

Voluntary Conservation Management Technical Assistance for the
Rusty Patched Bumble Bee (*Bombus affinis*)

U.S. Fish and Wildlife Service

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Note

The links in this document were updated on April 21, 2025. Most of the content has remained unchanged.

Background

On January 11, 2017, the U.S. Fish and Wildlife Service (FWS) published the final rule to list the rusty patched bumble bee (*Bombus affinis*) as an endangered species under the Endangered Species Act (ESA) (U.S. Fish and Wildlife Service 2017). The listing became effective on March 21, 2017. For more information about the species, as well as technical assistance under the Endangered Species Act, visit our website <https://www.fws.gov/species/rusty-patched-bumble-bee-bombus-affinis>.

The purpose of this document is to provide voluntary management technical assistance to help FWS, other federal agencies, state agencies, private landowners and land managers manage their land to benefit the rusty patched bumble bee. Much of this technical assistance is focused on management of natural areas; however, many of the same principles can be applied to urban areas. For actions that may affect the rusty patched bumble bee and that are funded, authorized, or carried out by one or more federal agencies, we suggest that you also review the rusty patched bumble bee voluntary section 7 consultation technical assistance document (<https://www.fws.gov/media/esa-section-7a2-voluntary-implementation-technical-assistance-rusty-patched-bumble-bee>).

This conservation technical assistance will also address the habitat needs of many pollinators, including all bumble bee species. Be sure to include milkweed in your floral resources and habitat for monarch butterflies will also be provided. This technical assistance document is subject to continual improvement and modification.

Species Needs and Targets

Needs

The rusty patched bumble bee needs three things: nesting habitat, floral resources to gather pollen and nectar, and overwintering habitat.

Nesting Habitat: Rusty patched bumble bee nests are typically in **abandoned rodent nests or other similar cavities, one to four feet below ground** (Plath 1922, pp. 190-191; Macfarlane et al. 1994, p. 4). Rusty patched bumble bee nests have also been occasionally observed above ground (Plath 1922, p. 190). Nests are thought to be typically within 1 km (0.6 mi) of summer foraging areas. Nests locations are likely to be in open areas or near open areas where it is not heavily forested and not too wet (*i.e.*, not marsh, shrub wetlands, or wetland forest). Rusty patched bumble bee queens search for nesting sites after emerging in the spring and the nests are occupied by the colony throughout the active summer and fall flight period (**Figures 1 and 2**).

Overwintering sites: Bumble bees overwinter in small chambers in **loose soil and/or leaf litter just a few centimeters below the ground** or they use compost or rodent hills/mounds (Goulson 2010, p. 11). Little is known about the specific overwintering habitats of rusty patched bumble bee foundress queens (the queens that develop in late summer and are the only members of the colony that survive winter). Overwintering habitat is often in or near **woodlands or woodland edges that contain spring blooming herbaceous plants, shrubs, and trees**, which allows proximity to woodland spring blooming flowers, particularly spring ephemeral wildflowers, a critical early spring food source. Solitary queens mate in the fall and overwinter roughly from mid-October through mid-March (**Figure 1**).

Floral Resources: Bumble bees gather pollen and nectar from the flowers of a wide variety of plants, typically within 1 km (0.6 mi) of nests (Xerces 2013, pp. 27-28, Knight et al. 2005, p. 1816; Wolf and Moritz 2008, p. 422; Dramstad 1996, pp. 163-182; Osborne et al. 1999, pp. 524-526; Rao and Strange 2012, pp. 909-911). The nectar provides carbohydrates and the pollen provides protein. The species is one of the first bumble bees to emerge early in the spring and the last to go into hibernation. To meet its nutritional needs, therefore, the rusty patched bumble bee requires access to a diverse group of plant species to ensure that there are flowers in bloom throughout the colony's long active flight period, roughly from mid-March through mid-October (**Figure 1**). The number of queens that a colony can produce is directly related to the amount of pollen that is available (Burns 2004, p. 150). The FWS, along with partners, developed a regionally specific plant list that is on our website at (<https://www.fws.gov/media/plants-favored-rusty-patched-bumble-bee>).

Spring Foraging Habitat: Rusty patched bumble bees may depend on woodland spring ephemeral flowers because of the species' early emergence; in the spring (roughly, mid-March through May) it is often found in and near woodland habitats (Colla and Dumesht 2010, p. 45-46).

