DEPARTMENT OF NATURAL RESOURCES

Pollinator Best Management Practices and Habitat Restoration Guidelines

SHORT TITLE: POLLINATOR BMPs

Overview

Insect pollinators native to Minnesota include hundreds of species of bees, butterflies, moths, flies, wasps, and beetles. By moving pollen from flower to flower, pollinators aid plant reproduction and help maintain plant diversity and functional ecosystems. Many pollinator species exist on state lands and benefit from habitat enhancement and restoration activities that promote diverse plant communities. Pollinator habitat requirements include suitable areas to nest and overwinter, larval host plants, and blooming forbs that provide nectar and pollen throughout the growing season. In nearly every case, good pollinator habitat is also good habitat for game and nongame wildlife. Unfortunately, pollinators face multiple interacting threats, including habitat loss and degradation, pesticide exposure, climate change, pathogens, and low genetic diversity.

In 2013, the state legislature passed Minnesota Statutes section 84.973, requiring the Minnesota Department of Natural Resources (DNR) to "develop best management practices and habitat restoration guidelines" that "must be used for all habitat enhancement or restoration of lands under the commissioner's control." Furthermore, "[p]rairie restorations conducted on state lands or with state funds must include an appropriate diversity of native species selected to provide habitat for pollinators throughout the growing season." In 2014, DNR staff developed Operational Order 130, "Pollinator Habitat," and an associated procedural document, DNR Pollinator Best Management Practices and Habitat Restoration Guidelines ("Pollinator BMPs"). This document is an update to the latter.

This document contains best practices for ongoing management activities in any habitat type (Table 1), as well as best practices for new restoration plantings that apply particularly, though not exclusively, to grasslands (Table 2). This document also contains standard language used in grants and contracts for habitat projects on state lands or state funded prairie restoration work on any lands (Appendix 1). These BMPs do not mandate specific plant species or seed mixes in habitat restorations or enhancements; dictate management on facility-oriented lands, parking lots, or farmed fields; provide specific guidelines for species protected by state or federal law; or provide guidance for managing honey bees.

Though these general BMPs are designed to improve habitat for many species, it is important to note that any given management action will negatively impact some species and positively impact others, depending on location, method, and time of year. Insects may overwinter above or below ground as eggs, larvae, pupae, or adults (Figure 1). Many species are capable of flight in adult stage for only a short time and are immobile or less mobile the rest of the year. Therefore, the seasons during which insects are vulnerable to above-ground (e.g., fire, mowing, haying, grazing) or below-ground (e.g., digging, disking) management practices differ by species. If protected species are identified during the Natural Heritage review process, always plan activities to comply with state and federal requirements. **In cases where protected species requirements are more restrictive than these BMPs, the project manager must follow the more restrictive requirements to comply with applicable endangered species laws.**

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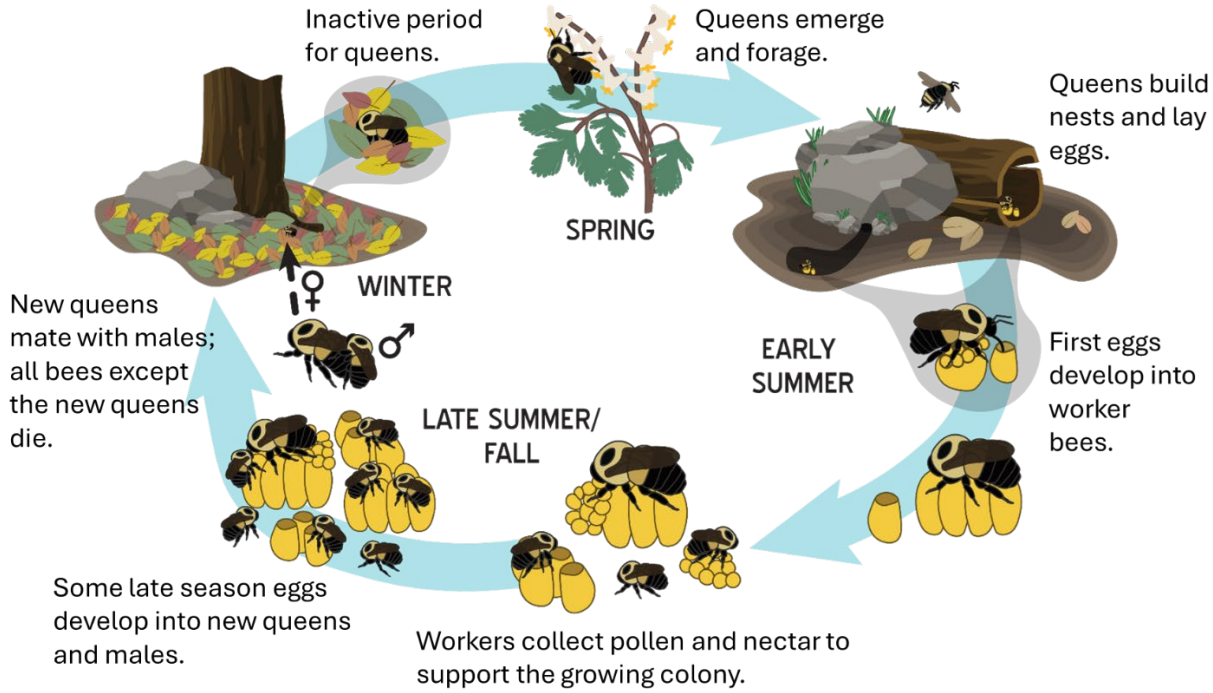
Figure 1. Example life cycles

