THE CITY OF LAKE ELMO

STAFF REPORT

DATE: July 18, 2017
REGULAR
ITEM #: 23

AGENDA ITEM: Bee Safe Resolution Amendment and Integrated Pest Management Plan
TO: Mayor and City Council
SUBMITTED BY: Kristina Handt, City Administrator

BACKGROUND:

In 2015, the City Council adopted a Bee Safe City Resolution that listed the following actions:

1. The City shall undertake its best efforts to become a Bee-Safe City by undertaking the best management practices in the use of plantings and pesticides in all public places within the City.
2. The City shall refrain from the use of systemic pesticides and systemic insecticides on City owned property including pesticides from the neonicotinoid family.
3. The City shall undertake its best efforts to plant flowers favorable to bees and other pollinators in the City's public spaces.
4. The City shall designate Bee-Safe areas in which future City plantings are free from systemic pesticides including neonicotinoids.
5. The City shall undertake its best efforts to communicate to Lake Elmo residents the importance of creating and maintaining a pollinator-friendly habitat.
6. The City shall publish a Bee-Safe City Progress Report on an annual basis.

Last year the Environmental Committee began discussing things they could do to meet those actions listed in the resolution. At their April and May meetings, the Environmental Committee heard about pollinator friendly practices and began work on developing an Integrated Pest Management Plan (IPM). They reviewed IPMs from the Pollinator Friendly Alliance and Washington County. They also did additional research on their own and in consultation with University of Minnesota staff.

The Council adopted the IPM at the June 20th meeting but requested the items be placed on a work session agenda for further discussion. These items were discussed at the July 11th work session.

ISSUE BEFORE COMMITTEE:

Should the Council amend or repeal the Bee Safe Resolution and Integrated Pest Management Plan?

PROPOSAL DETAILS/ANALYSIS:

Staff has drafted an amended resolution to remove the "systemic pesticides" as that was the language creating confusion for staff. As we heard from Laurie Schneider of the Pollinator Friendly Alliance, the only systemic pesticides are systemic insecticides.

FISCAL IMPACT:
NA

OPTIONS:

1) Approve the amended Resolution No 2017-80
2) Approve the amended Resolution No 2017-80 and repeal the IPM
3) Repeal the Bee Safe Resolution No 2015-13 and the IPM

RECOMMENDATION:
Motion to approve Resolution No 2017-80

ATTACHMENTS:

- Amended Resolution for Bee Safe Policies-redlined version
- Lake Elmo IPM

CITY OF LAKE ELMO
WASHINGTON COUNTY
STATE OF MINNESOTA

RESOLUTION NO. 2017-80

A RESOLUTION ENDORSING "BEE-SAFE" POLICIES AND PROCEDURES

WHEREAS, the City of Lake Elmo Park Commission is dedicated to the protection of pollinators and to promoting a healthy natural environment through the reduction and elimination of harmful pesticides; and

WHEREAS, bees and other pollinators are integral to a wide diversity of essential foods including fruit, nuts, and vegetables; and

WHEREAS, native bees and honey bees are threatened due to habitat loss, pesticide use, pathogens and parasites; and

WHEREAS, recent research suggests that there is a link between pesticides that contain neonicotinoids and the die-off of plant pollinators, including honey bees, native bees, butterflies, moths, and other insects; and

WHEREAS, neonicotinoids are synthetic chemical insecticides that are similar in structure and action to nicotine, a naturally occurring plant compound; and

WHEREAS, the City Council finds it is in the public interest and consistent with adopted City policy for the City to demonstrate its commitment to a safe and healthy community environment through the implementation of pest management practices in the maintenance of the city parks, open spaces and city property; and

WHEREAS, the City Council adopted Resolution No 2015-13 on March 3, 2015.