Summer and Fall Foraging Habitat: Bumble bees typically forage within 1 km (0.6 mi) of nests. While the rusty patched bumble bee may visit any available flowers within the typical foraging distance of its nest, it is reasonable to assume that core foraging areas are those areas with concentrated resources (*e.g.*, open fields and prairies with large patches of blooming native flowers) where the bee can find pollen and nectar while minimizing energy expenditure.

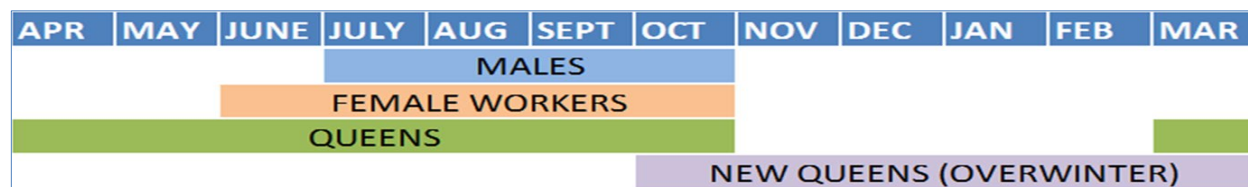


Figure 1: Phenology chart for rusty patched bumble bee. New queens overwinter from roughly mid-October through mid-March, when they then emerge and start to feed and establish colonies. The active foraging and flight period runs from mid-March through mid-October.

Spring – Early Summer

Include early-blooming plants and maintain a diversity of flowers in your landscape.

To protect overwintering queens, avoid early raking or mowing; raking is best done in April and May.

Keep large patches of land unmowed and untilled to provide secure nesting sites; healthy ground-nesting mammal populations help create future nesting sites.

Because queens are still foraging and colonies are usually very small, avoid the use of pesticides.

Summer – Fall

Include mid- and late-blooming plants such as goldenrod, milkweed, and aster in your landscape.

Leave leaf litter, downed wood, and uncut bunch grasses to serve as potential overwintering sites.

As colonies are producing new queens at this time of year, avoid using pesticides. If pesticides are necessary, choose products that are less harmful to bumble bees, and do not use them at times when bees are active or when plants are flowering.

Winter

Late fall and winter are the best times for mowing. Cut with the mower deck at the highest safe level to avoid disturbing overwintering queens.

To protect overwintering queens, continue to leave large sections of untilled ground.

Small, controlled burns are okay, but burn less than 1/3 of available land annually, and leave unburned patches as a refuge for animals.

If needed, this is the best time to use a targeted herbicide treatment for invasive species.

