The Rusty Patched Bumble Bee (*Bombus affinis*)
Voluntary Implementation Guidance for Section 10(a)(1)(B) of the Endangered Species Act

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Background and Purpose

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 2014). The listing becomes effective on March 21, 2017. The purposes of this document are to help project proponents and landowners to quickly and clearly determine whether their projects could incidentally take the rusty patched bumble bee; how they may be able to modify their projects to avoid incidental take of the species; and, if so, how they may plan and implement their projects while ensuring the species’ conservation and compliance with the ESA.

Section 9 of the ESA and its implementing regulations prohibit the take of animals listed as federally threatened or endangered. Take, as defined by the ESA, means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. Incidental take is defined by the ESA as take that is "incidental to, and not the purpose of, the carrying out of an otherwise lawful activity." Private landowners, corporations, state or local governments, or other non-federal entities, who wish to conduct activities that might incidentally take animals listed as threatened or endangered, and who are not otherwise exempted from the ESA's Section 9 take prohibition through other means, must first obtain an Incidental Take Permit from the Service under section 10(a)(1)(B) of the ESA to avoid liability. Finally, we note that any use of mandatory language throughout this guidance refers to lawful obligations present in statute or regulation. This guidance does not bind project proponents and landowner personnel and does not create any new mandatory procedure or requirement for the public.

Federal activities – and non-Federal activities that receive Federal funding or require a Federal permit – typically obtain incidental take authority through the consultation process under section 7 of the ESA. Thus, the Habitat Conservation Plan (HCP) process is designed to address non-federal land or water use or development activities that do not involve a federal project that is subject to section 7 consultation.

Current Versions of this Guidance

Check to make sure that you have the most recent version by comparing to the guidance version number at the following website –

Range of Rusty Patched Bumble Bee

The rusty patched bumble bee inhabits various habitat types in the United States and southern Canada (Fig. 1). The species was broadly distributed historically across the eastern United States, upper Midwest, and southern Quebec and Ontario, an area comprising 31 states or provinces and 394 U.S. counties and 38 county-equivalents in Canada. Since about 2007, the species’ distribution has declined across its range in the U.S.; current records and associated high potential zones (defined below) occur only in 9 states and 49 counties (Fig. 1). Similar
declines have occurred in Canada where it was listed as Endangered on Schedule 1 of the Species at Risk Act in 2012 (Szymanski et al. 2016).

Figure 1. Areas where there is evidence for the likely persistence of the rusty patched bumble bee in the United States (highlighted in red to increase visibility), based on the habitat model (described below) and on species survey data compiled from 2007 through 2016 (U.S. Fish and Wildlife Service Rusty Patched Bumble Bee Unpublished Geodatabase). The approximate historical range of the species is shown in light gray.

**Brief Description of the Habitat Model**

The Minnesota/Wisconsin FWS Field Office has adapted a habitat connectivity model to identify the zones around current (2007-2016) records where there is a high potential for the species to be present. This model allows us to assess the likelihood of bumble bee movement away from the locations of known records based on the manner in which various land uses and conditions
may affect those movements. Land classes are based on the National Land Cover Database and are grouped as having strong, moderate, weak, or no limits on rusty patched bumble bee movement based on the best available information for this species or similar bumble bee species. This methodology was adapted from a model created to examine movement of the yellow-faced bumblebee (B. vosnesenskii, i.e., Jha and Kremen 2013, entire).