THEREFORE, BE IT RESOLVED THAT by the City Council of the City of Lake Elmo the following Resolution No 2015-13 be amended as follows:

1. The City shall undertake its best efforts to become a Bee-Safe City by undertaking the best management practices in the use of plantings and pesticides in all public places within the City.
2. The City shall refrain from the use of ~~systemic pesticides and~~ systemic insecticides on City owned property including pesticides from the neonicotinoid family.
3. The City shall undertake its best efforts to plant flowers favorable to bees and other pollinators in the City's public spaces.
4. The City shall designate Bee-Safe areas in which future City plantings are free from systemic pesticides including neonicotinoids.
5. The City shall undertake its best efforts to communicate to Lake Elmo residents the importance of creating and maintaining a pollinator-friendly habitat.
6. The City shall publish a Bee-Safe City Progress Report on an annual basis.

NOW, THEREFORE, BE IT RESOLVED THAT the City Council does hereby approve the Bee-Safe Ordinance for the City of Lake Elmo.

Passed and duly adopted this 18th day of July, 2017 by the City Council of the City of Lake Elmo, Minnesota.

_____
Mike Pearson, Mayor

ATTEST:

_____
Julie Johnson, City Clerk

Integrated Pest Management Plan

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Introduction

As of March 3, 2015 the City of Lake Elmo has been declared a Bee-Safe City. The use of any pesticide that adversely affects pollinators is prohibited in any of the city's land including parks, roadways, and facility grounds.

Integrated Pest Management (IPM) is a system that establishes a sustainable approach to managing pests by combining cultural, mechanical, physical, biological and chemical tools to eliminate or mitigate economic, environmental and health damage caused by pests. IPM minimizes the use of pesticides and the risk to human health and the environment associated with pesticide applications. This system uses integrated methods, site or pest inspections, pest population monitoring, evaluations of the need for pest control, plus one or more pest control methods such as sanitation, structural repairs, both mechanical and living biological controls, and many other non-chemical methods. If nontoxic options are deemed unreasonable and have been exhausted, then resort to the least toxic pesticides.

The objective of this IPM plan is to:

- Identify cultural, mechanical, physical, biological and chemical control methods to manage noxious plants and pests.
- Identify cultural, mechanical, physical, biological and chemical control methods for maintenance practices including: parking lot and pavement preservation, trail maintenance, ROW maintenance and ecological restoration practices.

IPM Coordinator

The IPM Coordinators are the Planning Director for new developments and the Public Works Director for existing city facilities. The IPM Coordinators are responsible to implement the IPM plan and to coordinate pest management-related communications. The IPM Coordinators will review annually and update the IPM program.

Pest Definition

The primary focus of the IPM is an integrated approach for managing pests. For our purposes, a pest is an organism considered injurious or unwanted by humans. This can include, but not limited to groups, including animals, plants, fungi, and viruses.

IPM Decision Making Strategy

An Integrated Pest Management decision shall consist of the following steps:

1. Identify noxious plant/pest species
2. Monitor and assess the action levels of pests
3. Select the appropriate management methods based on current on-site information

4. Record keeping
5. Assess effectiveness of pest management
6. Tactics for future prevention
7. Further evaluation

1. Identify noxious plant/pest species
Proper and accurate ID of pests is essential for choosing the appropriate control method.

2. Monitor and asses action levels of pests
Some pests and plants can be tolerated at low levels. Monitoring on a regular basis ensures staff is taking action when an action threshold has been reached.

3. Select the appropriate management methods based on current on-site information
Decisions concerning whether or not pesticides should be applied in a given situation will be based on a review of all available options. Efforts will be made to avoid the use of pesticides by adequate pest proofing of facilities, beneficial sanitation practices, selection of pest-resistant plant materials, and appropriate horticultural practices.

When it is determined that a pesticide must be used in order to meet pest management objectives, the least-hazardous material will be chosen. The types of control methods are listed in the next section.

No person shall apply, store, or dispose of any pesticide on without being trained with the Public Works Department's Pesticide/Herbicide Safety training.

4. Record keeping
A record keeping system is essential to establish trends, patterns, and thresholds in pest outbreaks. Information recorded at every inspection or treatment should include pest identification, population size, distribution, recommendations for future prevention, and complete information on the treatment action. Records will be maintained for two years.