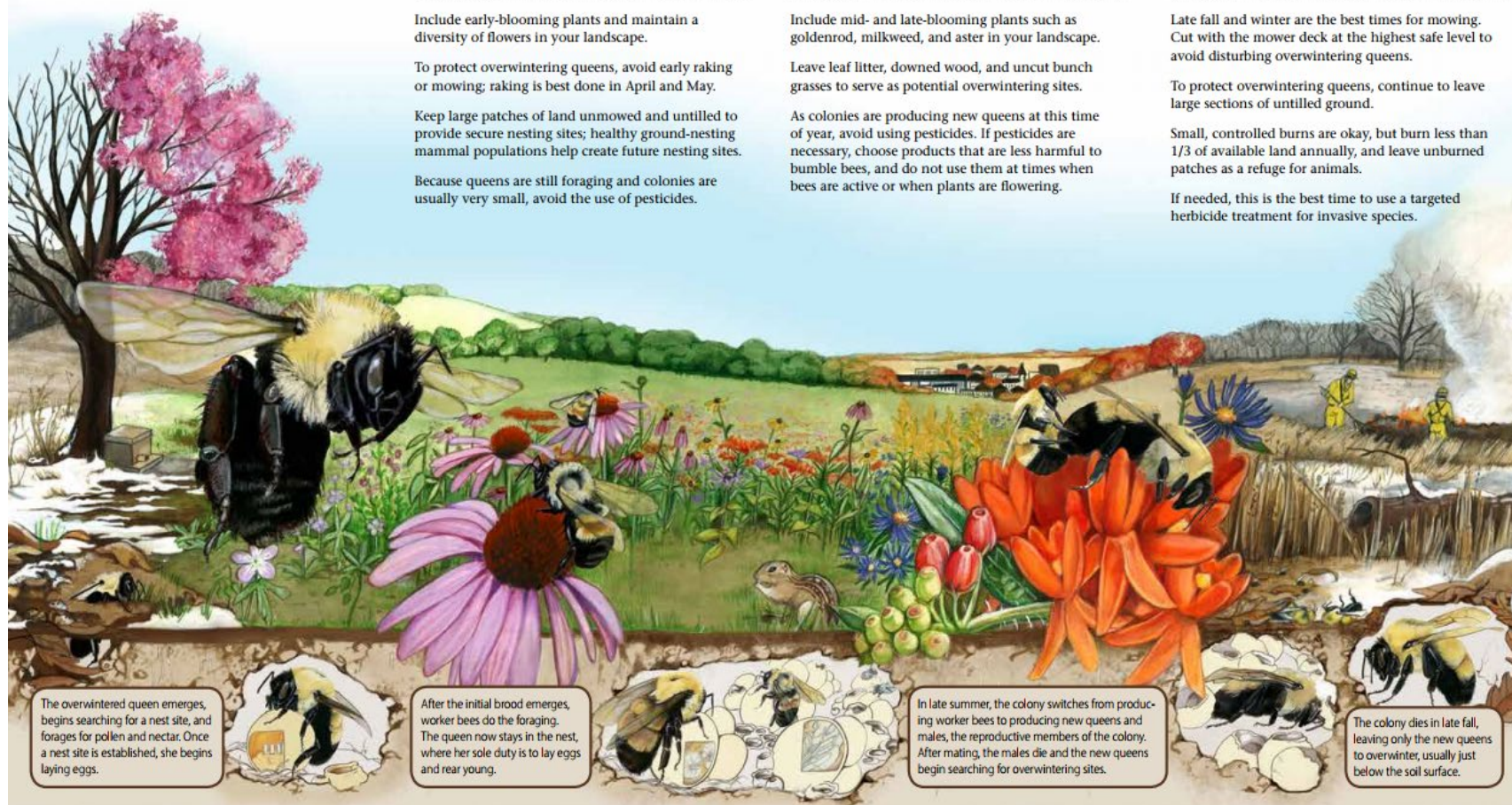


Figure 2: Illustration of the rusty patched bumble bee life cycle by Alix Lucas, courtesy of the Xerces Society, with some general management suggestions for bumble bee conservation by season.

Management Objectives and Targets for High Quality Rusty Patched Bumble Bee Habitat

Ideally, managed areas would have all three habitat features necessary to maintain one or more colonies of rusty patched bumble bee: nesting habitat, floral resources, and overwintering habitat. We recognize, however, that not every management area will contain all the features necessary for one or more colonies (e.g., small areas of land may only contain one key feature, such as overwintering habitat) and that areas are managed for a variety of purposes. We encourage land managers to consider how the areas under their management can contribute to habitat at the larger landscape level context in order to contribute to the conservation of one or more colonies of rusty patched bumble bee. For example, it is important to provide habitat heterogeneity at the county scale to help buffer from extreme events and climate variability at a broad scale.

Ideally, to sustain a colony or multiple colonies, an area would contain features and habitat characteristics necessary for foraging, nesting and overwintering that are identified in the following management objectives and targets.

1. Objective One – Create, enhance, or maintain foraging habitat

Objective One Targets

Create or maintain foraging habitat in your management area that meet the following targets:

- At least an estimated 50% of vegetative cover in the management area (*i.e.*, the area that is being considered for management) is comprised of foraging habitat (plants that provide food);
- Ten or more flowering plant (herbaceous, shrubs, or trees) species blooming during the spring, not including invasive or noxious weeds;
- Ten or more flowering plant (herbaceous, shrubs, or trees) species blooming during the summer, not including invasive or noxious weeds;
- Ten or more flowering plant (herbaceous, shrubs, or trees) species blooming during the fall, not including invasive or noxious weeds;
- Nine or more superfoods¹ present such as wild bergamot (*Monarda fistulosa*), prairie clover (*Dalea* spp.), hyssop (*Agastache* spp.), goldenrod (*Solidago* spp.), asters (*Symphyotrichum* spp.), leadplant (*Amorpha canescens*), joe pye weed (*Eutrochium* spp.), and coneflowers (*Echinacea* spp., *Ratibida pinnata*); and,
- Nine or more immune building² plant species present such as wild bergamot, sunflowers

¹ Superfood plants produce nectar that is rich in amino acids, a secondary source of protein for adult and larval bumble bees.

² Immune building plants are known to help build bumble bee immune systems.

(*Helianthus* spp.), white turtlehead (*Chelone glabra*), and native wild blueberries and cranberries (*Vaccinium* spp.).

- To buffer against extreme weather events, include frost and drought hardy plants that bloom throughout the active season, especially in the spring and fall.