Bumble Bee



Credit: Jeremy Hemberger (text added by Christina Locke)

Regal fritillary

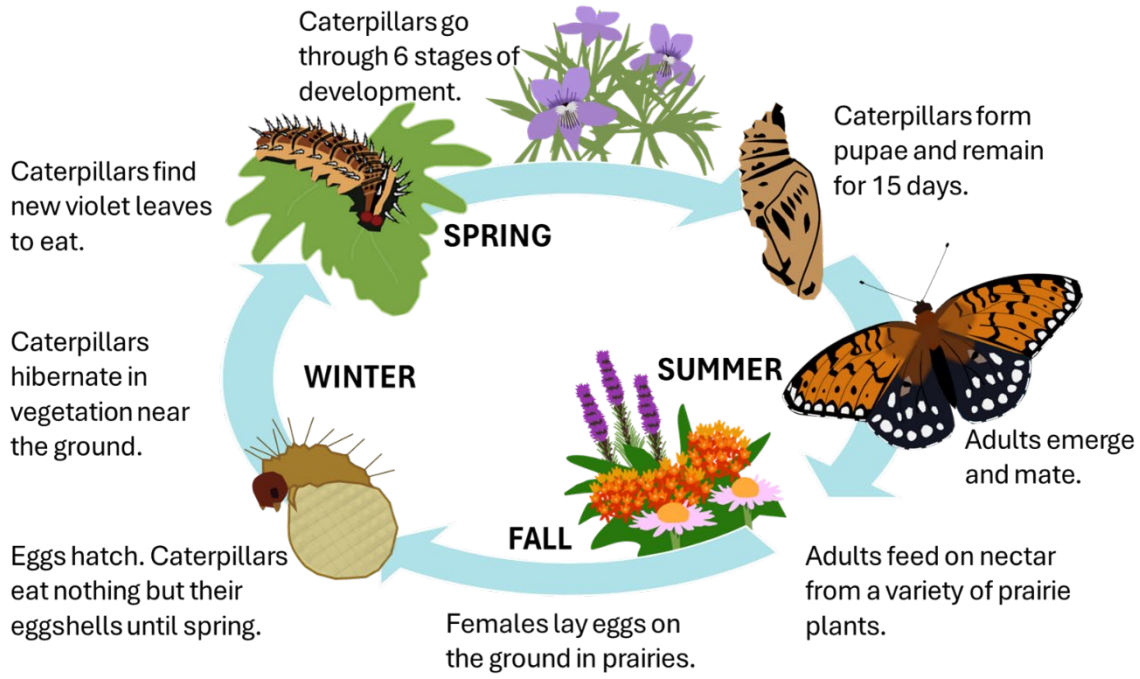


Table 1. Best practices for ongoing management to support pollinators, applicable to any habitat type