5. Assess effectiveness of pest management
Using the records kept by Park staff, and recent monitoring feedback, the IPM coordinator will review the management method used and decide if the method is producing the wanted outcome. If not, the IPM coordinator and staff will develop a new strategy to combat the pest at hand. Only after all IPM methods are expelled will the use of pesticide be necessary.

6. Tactics for future prevention
Prevention is the primary means of this, and any IPM program. Weed and pest problems can be largely avoided by careful design, soil preparation, proper planting/irrigation, and mulching practices. Park staff will use preventative actions to reduce conditions that attract pests to both the facility grounds and buildings. Finalized preventative measures will be incorporated into future and existing structures and designs.

7. Further evaluation

The Environmental Committee will review the IPM program annually to gauge the effectiveness and efficiency of the program. Updates and renovations will be added to the preceding year's IPM.

Control Methods

Once the decision making strategies have been considered and a pest has reached an action threshold, below are types of control methods to consider. These control methods are listed in order of most desirable #1 cultural control, to least desirable #5 chemical control.

***1. Cultural control**:*

-Selecting resistant species
-Proper planting and watering techniques
-Ensure healthy soil by using organic soil amendments such as compost
-Habitat modification

***2. Mechanical control**:*

-Mowing, cutting and pruning
-Mulching
-Hand pulling
-Hand torches/Flamers
-Sanitation practices

3. Physical control:

-Over-seeding
-Thinning plant canopy
-Tree tubes for young trees

4. Biological control:

-Enhancement of favorable environment for natural enemies of pests
-Introduction of native predators
-Use of natural grazers such as goats, sheep, cattle and bison

5. Chemical control:

-Only after exhausting non-chemical control methods
-IPM coordinator must approve and decide on the least toxic chemical to be used

Pesticide Application and Training

The Public Works Director shall be responsible for distributing a pesticide application training document and record keeping documents for staff using pesticides on public

property. Applicators must have the appropriate Minnesota Department of Agriculture pesticide license.

Plant-specific strategies for Minnesota noxious weeds

Minnesota State Statute 18.75 provides a list of plant species that required to be controlled due to their aggressive nature, and potential to cause economic damage to landowners. The City of Lake Elmo uses this list to prioritize control efforts throughout the parks. A description of each species and control methods are described below.

1. Eradicate List

Prohibited noxious weeds that are listed to be eradicated are plants that are not currently known to be present in Minnesota or are not widely established. These species must be eradicated, meaning all of the above and below ground parts of the plant must be destroyed, as required by Minnesota Statutes, Section 18.78. Additionally, no transportation, propagation, or sale of these plants is allowed. Measures must also be taken to prevent and exclude these species from being introduced into Minnesota.

a. Common teasel (*Dipsacus fullonum*)
b. Cut-leaved teasel (*Dipsacus laciniatus*)
c. Dalmatian toadflax (*Linaria dalmatica*)
d. Giant hogweed (*Heracleum Mantegazzianum Sommier* and *Levier*)
e. Grecian foxglove (*Digitalis lanata*)
f. Japanese hops (*Humulus japonicas Siebold* and *Zucc*.)
g. Oriental bittersweet (*Celastrus orbiculatus*)

Mechanical Control:
Small infestations can be hand-pulled, but the entire plant and roots should be removed.

Biological Control:
Goats can be used to suppress re-growth of plants which have been cut.

Chemical Control:
Foliar treatment of Bittersweet can be done with a 2% solution of triclopyr amine (Garlon 3a) mixed in water with a non-ionic surfactant (.5%) to the leaves. (8 oz per 3 gal. mix).