2. Objective Two – Create, enhance, or maintain nesting habitat

Objective Two Targets - Create or maintain nesting habitat in your management area that meets the following targets:

- At least an estimated 20% of the area with undisturbed (that are not dug up/tilled) native bunch grasses;
- At least an estimated 20% of the area with uncompacted, loose soil (one key indicator of loose soil is evidence of rodent activity and rodent holes);
- At least an estimated 20% of the area that is left un-mowed (or mowed at a height of greater than 12 inches in the fall or winter), no/low intensity grazing³, and infrequent⁴ burns (see prescribed fire and grazing sections below); and,
- Fallen leaves are not raked or otherwise removed.

3. Objective Three – Create, enhance, or maintain overwintering habitat

Objective Three Targets - Create or maintain overwintering habitat within your management area that meet the following targets:

- Wooded areas that contain highly diverse (10+) spring-time native flowering herbaceous plants, shrubs, and/or spring flowering trees;
- Wooded areas with less than 30% cover comprised of invasive or noxious weeds and woody plants (e.g., buckthorn); and,
- Areas with brush pile, duff layers, and fallen leaves that are not raked or otherwise removed.
- Plant hedgerows to help buffer against extreme events.

4. Objective Four – Create, enhance, or maintain target habitat features

Objective Four Targets – Create or maintain the following features within your management area:

- Permanent meadows or grasslands with a high diversity (10+ species) of native wildflowers;
- Maintain areas of open understory in woodlands to encourage the growth of native spring flowers;

³ No or low intensity grazing depends on the type of animal, the size of the herd, and the size of the grazed site. Grazing is further described in the “Grazing” section, below.

⁴ Fires are considered infrequent if *at least* 3 years is allowed to elapse without fire. Prescribed fire is further discussed in the “Prescribed Fire” section, below.

- If land is used for pasture or haying, the land is comprised of at least 30% non-invasive, forage plants;
- At least 60 % of the area under consideration that is within 25 ft (7.6 m) of surface water features has flowering forbs; and,
- Low density 0.5 hive/ac (0.5 hive/0.4 ha), or no domesticated honey bee hives present.

Actions that Could Cause Take

Land management activities can cause take of rusty patched bumble bees. The Voluntary Section 7 Technical Assistance document (available online at <https://www.fws.gov/media/esa-section-7a2-voluntary-implementation-technical-assistance-rusty-patched-bumble-bee>) includes brief descriptions of some, but not all, of the types of actions that we believe may lead to take. If the following management suggestions are taken, such take may be minimized but not necessarily eliminated.

Threats to the rusty patched bumble bee are discussed in more detail in the species status assessment and the listing documents (USFWS 2016, 2017), which can be found at <https://www.fws.gov/species/rusty-patched-bumble-bee-bombus-affinis>). Briefly, stressors that should be considered when evaluating the effects of managing land on the rusty patched bumble bee include, but are not limited to, prescribed fire, haying, grazing, herbicide use, land-clearing, pesticide use; and the use of non-native bees. In addition to direct take resulting from these activities, habitat fragmentation and loss of the diversity of habitat that may result from land management should also be considered and evaluated.

Conservation Management Technical Assistance

Protect, Create, Restore, and Maintain Habitats

Access to diverse and abundant floral resources is essential for the rusty patched bumble bee during its active season, which is typically long compared to most other bumble bee species. The species is active and reliant on flowers during the entire growing season (mid-March through mid-October). Therefore, any action that will increase the diversity of wildflower resources throughout the growing season will tend to contribute positively to rusty patched bumble bee colony health.

Following these suggestions will provide for most other bumble bees, solitary bees and many butterflies. Including milkweed in floral resources will provide for monarch butterflies.

In general, FWS suggests activities that would strive to meet the rusty patched bumble bee conservation objectives and targets (identified in the previous section: Management Objectives and Targets for High Quality Rusty Patched Bumble Bee Habitat) and:

- Increase the diversity of native wildflowers by direct seeding to establish a new cover type – for example, conversion of cropland, intensively managed pasture or range, or intensively managed hayland to native floral and grassland habitat;
- Implement or alter grazing practices, prescribed fire, or other land management to increase the diversity of native wildflowers and that maintain or facilitate the development of nesting and overwintering habitat;
- Remove and control invasive plants (*e.g.*, garlic mustard, *Allaria petiolata*) in woodlands, forest edges, prairies, and meadows – in any habitats used for foraging, nesting, or overwintering;
- Increase the diversity of native wildflowers in grasslands and pastures by inter-seeding or similar practices; and,
- Establish native trees and shrubs [*e.g.*, willows, serviceberry (*Amelanchier*)], whose flowers are often good early season pollen and nectar sources.