CATEGORY	MANAGEMENT PRACTICE	ADDITIONAL INFORMATION
COMPLIANCE	Before undertaking management or restoration activities, determine whether rare insects are likely present in or near the activity area.	DNR project managers and contractors are required to ensure compliance with state and federal threatened and endangered species protections. The project manager completes a Natural Heritage screen to start this process. If there are records of threatened or endangered species in the activity area, the activity meets criteria for further review and the manager coordinates with regional or district DNR staff to determine next steps. Plan all further activities in compliance with state and federal protected species requirements.
GENERAL	Vary the frequency and seasonality of management activities. Time management activities to avoid sensitive times for at-risk species. Monitor responses to management activities and adjust subsequent activities accordingly.	Vary disturbance return intervals (burning, stand thinning, mowing, haying, grazing, etc.) based on plant growth, management goals, and natural disturbance regimes rather than a set calendar schedule. Vary the season when management activities occur, unless this interferes with other management goals or required species protections, as variation avoids repeated negative effects to the same set of species year after year. Observe and assess vegetation responses to disturbances, and adjust type, timing, frequency, and intensity of subsequent management activities to achieve desired results.
HERBICIDE USE	Use spot treatments for invasive plants where practical.	Encouraging diverse plant communities is the best way to resist invasive plant spread. Herbicide treatments may be warranted to prevent seed production and slow the spread of some species. To avoid adverse effects on nontarget species, use selective rather than broad spectrum formulations, choose spot rather than broadcast treatments, and time applications to be most effective, e.g., treating buckthorn in winter while other plants are dormant. Refer to Operational Order 113, DNR's policy for invasive species prevention and management, and Operational Order 59, DNR's policy on pesticide use.
INSECTICIDE USE	Minimize the use of insecticides on state lands.	Insecticides can be detrimental to non-target organisms including pollinators and are typically not needed to achieve habitat management goals. In cases where insect pests are a concern, use integrated pest management principles to identify and assess a course of action that prioritizes non-pesticide methods (Operational Order 59). For personal tick protection, refer to DNR's Tick Protection policy.

CATEGORY	MANAGEMENT PRACTICE	ADDITIONAL INFORMATION
PRESCRIBED FIRE	Set aside refugia during burns.	Prescribed fire can be used to meet many management objectives, including managing weedy species, promoting forb bloom and understory plant growth, and decreasing thatch or woody growth. Unburned areas of similar habitat type and quality as the burned areas may be considered refugia for pollinators. For each habitat type, leave at least half of the area within 1 km (0.6 mile) undisturbed. Refugia can be established by designating burn and unburned units within or adjacent to a management area, or by intentionally leaving unburned areas ("skips") within the burn boundary. See Operational Order 47 and the DNR Prescribed Burn Handbook for policies and procedures.
MOWING AND HAYING	Set aside refugia while mowing or haying. Set mower deck height as high as possible while still addressing management goals.	Mowing and haying can be used to release forbs from competition with tall grasses, particularly in mid summer. Unmowed/unhayed areas of similar habitat type and quality as the mowed/hayed areas may be considered refugia for pollinators. For each habitat type, leave at least half of the area within 1 km (0.6 mile) undisturbed. If mowing/haying the entire site is necessary, subdivide the site into at least two units and mow/hay the units several weeks apart.
GRAZING	Leave at least one third of the site ungrazed at any given time. Rest grazed sites long enough for full plant recovery.	Grazing is one way to diversify vegetation height and release forbs from competition with tall grasses. Diverse native plantings work well both as pollinator habitat and as nutritious forage for grazing. Ungrazed paddocks, and areas of similar habitat type and quality on adjacent ungrazed lands, may be considered refugia for pollinators. If grazing an entire site is necessary, subdivide the site into paddocks and rotate grazers across paddocks. For example, paddocks may be grazed rotationally at a high livestock density for short durations, followed by rest periods of 30-90 days. Grazing can be combined with other management techniques like prescribed fire, e.g. patch burn grazing.
GRAZING	Include livestock pest control BMPs in grazing contracts.	Some pesticides used to treat livestock pests can negatively affect beneficial insects and pollute water after being introduced to the environment via animal waste. The livestock pest control BMPs in Appendix 2 specify post-treatment lag times and other considerations to reduce these concerns for grazing on DNR lands.