Cut –stem treatment can be done with a 25% mix of triclopyr amine (Garlon 3a) and applied to the stem.

h. Yellow starthistle (*Centurea solstitialis*)

2. Controlled List:

Prohibited noxious weeds listed to be controlled are plants established throughout Minnesota or regions of the state. Species on this list must be controlled, meaning efforts must be made to prevent the spread, maturation and dispersal of any propagating parts, thereby reducing established populations and preventing reproduction and spread as required by Minnesota Statutes, Section 18.78. Additionally, transportation, propagation, or sale of these plants is prohibited.

a. Common Barberry, *Berberis vulgaris L.*
b. Narrowleaf Bittercress, *Cardamine impatiens L.*
c. Plumeless Thistle, *Carduus acanthoides (L.)*
d. Spotted Knapweed, *Centaurea stoebe spp. micranthos*
e. Canada Thistle, *Cirsium arvense (L.) Scop.*
f. Leafy Spurge, *Euphorbia esula (L.)*
g. Purple Loosestrife, *Lythrum salicaria, virgatum (L.)*
h. Wild Parsnip, *Pastinaca sativa L. (Except for non-wild cultivated varieties)*
i. Common Tansy, *Tanacetum vulgare (L.)*

3. Restricted List:

Restricted noxious weeds are plants that are widely distributed in Minnesota and are detrimental to human or animal health, the environment, public roads, crops, livestock or other property, but whose only feasible means of control is to prevent their spread by prohibiting the importation, sale, and transportation of their propagating parts in the state except as allowed by Minnesota Statutes, Section 18.82. Plants designated as Restricted Noxious Weeds may be reclassified if effective means of control are developed.

a. Tree of Heaven, *Ailanthus altissima (Mill.) Swingle*
b. Garlic Mustard, *Alliaria petiolata (Bieb.)*
c. Porcelain Berry, *Ampelopsis brevipedunculata (Maxim.) Trautv.*
d. Crown Vetch, *Securigera varia (L.) Lassen - formerly Coronilla varia L.*
e. Wild Carrot / Queen Anne's Lace, *Daucus carota L.*
f. Glossy Buckthorn (and all cultivars), *Frangula alnus Mill. (columnaris, tallcole, asplenifolia and all other cultivars)*
g. Amur Honeysuckle, *Lonicera maackii (Rupr.) Herder*
h. Morrow's Honeysuckle, *Lonicera morrowii A. Gray*
i. Bell's Honeysuckle, *Lonicera x bella Zabel*
j. Common Reed - non-native subspecies, *Phragmites australis subspecies australis (Cav.) Trin. ex Steud.*
k. Common or European Buckthorn, *Rhamnus cathartica (L.)*
l. Black Locust, *Robinia pseudoacacia L.*
m. Multiflora Rose, *Rosa multiflora Thunb.*
n. Tatarian Honeysuckle, *Lonicera tatarica L.*

* For photos of noxious weeds visit:
https://www.mda.state.mn.us/plants/pestmanagement/weedcontrol/noxiouslist.aspx

4. Specially Regulated Plant List:

Specially regulated plants are plants that may be native species or have demonstrated economic value, but also have the potential to cause harm in non-controlled environments. Plants designated as specially regulated have been determined to pose ecological, economical, or human or animal health concerns. Plant specific management plans and or rules that define the use and management requirements for these plants will be developed by the Minnesota Department of Agriculture for each plant designated as specially regulated. Measures must also be taken to minimize the potential for harm caused by these plants.

a. Poison Ivy, *Toxicodendron radicans (L.) Kuntze & T. radicans (Small) Green*
Must be eradicated or controlled for public safety along rights-of-ways, trails, public accesses, business properties open to the public or on parts of lands where public access for business or commerce is granted. Must also be eradicated or controlled along property boarders when requested by adjoining landowners.

b. Japanese Knotweed, *Polygonum cuspidatum Seib. & Zucc. Synonym as Fallopia japonica (Houttuyn) Ronse-Decraene*

c. Giant Knotweed, *Polygonum sachalinense F. Schmidt ex Maxim. Synonym: Fallopia sachalinensis (F. Schmidt) Ronse-Decraene*
Any person, corporation, business or other retail entity distributing Japanese and/or giant knotweeds for sale within the state, must have information directly affixed to the plant or container packaging that it is being sold with, indicating that it is unadvisable to plant this species within 100 feet of a water body or its designated flood plain as defined by Minnesota Statute 103F.111, Subdivision 4.