We suggest assessing habitat within your management unit(s). Ideally, habitat would be assessed prior to management to quantify the baseline quality of the habitat for rusty patched bumble bee and to evaluate any stressors that might be affecting the bee or its habitat. Post management assessments will help to quantify habitat improvements and assess future needs.

Prescribed Fire

Prescribed fire is an excellent tool to maintain, restore, and enhance rusty patched bumble bee habitat, but must be implemented with considerable care and planning. Prescribe fire has the potential for complex effects on the plant communities that are critical to the persistence of local colonies and fire and smoke could harm or kill bees in the burned area. In addition, fire may not be needed to conserve a rusty patched bumble bee colony(ies) unless certain aspects of the plant community (*e.g.*, low density of nectar or pollen plants) are currently limiting colony growth. **When using prescribed fire, we suggest the following measures:**

General suggestions:

- Consider the landscape in which the actions will occur, specifically, the area within 1km (0.6 mi) from your area of interest, to determine if there are nearby floral resources available.
- Consider the timing of the burns and the habitat within the burns will occur, in particular, consider when floral resources will return and be available for foraging.
- **Only burn a specific area once every 3 to 6 years.** Use the maximum length fire return interval that is adequate to maintain or restore meadows and/or high-quality native prairie habitat on each unit. Allow *at least* 3 years to elapse without fire (*i.e.*, minimum 4- year rotations) before re-burning any area. Burning more frequently may be required for establishing new habitat (*e.g.*, burning for 2-3 years in a row).
- **Burn only small sections at a time.** If feasible to achieve your management objectives, allow fires to burn in a patchy ("finger") pattern within units. Do not make a concerted effort to burn

‘every square inch’; leave fire “skips” unburned. Burning under cool or damp conditions may increase survival of insects present in the litter layer within the burned unit (*e.g.*, Panzer 2002).

- **Map the extent of each fire** in rusty patched bumble bee habitat to ensure that future fire planning is based on an accurate understanding of prior fire history.
- **Mow fire breaks that will result in patches of unburned areas**, if possible, to serve as refuge for animals within burn areas. Consider the use of proactive techniques to increase the patchiness of fires, especially if habitats that would serve as sources of recolonizing adults are small or within the foraging distance of the burn unit.
- **Conduct pre-burn bumble bee surveys** and evaluate other applicable information to understand the distribution and relative abundance of rusty patched bumble bees within and among burn units and elsewhere within the area inhabited by the local colony(ies). See the rusty patched bumble bee survey protocols provided on our rusty patched bumble bee ESA technical assistance website (<https://www.fws.gov/media/survey-protocols-rusty-patched-bumble-bee>) for proper survey conditions, time of year, etc.
- **Avoid high intensity fires.** High fuel levels increase the likelihood that fires may destroy nesting habitat for rusty patched bumble bees. Therefore, consider reducing fuel levels (*e.g.*, by haying the previous late fall) before conducting burns where fuel levels seem to be high – if that would not interfere with the burn objectives.
- If you plan to change the configuration of burn units or make other changes to your prescribed fire plan, **review the location and timing of recent burns.** Evaluate the potential effects of those recent burns on the current abundance and distribution of rusty patched bumble bees within the management area and elsewhere within the presumed extent of the local population (*e.g.*, one or more colonies may be found within the High Potential Zone, see maps on <https://www.fws.gov/species/rusty-patched-bumble-bee-bombus-affinis>).
- Plan for the contingency that a prescribed fire will escape a burn unit and burn one or more additional units that contain rusty patched bumble bee habitat. If this is reasonably likely, determine how the rusty patched bumble bee colony or group of colonies would persist despite such a scenario.

If burning in foraging habitat (see habitat definitions identified in the Species Needs and Targets section, above on pp. 3 -4):

- **Conduct burns from mid-October through early- April**, if possible, so that floral resources are not reduced when the species is feeding. If feasible to achieve your management objectives, conduct spring burns as early as is feasible or late fall burns. Late spring burns may reduce the nectar and pollen sources for newly emerged queens that are gathering food to establish their colonies.
- **If you cannot burn outside of the active season, burn no more than one-third of the suitable foraging habitat within your management area each year.** Consider the landscape context of the burns and include in your assessment the land within 1km (0.6 mi) of your area.
 - If possible, burn small sections at a time. Divide the rusty patched bumble bee habitat,

where prescribed fire is proposed, into as many burn units as is feasible and burn no more than one unit in any single year. Units should contain approximately equal amounts of rusty patched bumble bee habitat to ensure that the colony that is utilizing the site is not disproportionately affected by any single burn.