CATEGORY	MANAGEMENT PRACTICE	ADDITIONAL INFORMATION
PLANT COMMUNITIES	Encourage the growth of native plant species that bloom in early, mid, and late periods of the growing season.	If fewer than five native plant species are in bloom in a season (spring, summer, fall), management should be adapted to encourage plant diversification. DNR's Pollinator Resource Tables list plants suited to many different habitat types in Minnesota.
PLANT COMMUNITIES	Encourage the growth of native plants that support specialist pollinators.	Specialist species are more vulnerable to change than generalist species because they rely on a narrower set of resources. The Minnesota Pollination Guide identifies plants that provide resources for specialist bees, moths, and butterflies in Minnesota.
PLANT COMMUNITIES	Retain unique or rare plants whenever possible and appropriate.	These include woodland spring ephemerals, old growth forests, remnant prairies, and wetlands. Note that some ecosystem types are protected by statute and would be identified during the Natural Heritage screen and review process.
NESTING HABITAT	Retain nesting and larval habitats, where appropriate. These may include areas of bare soil, bunch grasses, stems of grasses and shrubs, leaf litter, and standing dead and fallen trees. Minimize soil disturbance.	These features serve as nesting habitat for ground and cavity-nesting bees, sheltered areas for overwintering and nesting bumble bees, and larval food sources for many species of beetles and hoverflies.

Table 2. Best practices for habitat reconstruction or restoration (new plantings)

CATEGORY	RESTORATION PRACTICE	ADDITIONAL INFORMATION
COMPLIANCE	Before undertaking management or restoration activities, determine whether rare insects are likely present in or near the activity area.	DNR project managers and contractors are required to ensure compliance with state and federal threatened and endangered species protections. The project manager completes a Natural Heritage screen to start this process. If the activity meets criteria for further review, the manager coordinates with regional or district DNR staff to determine next steps. Plan all further activities in compliance with state and federal protected species requirements.
RESTORATION: PLANNING	Assess past practices on the site. Consider how the restoration will contribute to habitat connectivity.	Use knowledge of the historic plant communities and management activities at the site to guide restoration planning. Also consider how future conditions may change due to climate and surrounding land use changes. Restorations as part of larger complexes or corridors can be especially beneficial for wildlife, including pollinators.
RESTORATION: PLANNING	Avoid pesticide carryover into new plantings. Record past pesticide use on the site. Allow a rest period in areas treated with pesticides.	Allowing time for remaining herbicide and insecticide residues to degrade is expected to lessen negative impacts on new plantings and pollinators. A temporary cover crop may be planted during the rest period. Refer to herbicide rotation restrictions for forage and cover cropping systems for recommended wait times prior to planting. Although this document was developed for agricultural plantings, it can also be used to infer wait times for native plantings.
RESTORATION: SITE PREP	Retain fallen or dead trees during forest and woodland restoration, when appropriate.	Dead wood provides nesting sites and food for larvae.
RESTORATION: SEED MIX DESIGN	Prioritize forbs when calculating seeding rates.	Flying pollinators are attracted to areas with high flower densities. Use an overall seeding rate of at least 40 seeds per sq ft, with at least 40% of the rate made up of native perennial forbs. Big bluestem and Indian grass should account for no more than 2% of the mix each. Diversifying grasses and sedges is important to achieve structural heterogeneity good for nesting and foraging pollinators.