d. Japanese Barberry, *Berberis thunbergii DC.* Phase-out of seediest varieties listed below:
These cultivars average greater than 600 seeds per plant and will begin a three-year phase-out period in Minnesota beginning January 1, 2015.
'Anderson' (Lustre Green™); 'Angel Wings'; 'Antares'; 'Bailgreen' (Jade Carousel®);'Bailone' (Ruby Carousel®); 'Bailsel' (Golden Carousel® - B. koreana × B. thunbergii hybrid); 'Bailtwo' (Burgundy Carousel®); B. thunbergii var. atropurpurea; 'Crimson Velvet'; 'Erecta'; 'Gold Ring'; 'Inermis'; 'JN Redleaf' (Ruby Jewel™); 'JN Variegated' (Stardust™); 'Kelleris'; 'Kobold'; 'Marshall Upright'; 'Monomb' (Cherry Bomb™); 'Painter's Palette'; 'Pow Wow'; 'Red Rocket'; 'Rose Glow'; 'Silver Mile'; 'Sparkle'; 'Tara' (Emerald Carousel® - B. koreana × B. thunbergii hybrid); Wild Type (parent species – green barberry)
At the end of the phase-out period (December 31, 2017), these species will become Restricted Noxious Weeds in Minnesota and will be illegal to sell and propagate.

e. Amur Maple, *Acer ginnala Maxim*
Sellers shall affix a label that advises buyers to only plant Amur maple and its cultivars in landscapes where the seedlings will be controlled by mowing or other means. Amur maple should be planted at least 100 yards from natural areas.

Pest-Specific Strategies for Site Types

Sites types differ throughout the city and therefore require various control methods to suit their specific needs. Listed below are the site types.

1. Trails and Pathways
2. Waterways
3. Right-of-Ways
4. Landscape Beds
5. Turf Areas
6. Hard Surface Areas
7. Playgrounds
8. Natural Areas
9. No pesticide Zones

Parking lot and pavement preservation

Flame technology

Flame technology for home gardens have been around since the 1940s, and can be used on parking lot and pavement preservations to suppress vegetation growth within the cracks. Portable gas torches that produce heat above 2,000°F and can harm the vegetation structure within seconds. As the flame comes into contact with the vegetation, the heat boils the water within the plants' cells, causing the cells to burst and destroying the cell and foliage. Portable torches should be used in early spring and summer as the annual and perennial weed emerges. Controlling the vegetation at an early stage will save on time and fuel.

Proper personal protective equipment should always be worn and the manufacturer's instructions should be well understood. Torches should never be used during extreme dry periods and the area should be clear of any unwanted debris. Torches should only be used with wind speeds below 5-miles-per-hour and outside of vehicles including Kubota™, Gator™, etc. Torch control works best when the vegetation is one to two inches tall.

Warning signs should be placed at least 100 feet away from the beginning and end of the area of flame work. Flame tanks can range from 14-16oz tanks to five gallon tanks; using a larger tank does increase the time and area that can be burned. While pavement and parking lot protocols are being conducted a fire extinguisher should be within the vicinity in case the fire gets out of comfort. The operator should be wearing fire resistant gloves, long sleeve cotton shirt, long pants, and closed-toes boots. The tank hoses will vary by model. If the tank hose has a "torch bell" a hand lighter with a long neck should be used to light the torch. Do not use matches or a small lighter. Hands should not go near the end of the hose during the ignition process. Review all safety data sheets and company product protocols before going out into the field.

Safety and Protocols

Propane tanks can range from 14-16oz to five gallons using a larger tank increases the time and area that can be burned. While pavement and parking lot protocols are being conducted, a fire extinguisher should be within the vicinity in case the fire gets out of comfort. The operator should be wearing fire resistant gloves, long sleeve cotton shirt, long pants, and closed-toes boots. The tank hoses will vary by model. If the tank hose has a "torch bell" a hand lighter with a long neck should be used to light the torch. Hands should not go near the end of the hose during the ignition process.