- o In cases where there are nearby local colonies of rusty patched bumble bee that will provide immigrants from outside of the management area it may also be feasible to conserve a rusty patched bumble bee colony with less than three burn units, but that would require close coordination with neighboring landowners (see **Coordinated Management**, below).

If burning in overwintering habitat or early spring foraging habitat (see habitat definitions identified in the **Species Needs and Targets** section, above on pp. 3 -4):

- **If burning during the overwintering period (mid-October through mid-March/early April) or in spring, burn no more than one-third of the suitable habitat within your management area each year.** Units should contain approximately equal amounts of rusty patched bumble bee habitat to ensure that the colony that is utilizing the site is not disproportionately affected by any single burn. **Consider the landscape context of the burns and include in your assessment the land within 1km (0.6 mi) of your area.**
- If you need to burn in late spring to address a particular management need (e.g., control of smooth brome, *Bromus inermis*), other precautionary measures will be especially important. These include the division of occupied rusty patched bumble bee habitat into as many burn units as is practicable; ensuring that fires do not escape from burn units; maximizing the number of years between fires; and, reducing fuel loads (e.g., by grazing) in rusty patched bumble bee habitat in units where frequent or intense fire is not necessary.
- If it is not practicable to divide rusty patched bumble bee habitat into separate burn units within a management area, then we suggest carefully implemented grazing or haying, if feasible, instead. Alternatively, consider the landscape context to determine if at least two-thirds of suitable habitat remains unburned within 1 km (0.6mi) of your management area.

Mowing/Haying

Mowing and haying can be a useful management tool to control invasive plants and maintain open meadows and prairies. Meadows and gardens with a variety of structural layers of habitat and bunch grasses have been shown to have a higher diversity of bumble bees than areas without such features (e.g., Mader et al. 2011). However sites under certain mowing regimes (e.g., May and/or July mowing) were found to have significantly fewer nests than non-mowed areas (i.e., Potts 2009), likely due to a loss in floral resources. **When mowing or haying, we suggest the following measures:**

- **Mow outside of the active season** (i.e., mid-October through mid-March/early April), if possible, in areas that provide summer foraging habitat. If mowing must occur during the active flight

season (mid-March through mid- October), attempt to create a mosaic of structurally different habitat patches or ensure that the extent of the area mowed is not likely to affect more than one-third of the foraging habitat that is available on site or within the larger landscape [within 1 km (0.6mi)] of the site boundary.

- **Mow at the highest cutting height possible**, ideally 12-16 inches (30 - 40 cm), or a minimum of 8-10 inches (20 - 25cm) if possible. Mowing at this height will reduce disturbance of established nests or overwintering queens.
- **Mow no more than 1/2 of the open, non-forested foraging habitat within your management area per year**, if possible. Leave patches of unmowed habitat for the entire year. Consider the habitat availability in the larger landscape context [within 1 km (0.6mi) of your area].
- In cases where there are nearby local colony(ies) of rusty patched bumble bee that will provide immigrants from outside of the management area it may also be feasible to conserve a rusty patched bumble bee colony (ies) with less than three mow units, but that would require close coordination with neighboring landowners (see **Coordinated Management**, below).
- **Mow at reduced speeds (< 8mph)**, if possible, to allow time for bees to avoid mowing equipment.
- **Map the extent of mowed areas** in rusty patched bumble bee habitat to ensure that future mowing planning is based on an accurate understanding of prior mowing history.

Grazing

Grazing can be a useful management tool to encourage the growth of nectar resources, provide structural diversity for nesting habitat, control invasive species and maintain open meadows and prairies by managing succession. When grazing land, we suggest the following measures:

- **Design and conduct prescribed grazing practices that encourage wildflower diversity and abundance**, such as low intensity grazing and/or short duration grazing with long recovery periods.
- Do not exceed moderate stocking rates (*e.g.*, such that the forage harvested by grazing animals does not exceed one-third of the current available forage).
- Divide the rusty patched bumble bee habitat where grazing is proposed into as many grazing units as is feasible and graze no more than one unit in any single year. Allow the vegetation to recover by rotating grazing areas and establishing ex-closures. Units should contain approximately equal amounts of rusty patched bumble bee habitat to ensure that the colony(ies) is not disproportionately affected by any single graze unit. If it is not practicable to divide rusty patched bumble bee habitat into separate grazing units within a management area, then we suggest carefully implemented prescribed fire or haying, if feasible, instead.
- In cases where there are nearby local colonies [within the estimated dispersal distance of 10km (6mi)] of rusty patched bumble bee that will provide immigrants from outside of the management area it may also be feasible to conserve rusty patched bumble bee with less grazing units, but that would require close coordination with neighboring landowners to ensure

that dispersal of adults is likely to be sufficient to reinforce numbers in the grazed area (see **Coordinated Management**, below).