CATEGORY	RESTORATION PRACTICE	ADDITIONAL INFORMATION
RESTORATION: CHOOSING PLANTS	Choose a seed or plant mix that is appropriate for the site conditions and has appropriate native plant diversity. Choose native forbs that bloom at different periods during the growing season: spring, summer, and fall.	Diverse native plant communities support diverse pollinator communities. Ideal seed mixes include multiple species from each of these categories: warm-season grasses, cool-season grasses, sedges/rushes, legume forbs, non-legume forbs, and woody plants (if appropriate for the site). Include at least five spring blooming species, five blooming in summer, and five that bloom into the fall. More than one seed mix may be needed, depending on soil and drainage characteristics. Supplement purchased seed mixes with native harvests to increase species diversity. Test mechanically harvested seed mixes to know the species composition before sowing. DNR's Pollinator Resource Tables and BWSR's state seed mixes may be used as guidance for choosing plants.
RESTORATION: CHOOSING PLANTS	Include native plants that support specialist pollinators.	Specialist species are more vulnerable to change than generalists because they rely on a narrower set of resources. The Minnesota Pollination Guide identifies plants that provide resources for specialist bees, moths, and butterflies.
RESTORATION: CHOOSING PLANTS	In areas where woody species are appropriate, consider selecting native shrubs or trees that provide resources for pollinators.	Native trees and shrubs in the following genera are host plants or food sources for pollinators: *Acer, Alnus, Amelanchier, Arctostaphylos, Aronia, Betula, Cornus, Corylus, Crataegus, Dasiphora, Fraxinus, Physocarpus, Picea, Pinus, Populus, Prunus, Quercus, Rosa, Rubus, Salix, Sambucus, Sorbus, Spiraea, Tilia, Ulmus, Vaccinium.*
RESTORATION: CHOOSING PLANTS	Use seed mixes or live plants that have not been treated with insecticides.	Systemic insecticides used in nurseries can affect beneficial insects, including pollinators, long after application. Ask native plant suppliers to identify any pesticides used in plant and seed production. Follow Integrated Pest Management (IPM) principles that include prioritizing non-chemical, targeted treatments for identified pest problems (Operational Order 59).
RESTORATION: SOIL STABILIZATION	Choose diverse (e.g., pollinator-friendly) native seed mixes for erosion control and bank stabilization projects.	The Minnesota Board of Water and Soil Resources (BWSR) maintains a list of seed mixes that includes cover crops for temporary soil stabilization as well as native seed mixes for a variety of habitats.

CATEGORY	RESTORATION PRACTICE	ADDITIONAL INFORMATION
RESTORATION: HERBICIDE USE	Avoid broadcast herbicide applications after new plantings when other means of weed control are available.	Following new plantings, weedy annual plants are a normal component of early succession and will often reduce in abundance over time without broadcast herbicide use. Weedy plants often provide shelter and forage for pollinators during this time. If herbicide use is warranted to allow target plant species to establish, use selective rather than broad spectrum formulations, and choose spot rather than broadcast treatments. Refer to Operational Order 113, DNR's policy for invasive species prevention and management, and Operational Order 59, DNR's policy on pesticide use.
RESTORATION: RECORD KEEPING & MONITORING	Record planting details and subsequent management activities at the site. Compiled records can inform future restoration and management activities.	Project managers should keep records regarding site prep, seed mix lists, seeding rates, timing, methods, site location, acreage, and subsequent management activities at the site. The Prairie Reconstruction Initiative provides a platform to enter restoration information into a database. The information is accessible through an online portal and can be used to inform future management decisions. When paired with ongoing vegetation monitoring, DNR staff use this tool to track reconstruction establishment over time (Figure 2).

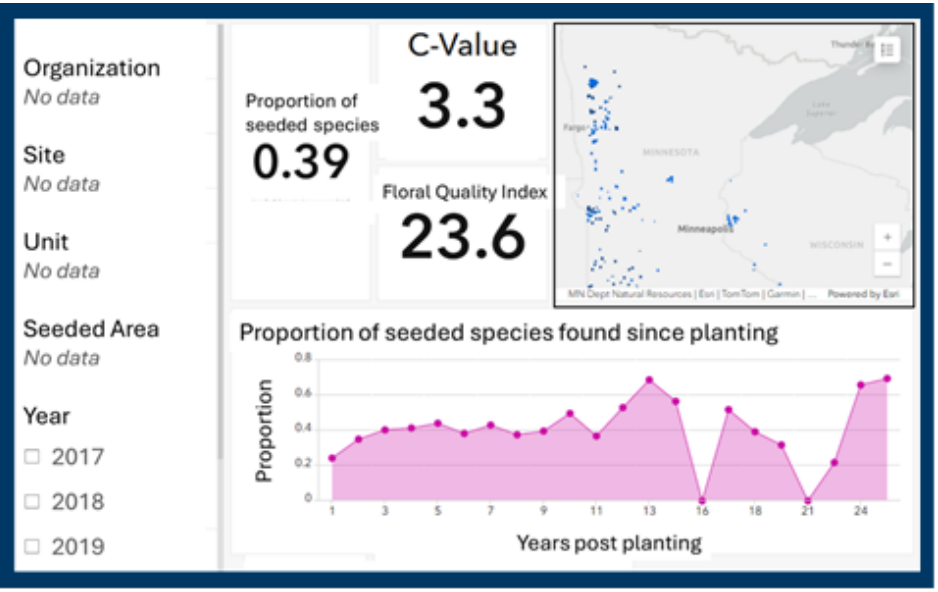


Figure 2. Database tools like those provided by the Prairie Reconstruction initiative allow project managers to track success metrics over time.