Organic herbicide

SummerSet Alldown Concentrate is a non-selective broadcast leaf and grass herbicide with the primary active ingredients of acetic acid and citric acid. Mixing should be done away from human and vehicle traffic. Alldown should be mixed two part of chemical to one part water (2:1 ratio). Rubber gloves, protective glasses, and long sleeves should be worn while the chemical is being handled.

Pour the designated amount of chemical into the backpack sprayer, use water from the nearest hose to fill the tanks to the desired amount. The hose should NOT be placed in the tank to fill. The hose mouth should be held six to twelve inches away from the sprayer. Spraying should only occur when the temperature is between 65ºF - 90ºF for effective vegetation degradation. Spraying should be conducted with a wind speed of less than 10 miles-per-hour. Material safety data sheets should be reviewed before using the chemical.

Proper safety equipment should be worn while cleaning; i.e. safety glasses, gloves, long sleeves, and long pants. Rinsing the spraying containers, wands and nozzles should be done away from vehicle traffic, human traffic, and natural water sources. Fill the container ¼ full with water and replace cap to prime pressure. Spray diluted chemical into ground for ten seconds. All containers should be properly labelled.

Chemical Herbicide

Rodeo herbicide can be used to eradicate a broad range of invasive and native vegetation. Rodeo can be mixed in variety sizes of herbicide backpack sprayers and tank sprayers with the correct ration of Rodeo to water. It is necessary to record the; date, applier, chemical used, location; and if there was an excess amount remaining in the backpack, if a label was created for the backpack, or the backpack was rinsed three times at the end of the use in the Pesticide Application Records three ringed-binder located in the chemical room of its designated park. Spraying should be conducted with a wind speed of less than 10 miles-per-hour and should be conducted between 65ºF - 90ºF. Material safety data sheets should be reviewed before using the chemical

The chemical and water should be mixed away from human and vehicle traffic. Rubber gloves, protective glasses, and long sleeves should be worn while the chemical is being handled. Pore the designated amount of chemical into the backpack sprayer, use water

from the nearest hose to fill the tanks to the desired amount. The hose should NOT be placed in the tank to fill. The hose mouth should be held six to twelve inches away from the sprayer.

Rinsing the spraying containers, wands and nozzles should be done away from vehicle traffic, human traffic, and natural water sources. Fill the container ¼ full with water and replace cap to prime pressure. Spray diluted chemical into ground for ten seconds. Dispose of excess chemical and refill and repeat actions two more times creating a, "triple rinse". All containers should be properly labelled as "clean". If the chemical was not used or cleaned and is still in the container, a label should be placed on top of the container that has the date, chemical, and percent of chemicals (i.e. mmdd rodeo @5%).

Trail maintenance

Management of trails in regards to IPM primarily involves the removal of invasive species, unwanted native species, pesky insects, problematic small mammals, and to ensure the structural integrity of the trail itself. Park staff identify the plant in question and then assess the population at hand. Once an IPM method has been decided on and implicated, further monitoring must be done to ensure the pest is under control or eradicated.

Removal of either invasive or unwanted native species can be done by hand pulling or by using machinery. To prevent vegetative pests on trails, the depth of the trail material is monitored. Thinning trails receive new surface material to combat weed penetration. Insects and small mammal pests are deterred by introducing natural predators or the pest's natural enemies; this can be done by shaping the infected area to the wanted animal's preferred habitat. Eroding trails receive new surface material and may need plant species with extensive root systems planted along them to prevent future deterioration.

ROW maintenance

> Lake Elmo's Ordinance for the Management of Right of Ways states: "To provide for the health, safety, and well-being of its citizens, and to ensure the structural integrity of its streets and the appropriate use of the rights-of-way, the city strives to keep its rights-of-way in a state of good repair and free from unnecessary encumbrances."

