide applicators at recertification credit clinics can request a scripted presentation and a handout on pollinator protection by contacting Ana Heck.

The working Managed Pollinator Protection Plans Working Group also developed an online course called Pollinator Protection for Pesticide Applicators. Upon course completion, certified pesticide applicators in Michigan can request one restricted use pesticide (RUP) credit (categories 1A, 1B, 1C, 7A, Commercial Core or Private Core). The group also created a version of the course called Pollinator Protection for Land Managers, which offers an RUP credit (categories 2, 3A, 3B, 6, & 7A, Commercial Core or Private Core).

Michigan Department of Agriculture & Rural Development Inspectors

MSU led in-hive trainings with inspectors from Michigan Department of Agriculture & Rural Development who work with honey bees and beekeepers.

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Appendix II: How to report a pesticide-related bee kill

Report all suspected pesticide-related bee kills to the state pesticide program immediately. Regularly inspect your bees' behavior and overall health. If you suspect that your colonies have been exposed to pesticides that are toxic to bees, report the case to the Michigan Department of Agriculture and Rural Development, Pesticide & Plant Pest Management Division at (800) 292-3939.

In the event of a pesticide-related bee kill incident, it is important to report to the EPA and your state lead pesticide agency. The Honey Bee Health Coalition compiled a quick guide to reporting a pesticide-related bee kill incident:

1. Contact your state lead pesticide agency to begin investigation and determine when the inspector will come to your site. If you do NOT want to begin an investigation, you should still collect information and file a report with the EPA (see below).
   a. **Lead Pesticide Agency in Michigan**

      Michigan Department of Agricultural and Rural Development,

      Pesticide and Plant Pest Management Division

      (800) 292-3939
   b. File a report with the EPA through the National Pesticide Information Center (NPIC) web portal for the Ecological Pesticide Incident Reporting or by sending an email directly to beekill@epa.gov
2. Take photos/videos of the honey bees and incident area; record as much information as possible on conditions surrounding the loss.
3. Consider collecting your own evidence for analysis by a private laboratory (i.e. pollen, comb, leaves or blooms from the plant on which bees are foraging). For details on how to collect samples and what labs to send your evidence for analysis, visit the Pollinator Stewardship Council website on "Report a Bee Kill."
4. Contact the grower and/or applicator and determine what product(s) were applied.
5. If a particular product is suspected, contact the manufacturer of the product by using the toll-free number provided on the product label, report the incident, and determine if and when they will visit the site of the incident.
6. Meet with your MDARD inspector; meet with the manufacturer (if applicable).
7. Follow up with the lab to secure reports from the analysis of your own samples, and those evidence samples collected by the state (if available),

and the manufacturer.

8. Consider contacting the Pollinator Stewardship Council for assistance in filing a report with the EPA (Honey Bee Health Coalition, 2016

Appendix III: Additional resources

Results from stakeholder listening sessions and survey questionnaires highlighted future areas of consideration to address. Below you can find links to web resources for future reference.

MSU Extension resources

- Resources for:
    - Fruit
    - Vegetables
    - Field Crops
    - Christmas Trees
- MSU's IPM page
- E- 154 Pest Management Guide
- Minimizing pesticide risk to bees in fruit crops

Laws and Regulations for keeping bees in Michigan

- Starting and keeping bees in Michigan: Rules and Regulations.
- Michigan The law and regulations governing pesticide use in the state can be reviewed at the Michigan Department of Agriculture and Rural Development website.

General resources

- Michigan GAAMPS for beekeeping
- Apiary Law Act 412 of 1976

EPA documents

- EPA proposal to protect bees from acutely toxic pesticides
- EPA pesticide labeling Q&A
- National Honey Bee Health Stakeholder conference 2012
- Risk Assessment for Bees
- White Paper in Support of the Proposed Risk Assessment Process for Bees

- Guidance for Assessing Pesticide Risks to Bees
- U.S. Environmental Protection Agency's Policy to Mitigate the Acute Risk to Bees from Pesticide Products
- EPA info on the Bee Advisory Box

Pesticide use in Michigan is regulated under the Natural Resources and Environmental Protect Act, Act 451 of 1994 as amended, Part 83 Pesticide Control, and the regulations authorized by the act. Part 83 defines terms such as certified applicator, commercial applicator and private applicator, and identifies the responsibilities of each person that uses pesticides in the state of Michigan.

- Natural Resources and Environmental Protection Act 451 of 1994

Pollinator Protection Plan links

Listening session report – online.

- MSU Pollinator Website
- MDARD Website
- SFIREG Guidance for the development and implementation of managed pollinator protection plans
- Association of American Pesticide Control Officials Pollinator Protection

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