The model produces a series of irregular rings or levels around each record that represent successively decreasing likelihoods of movement by a bumble bee away from the point of observation in all directions. We have adapted the innermost ‘ring’ around each rusty patched bumble bee record, dated 2007-2016, to produce discrete zones where there is a high potential for the species to be present (Fig. 2). Due to the variations in land condition around each record, the area of high potential averages about 2.5 miles (about 4 km) from observation points and together comprises only about 0.1% of the species’ historical range (Fig. 1).
With respect to typical foraging (food searching) distances and potential dispersal movements of rusty patched bumble bees, the high potential zones provide a reasonable basis for describing where the species is likely to be present. Studies of other bumble bee species indicate that they typically move less than 0.6 mile (1 km) from their nesting sites to search for food (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). In addition to typical
foraging distances, however, we should also consider movements that rusty patched bumble bees may make to establish new home ranges – that is, dispersal. Based on studies of a closely related species, the buff-tailed bumble bee (B. terrestris), the maximum dispersal distance of the rusty patched bumble bee is likely about 0.6 to 6 miles (1-10 km, Kraus et al. 2009, p. 249; Lepais et al. 2010, pp. 826-827). Therefore, the high potential zones include the areas within which rusty patched bumble bees would move from the point of observation to forage and cover almost half of the area into which they may disperse.

In summary, the FWS concludes that the rusty patched bumble bee is likely to be present within “high potential” zones around each recent (2007-2016) record. These zones, although not of uniform size, have discrete boundaries that will be used by FWS field offices and served online via the FWS Information for Planning and Conservation website (IPaC, https://ecos.fws.gov/ipac/) to help project proponents and landowners determine when incidental take of the species may occur.

Section 10(a)(1)(B) of the Endangered Species Act and the Rusty Patched Bumble Bee

Screening and Evaluation of Projects – A Stepwise Approach

Step 1. Determine whether the rusty patched bumble bee is likely to be present in the project area.
To determine whether the FWS would recommend that project proponents and landowners consider applying for a section 10(a)(1)(B) permit, they should first determine whether the project may affect an area where the rusty patched bumble bee is likely to be present. This may be done either online – by using IPaC (Option 1, below) – or with direct assistance from a FWS field office (Option 2, below). Regardless of which option is followed, the Service outcome will rely on information in our rusty patched bumble bee database and the results of the habitat connectivity model (described above). Project proponents or landowners may use other methodologies to confirm where the species is likely to be present, but we recommend that they document their methods and findings regardless of the process followed.

Option 1 – Use the FWS Information for Planning and Conservation (IPaC) website.

Preliminary/Coarse Screening at the County Level
Project proponents may first want to determine if the rusty patched bumble bee is present in the county or counties that their project or activities will affect to determine if a more detailed review of the project area is needed. The FWS IPaC website (https://ecos.fws.gov/ipac/) is an
efficient and user-friendly way to determine whether the rusty patched bumble bee is likely present in any county – or in precisely defined action areas. If the species is on the list of endangered species generated in IPaC for the county or counties of interest, refer to the instructions immediately below for *Screening Precisely Defined Project Areas*.

If the rusty patched bumble bee is *not* on the list of endangered species generated in IPaC for the county or counties of interest, the species is unlikely to be present in the area to be affected and, therefore, unlikely to be incidentally taken; we recommend that the project proponent document this finding (Fig. 3). IPaC provides user-friendly tools for this documentation.

![Flow chart of voluntary process recommended by FWS to determine potential need for an incidental take permit under section 10(a)(1)(B), with specific reference to the rusty patched bumble bee.](image)

*Figure 3.* Flow chart of voluntary process recommended by FWS to determine potential need for an incidental take permit under section 10(a)(1)(B), with specific reference to the rusty patched bumble bee.
**Screening Precisely Defined Project Areas**

As an alternative to screening at the county level, or as follow-up, project proponents may define the project area more precisely in IPaC with a sketch, polygon, or line or by uploading with a GIS shapefile. If IPaC generates a list of endangered species that includes the rusty patched bumble bee, the species is likely to be present in the project area. Go to **Step 2**.

If the rusty patched bumble bee is not on the list of endangered species generated in IPaC for the project area, the species is unlikely to be present in the area to be affected and, therefore, unlikely to be incidentally taken; we recommend that the project proponent document this finding (Fig. 3). IPaC provides user-friendly tools for this documentation.