Right of ways (ROW) include medians, curbsides, ditches, and landscape beds within the right of way. Since the City of Lake Elmo is a Bee-Safe City, the goal of the ROW maintenance is to provide suitable habitat for pollinators, with special emphasis on bees and monarch butterflies. This includes planting native plants in diverse and dense amounts, reducing mowing, and limiting herbicide use.

Alternative Pesticide List – 2017	
PESTICIDE OR BEST PRACTICE	**USED FOR**
Phydura – Organic (Soil Tech Corp) citric acid, malic acid, clove oil	HERBICIDE: non-selective herbicide for herbaceous broadleaf and grass weeds including garlic mustard and leafy spurge.
Scythe – Organic (DOW AgroSciences) Perlargonic acid	HERBICIDE: removes or burns waxy cuticle of green vegetation. Will not translocate. Non-selective, post-emergence for grasses and broadleaf weeds, perennial herbaceous plants. Alternative to glysophate.
White Vinegar or acetic acid (Final Stop by Dr. Earth)	HERBICIDE: Broad spectrum for weeds and grasses including poison ivy. Apply during hot sunny months.
AllDown – Organic (Summerset)	HERBICIDE: Non-selective annual broadleaf, perennial weeds and grass herbicide including Canada Thistle. Acetic acid, citric acid. Will not translocate. Alternative to glysophate.
Burn-out / Bonide – Organic (Bayer Cropscience) clove oils, citric acid	HERBICIDE: post defoliant on annual, perennial and grassy weeds. Non selective. Will kill most roots, will not translocate. Alternative to glysophate.
Corn gluten – Organic	HERBICIDE: pre-emergent herbicide for germinating weed seeds for broadleaf and grassy weeds. Often used for landscapes and gardens.
Integrated Pest Management Practices	Monitoring, identification and long term planning for insects and plants. Ground covers, biological controls, hedgerows, beetle banks, wind blocks, and hand pulling weeds. Improving soil health. Carefully planned mowing, brush hogging and management.
Fire: Flameweeding, blow torch, controlled burns	Used for weeds in crevices, along roadsides, trails. Annual controlled burns to encourage diversity and soil health.
Plant Identification charts and education: for example: Thistle (Natives: Hills, Tall, Field, Flodmans, Swamp) (Non-native: Canada, Bull, Plumeless, Musk)	Field staff may mistake native thistle for non-native. Visual field charts plus education can cut down on maintenance (State of Ohio uses this practice)
Shade cloth smother	Leave shade cloth in place for 1-2 years, remove and reseed in nutrient rich soil (State of Oregon uses for knapweed control)

Goats or sheep	For large areas that are hard to manage, wooded areas with bushes and invasives like buckthorn. Fencing can be a challenge for goats. (Washington County used for buckthorn)
Soil testing	Make soil inhospitable for undesirable plants by augmenting soil with nutrients contrary to what non native plant requires (such as magnesium)
Surround WP (Novasource) Kaolin clay	INSECTICIDE: for fruit trees, bushes and plants. Sprayed on plants, leaves a protective powdery film on surface of leaves, stems and fruit. Controls long list of insect pests on fruit trees and ornamentals. Avoid spraying on blooming flowers and pollinators. (Used extensively in South America and Africa)
Bacillus Thuringiensis (BT bacteria)	INSECTICIDE: Naturally occurring soil bacterium kills specific insect larvae like cabbage worm larvae. Can be used to target mosquito and black fly larvae.
Beneficial Insects (like hover flies, braconid wasps, tachinid flies, lacewings, lady beetles)	When scouting plants for pests, check for both pest and beneficial insects such as lady beetles and bees. If beneficial insects are present, wait to treat and see if the beneficial insects can control the pest insects.
Roadside mowing practices	Reduce mowing of roadside beyond clear zone to benefit pollinators and reduce maintenance costs. Reduce frequency of mowing (one side per year), or timing (October or later). Restore remnant habitat and existing native vegetation.
Protect pollinators. Use pesticides only when absolutely necessary. Least toxic insecticides include: boric acid, diatomaceous earth, neem oil, horticulture soap, and kaolin clay.	If pesticides are necessary, use spot treatments. Do not use systemic insecticides which are highly toxic to pollinators and stay in the plant, soil or tree. Never spray flowers or buds. Do not apply while plants are in full bloom. Spray in the evening when bees are not foraging.
Swarm Catchers: 651-436-7915	Statewide swarm rescue. Identify the insect species first if possible. Catchers will rescue and relocate honeybees, bumblebees and some native bees.
Resources: Compiled by Pollinatorfriendly.org 1/2017	www.omri.org (Organic Materials Review Institute) www.beyondpesticides.org (Pesticide Gateway found under Resources) www.pesticideinfo.org (PAN Pesticide Database) www.cdms.net/label-database (Data Logic Database)