Glossary of terms

Habitat enhancement or **habitat management** - A series of actions such as prescribed burning, grazing, stand thinning, brush clearing, haying, seeding, or other activities performed periodically to maintain or improve the overall quality and function of an ecological community over time.

Habitat restoration – Rebuilding an ecosystem where a native plant community no longer exists. The DNR typically refers to this work as habitat **reconstruction**.

Natural Heritage screen - The process of querying data from the Natural Heritage Inventory System to determine whether rare features have been observed in the vicinity of a proposed activity. A DNR **activity lead** (e.g., land manager) completes a Natural Heritage screen before performing land or water management activities, developing management plans, or administering grants, contracts, or permits. The Natural Heritage screen is the first step toward compliance under Minnesota Statute 84.0895 and Minnesota Rules Chapter 6212.1800 (collectively known as "Minnesota Endangered Species Law"). Entities external to DNR can request an automated assessment of a project's potential impacts to rare features via the Minnesota Conservation Explorer online tool.

Pesticide - A substance or mixture of substances intended to prevent, destroy, repel, or mitigate a pest, and a substance or mixture of substances intended for use as a plant regulator, defoliant, or desiccant (Minnesota Statutes, section 18B.01, subd. 18). Pesticide is a general term used to refer to any type of insecticide, herbicide, fungicide, acaracide, miticide, etc.

Pollinators - For purposes of these BMPs, pollinators are insects that transfer pollen between the anthers and stigmas of flowers. This includes species in the orders Hymenoptera (bees, wasps, ants, etc.), Lepidoptera (butterflies and moths), Coleoptera (beetles) and Diptera (flies) which are known to transfer pollen. It does not include vertebrate species which may also transfer pollen in some cases.

Refugia - In a land management context, refugia are undisturbed areas of habitat that are of similar or better quality as the areas disturbed by management activities. Because the dispersal ability of pollinators is limited, undisturbed areas nearer to the disturbed sites are assumed to be more beneficial than areas farther away.

Remnant habitat – An ecological community dominated by native flora and fauna usually occurring where the soil has never been cultivated for crop farming.

Site - management unit, project area, or activity area.

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- Minnesota Department of Natural Resources (2026). Native Bees. https://www.dnr.state.mn.us/pollinators/mn-bees.html
- Minnesota Department of Natural Resources (2026). Specialist Bees. dnr.state.mn.us/pollinators/specialist.html

Threatened and endangered species protections

- Minnesota Department of Natural Resources (2026). Natural Heritage Review Program. https://www.dnr.state.mn.us/nhnrp/natural-heritage-review.html

Native plants

- Minnesota Board of Water and Soil Resources (2026). State seed mixes. bwsr.state.mn.us/seed-mixes
- Minnesota Department of Natural Resources (2026). Minnesota Pollinator Resource Tables. www.dnr.state.mn.us/pollinator_resources_tables/index.html
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Cover cropping as site prep

- Bosak, E., et al. (2024). Herbicide Rotation Restrictions in Forage and Cover Cropping Systems. University of Wisconsin-Extension Nutrient and Pest Management Program. https://cropsandsoils.extension.wisc.edu/files/2024/03/RotationalRestrictions_2024_digital.pdf
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Monitoring and adaptive management

- Minnesota Prairie Conservation Plan (2018). https://www.dnr.state.mn.us/prairieplan/index.html
- Prairie Reconstruction Initiative (2026). https://sites.google.com/view/prairiereconinitiative/home
- Symstad, A. J., & Jonas, J. L. (2011). Incorporating biodiversity into rangeland health: plant species richness and diversity in Great Plains grasslands. *Rangeland Ecology & Management*, *64*(6), 555-572.