- The timing and frequency of grazing rotations will depend on the type and size of herd and the size of the area to be grazed. In general, grazing should occur for a short period of time and the site should be allowed an extended period for recovery (e.g., 14 days of grazing with 80-90 days of rest).
- We suggest that land managers **complete grazing strategy** according to the site characteristics and the type of grazing animals. We suggest that the grazing plan includes prescribed grazing practices that encourage wildflower diversity and abundance to help reach the rusty patched bumble bee **Management Objectives and Targets** described above.
- Limit grazing in high quality habitat during the active season (mid-March through mid - October) to ensure that it continues to meet the **Management Objectives and Targets** described above.
- **Map the extent of grazing** in rusty patched bumble bee habitat to ensure that future planning is based on an accurate understanding of prior grazing history.

Pesticide Use

Targeted herbicide and insecticide use can be a useful management tool to control pests and invasive plants. Nevertheless, rusty patched bumble bees are unlikely to thrive if they are exposed to insecticides that are used broadly and systemically (e.g., seed coatings) or are foliar sprayed. When pesticides must be used, we suggest the following measures:

Insecticide Use

Whenever applicable, in order to prevent insecticide exposure to pollinators, the safest action is to avoid use of insecticides in rusty-patched bumble bee habitat or in areas near habitat. There are a number of resources available to help with decisions on how to reduce pesticide use, how to reduce the potential for drift of pesticide to habitat, and how to keep yards and lawns pollinator friendly. The following is a list (not comprehensive) of resources that are available:

Insecticides Used in Agricultural Production Areas:

- Use the principles of Integrated Pest Management (IPM) which includes the use of multiple practices to control pests or invasive plant species, which lower pesticide use, including insecticides.
 - Use the services of certified crop advisors such as Natural Resources Conservation Service (NRCS) or your local extension office to help implement an IPM program.
 - NRCS has various programs that offer financial incentives for certain IPM practices, please contact a local NRCS representative for a list of these opportunities.
 - Please see specific IPM technical assistance:
 - NRCS IPM Technical assistance:

https://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/energy/conservation/?cid=nrcs143_023640

- FWS IPM Technical assistance: <https://www.fws.gov/media/reducing-risks-pollinators-insect-and-plant-pest-control-using-integrated-pest-management-0>
- Environmental Protection Agency (EPA) Reducing Pesticide Drift: <https://www.epa.gov/reducing-pesticide-drift>.
- Read the label on the insecticide container and look for information on use and potential effects on bees and other pollinators. Product labels are legally binding and must be followed exactly, including specific pollinator protection language.

Pesticides used in Lawns and Gardens - Backyard Habitat

- EPA Tips for Reducing Pesticide Impacts on Wildlife: <https://www.epa.gov/safepestcontrol/tips-reducing-pesticide-impacts-wildlife>
- FWS guidelines on protecting pollinators from pesticides: <https://www.fws.gov/media/reducing-risks-pollinators-insect-and-plant-pest-control-using-integrated-pest-management>
- NRCS Tips for Backyard Conservation: https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/home/?cid=nrcs143_023552
- Minnesota Pollution Control: Reducing Pesticides in Lawns: Landowners with Yards/Gardens: <https://www.pca.state.mn.us/sites/default/files/w-hhw2-21.pdf>

Herbicide Use

- Contact your local extension agents and NRCS to learn about IPM methods and other actions on using herbicides that may limit effects to rusty-patched bumble bee habitat. Some of those suggestions could be:
 - Apply herbicides as locally and directly as possible (cut-stem application, hand applications, spraying directly on the target plant).
 - If feasible to ensure effective control of target plant species, apply herbicides pesticides when at times when bumble bees are less active (late at night, or late fall and winter). Bumble bees can fly at relatively cold temperatures and are active in early spring (*e.g.*, mid- March) and in the morning and evening hours.

Tree Clearing/Forest Management

Tree clearing/forest management may lead to increases in foraging habitat or may provide better nesting habitat. Soil disturbance that occurs during timber operations, however, can be harmful to overwintering bumble bees. High quality forested habitats comprised of a diverse array of native plant species provide important foraging habitat for the rusty patched bumble bee in the spring, provide are the primary overwintering habitat for the species, and also provide nesting habitat along their edges.