Insecticide Toxicity to Bees: By Active Ingredient

Chemical class	Examples of common names	Examples of trade names	Toxicity			
			Non	Low	Mod	High
Carbamates	carbaryl	Sevin				x
Neonicotinoids	Imidacloprid (I) thiamethoxam (T) clothianidin (C) dinotefuran (D) imid+bifenthrin (I,B)	Nursery/landscape Merit, Marathon, Flagship, Meridian, Arena, Aloft, Safari, Allectus, Field crops: Gaucho (I), Poncho (C), Cruiser(T) (seed treatments), Admire/Provado (I), Venom (C), Platinum (T)				x
	Acetamiprid (A), thiacloprid (T)	Tristar (A), Assail (A), Calypso (T)		x		
Organophosphates	acephate, chlorpyrifos, dimethoate, malathion, phosmet	Orthene, Dursban/Lorsban, Dimethoate, Malathion, Imidan				x
Pyrethroids	bifenthrin, cyfluthrin, fenpropathrin, lambda-cyhalothrin, permethrin	Attain/Talstar, Tempo, Decathalon, Tame, Scimitar, Astro				x
Botanical	pyrethrum/pyrethrins azadirachtin, neem oil	Pyganic, Azatin, Ornazin, Triact				x
Insect growth regulators	diflubenzuron tebufenozide	Adept, Dimilin, Confirm			x	
	azadirachtin buprofezin pyriproxyfen	Aza-Direct, Azatin, Ornazin, Talus Distance		x		
	novaluron	Pedestal				x
Juvenile hormone	s-kinoprene	Enstar II		x		
Diamides	chlorantraniliprole	Acelepryn	x			
Macrocyclic lactones	abamectin/avermectin, emamectin benzoate	Avid, Tree-Age				x
Miticides	acequinocyl, extoxazole, fenpyroximate, fenbutatin-oxide	Shuttle, TetraSan, Akari,Vendex	x			
	clofentezine, hexythiazox	Ovation, Hexagon		x		
	bifenazate	Floramite			x	
	pyridaben	Sanmite				x
Spinosyns	spinosad	Conserve/Entrust, less toxic dried		x		
Tetronic acids	spiromesifen	Judo			x	
Tetramic acid derv	spirotetramat	Kontos				x
GABA-gated chloride channel	fipronil	Fipronil, Termidor,				x
Pyridine carboxamide	flonicamid	Aria	x			
Pyridine azomethines	pymetrozine	Endeavor	x			
Other insecticides	*Bacillus thuringiensis, Cydia pomonella* granulovirus	Bt/Dipel, Carpovirusine/Cyd-X	x			
	Kaolin clay, soaps	Surround, M-Pede		x		
	horticultural mineral oils	Monterey Oil			x	
	indoxacarb	Provaunt				x

- For a list of bee safe herbicides visit: http://www.medinabeekeepers.com/index.php?title=Pesticide_toxicity
- Plants and Grasses: http://cues.cfans.umn.edu/old/gervais/keytable.htm
- Additional resources: https://www.pesticideresearch.com/site/?page_id=9990
  http://pollinatorstewardship.org/?page_id=1994