Minnesota DNR Policies

Documents available on the DNR Pollinator Resources webpage:

- Operational Order 47 "Prescribed Burning"
- Operational Order 59 "Pesticide Use"
- Operational Order 113 "Invasive Species Prevention and Management"
- Operational Order 130 "Pollinator Habitat"
- Policy 2-30-1-02 “Tick Protection”

DEPARTMENT OF NATURAL RESOURCES

Appendix 1. Contract and grant language

The following paragraph is included as standard language in contract or grant agreements for habitat restoration or enhancement on DNR lands or any prairie restorations that use state funds. Please ensure the document link is current before finalizing contracts and grants that use this language. Any modifications to the standard language should be approved by one of the contacts listed on this document. Additional language from this document may be used directly in contracts and grants where applicable.

> Pollinator Best Management Practices
>
> Pursuant to Minn. Stat. § 84.973, habitat restorations and enhancements conducted on DNR lands, and prairie restorations on state lands or on any lands using state funds, are subject to "Pollinator Best Management Practices and Habitat Restoration Guidelines" (mndnr.gov/pollinators). Practices and guidelines ensure an appropriate diversity of native species to provide habitat for pollinators through the growing season.

Appendix 2. Livestock pest control BMPs for grazing on DNR lands

Some pesticides used to treat flies, lice, mites, and ticks in livestock can contaminate the environment via livestock waste for several weeks after treatment. This presents risk to non-target species including pollinators. The following best management practices (BMPs) are designed to minimize unintended negative impacts of parasite treatments when livestock are grazed on DNR lands. These BMPs follow Integrated Pest Management (IPM) principles and were first developed in 2014 with input from cattle producers, the Minnesota State Veterinarian, and staff from the Minnesota Board of Animal Health and Minnesota Department of Natural Resources (DNR).

1-3 Months Prior to Livestock Arrival at DNR Land

- **Monitor.** If there are no known pest or parasite problems in the herd, do not treat cattle prior to release on DNR land.
- **Diagnose**. If there are signs of a pest or parasite, correctly identify the pest(s) before considering treatment options.
- **Communicate with the DNR manager**. DNR area wildlife managers have authority to approve insecticide applications prior to livestock being placed on state land. Include the manager in treatment planning.
- **Consider treatments.** Some insecticides persist in the environment weeks after treatment and can harm beneficial insects and contaminate soil and water. DNR, therefore, maintains waiting times for cattle treated with certain insecticides:
    - Livestock treated with products containing ivermectin, doramectin, or eprinomectin shall not be released on DNR lands for at least **30 days** following treatment.
    - Dewormers containing fenbendazole (e.g. Safeguard) can be used directly prior to turnout.
    - Guidelines for other pesticides vary by case and should be discussed with the DNR manager.

While Livestock are on State Land

Insecticide applications to livestock on state land are only allowable for emergency use after gaining permission from the DNR regional wildlife supervisor. The exception is insecticide ear tags, which are allowed for non-emergency use if approved by the area land manager (though not recommended for reasons noted in the last bullet below).

- If parasite treatment is needed during the contracted grazing period, the best practice is to remove affected animals for treatment and return them to the site after the recommended amount of time. A protocol for this should be established with the DNR land manager.
- If a sick animal needs to be removed, replace it with another of similar age and size whenever possible.
- Dusters or pour-ons are not allowed on state land.
- Some salt/mineral blocks contain insecticides such as methoprene (e.g. Altosid) or stirofos (e.g. Rabon) and should be discussed with the DNR land manager prior to use.
- Horn flies at concentrations of under 200 flies per animal, and face flies at any concentration, do not require treatment.

- Insecticide ear tags are not recommended because horn flies have developed resistance to them. If ear tags are used, it is best to skip years between use, use in spring/summer only, and alternate between tags containing different types of insecticides, i.e., pyrethroid, organophosphate, and macrocyclic lactone. Examples of pyrethroids include permethrin, β-cyfluthrin, λ-cyhalothrin, and zeta-cypermethrin. Examples of organophosphates include coumaphos, diazinon, and pirmiphos-methyl. Abamectin is a macrocyclic lactone used in some ear tags.