Forest management during the species' active season (mid-March through mid-October) may be less likely to impact the species directly if conducted after spring ephemerals are no longer flowering and floral resources have drawn the bees out into open foraging and nesting areas. When rusty patched bumble bee overwintering is suspected (see definitions of overwintering habitat above) to be within the management/project area:

- **Implement your state's best management practices (BMPs), especially those that serve to minimize the spread of invasive species and to avoid or minimize soil compaction.** Visit (<https://stateforesters.org/action-issues-and-policy/state-forestry-BMPs-map-o-o>) for up to date information about BMP recommendations by state.
- **Avoid or minimize forest management that may destroy spring blooming flowers during their bloom periods.**
- **Consider thinning or single tree selection and dense invasive shrub removal** that may improve overwintering and spring foraging habitat.

Commercial Bumble Bees

Currently only one species of bumble bees is being used for commercial operations – the common eastern bumble bee (*B. impatiens*). Commercial bumble bees are used in contained commercial facilities (e.g., tomato greenhouses) or may be used in open environments (e.g., for open-field pollination services). Commercially raised common eastern bumble bees may spread pathogens into wild bee populations and compete with wild bees for resources. **When using commercial bumble bees, care should be taken to minimize exposure of wild bees to managed bees and we suggest the following measures:**

- Limit use of commercial bumble bees to closed-systems (e.g., greenhouses) and try to avoid use in open fields.
- Place screens over openings (e.g., vents, windows, etc.) in greenhouses to minimize escape of the managed bees.
- Properly dispose of commercial bees after their use and do not release them into the wild.
- Do not purchase commercial bumble bees to use outside of the native range of the commercial species (e.g., do not purchase *B. impatiens* to use in western United States, where they are non-native).

Commercial Honeybees

European honeybees (*Apis mellifera*) have documented negative effects on the reproductive success of bumble bees (e.g., Goulson and Sparrow 2009, Singh et al. 2010, and Thompson 2004). Additionally, pollen can be a vector for disease transmission between honey bees and bumble bees (e.g., Singh et al. 2010; Fürst et al. 2014, Graystock 2015). We suggest that managers discourage the placement of domesticated honeybee hives in natural areas with high quality habitat (abundant and diverse floral resources) where rusty patched bumble bees are likely to be present. We are not discouraging the use

of honey bees in agricultural fields, but encourage landowners to plant native flowers and to try to keep their honey bee hives disease and pest free.

We make the following suggestions for natural areas:

- Discourage placement of domesticated honeybee hives in natural areas with high quality rusty patched bumble bee foraging and nesting habitat.
- Place hives as far away as possible from natural areas (at minimum 1 km [0.6 mi]) and away from potential rusty patched bumble bee nesting sites.
- Keep domesticated hive density below 0.5 hive/ac (0.5 hive/0.4 ha), if possible, particularly in areas that are on or near locations with recent (within the year 2007 or more recent) rusty patched bumble bee observations.

Coordinated Management among Nearby Sites

Conservation of the rusty patched bumble bee will ultimately depend in part on connecting patches of high quality habitat and coordinated management may be one avenue to do so. We make the following suggestions to help facilitate coordinated management:

- Conduct bumble bee surveys or review available data to understand the extent of nearby local rusty patched bumble bees colonies and habitats. This may facilitate coordination and management of colonies that may cross between management units and ownerships. To see where there are known locations of the rusty patched bumble bee, see the Rusty Patched Bumble Bee Interactive Map (<https://www.fws.gov/species/rusty-patched-bumble-bee-bombus-affinis>).
- Coordinate management activities with property owners and managers of nearby rusty patched bumble bee habitats. For example, plan burns and other temporarily adverse management activities during years when nearby habitats will not be burned.
- Where there are nearby local colony(ies) (within the estimated dispersal distance of 10km [6mi]) of rusty patched bumble bee that will provide immigrants from outside a management area, it may be feasible to conserve a rusty patched bumble bee colony (ies) with less than the suggested number of management units (*e.g.*, mow or burn units). This would require close coordination with neighboring landowners to ensure that dispersal of adults is likely to be sufficient to reinforce numbers in the mowed area. To determine if there are nearby colonies, see the maps on (<https://www.fws.gov/species/rusty-patched-bumble-bee-bombus-affinis>) – the red “High Potential Zone” polygons are areas with recent records of the species.

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