**Option 2 – Work directly with the FWS field office.**

Due to limits on the nature and size of files that may be uploaded, IPaC may not work well for some reviews of precisely defined project areas that cover large geographic areas. In addition, some project proponents may prefer to work directly with FWS field offices or have established methods for screening projects that do not include the use of IPaC. In those cases, project proponents may work with the local FWS field office (https://www.fws.gov/offices/) directly to determine where their project area may overlap with the current distribution of the rusty patched bumble bee.

**Surveys**

If the project area overlaps with a high potential zone (Fig. 1) and contains suitable habitat for the rusty patched bumble bee (for example, see Fig. 2), the project proponents and landowner may assume that the species is present and proceed to Step 2 or it may complete a survey for the species. The results of a survey, if they are negative and are carried out in accordance with FWS-recommended survey protocol, would indicate that the project is not likely to incidentally take the species (Fig. 3). Project proponents and landowner should document this finding for their administrative record (Fig. 3).

The project proponents and landowner may, of course, conclude for any documented reason that the species is not likely to be present in the project area so long as the basis for its conclusion is supported in its administrative record. In other words, surveys are not required but represent one way to confirm the presence or absence of the species. Alternatively, for example, a project proponents or landowner may find that their project area does not contain

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1 IPaC does not allow the uploading of shapefiles that consist of multiple line segments, but line segments may be converted to polygons in GIS by buffering the line segments and then uploading the polygon shapefile to IPaC. There is a 500 kB limit to file sizes uploaded to IPaC, but you may upload zipped shapefiles.
suitable habitat for the species even when it overlaps with a high potential zone. When that is the case, surveys would not be necessary because the species would not be exposed to stressors associated with the project. Some areas within high potential zones do not contain suitable habitat for the species (Fig. 2).

The FWS-recommended survey methods are provided in “Survey Protocols for the Rusty Patched Bumble Bee (Bombus affinis)” (protocol, http://www.fws.gov/midwest/endangered/insects/rpbb/guidance.html). The protocol recommends one sampling season of surveys with sufficient effort\(^2\) to support a finding that the species is not likely to be incidentally taken by the project. Note that surveys should be conducted within a year before the project is initiated for negative survey results to remain valid throughout the duration of the project unless new information (e.g., new positive surveys) suggests that the species is likely to be present in the project area. In that case, project proponents and landowners and the FWS field office (https://www.fws.gov/offices/) should work together to ensure that the best available information is considered.

**Step 2 - Review the Project for its Potential to Incidentally Take the Species**
If you have reached Step 2, you should determine whether the project is reasonably certain to result in the incidental take of the rusty patched bumble bee. This is typically a two-step analysis to address:

1) Will any rusty patched bumble bees be exposed to one or more aspect (stressor) of the project that may influence their activity or condition?
2) How will the exposed rusty patched bumble bees respond to the stressor(s)?

FWS field offices are available to assist with this assessment (https://www.fws.gov/offices/).

**Rusty Patched Bumble Bee Life Cycle - In Brief**
The rusty patched bumble bee occurs in underground habitats throughout the year as solitary queens or in colonies that the queen initiates in the spring. During its active season, which is atypically long compared to other bumble bee species, access to diverse and abundant floral resources is essential. The rusty patched bumble bee’s annual cycle begins in early spring with colony initiation by solitary queens and progresses with the production of workers throughout the summer (Fig. 4). Reproductive individuals (males and potential queens) are produced in

\(^2\) Sufficient effort would consist of four approximately equally spaced sampling periods during the the sampling season (early June to mid-August); one-person hour of search time per three acres of suitable habitat using non-lethal netting techniques. The survey protocol provides further details on methods, techniques, and best practices (www.fws.gov/midwest/endangered/insects/rpbb/guidance.html) and is subject to continual improvement and modification.
mid- to late summer and early fall (Macfarlane et al. 1994, p. 4; Colla and Dumesh 2010, p. 45; Plath 1922, p. 192). The males and new queens (gynes, or reproductive females) disperse to mate and the original founding queen, males, and workers die. Colony sizes of the rusty patched bumble bee are considered large compared to other bumble bees, and healthy colonies may consist of up to 1000 individual workers in a season (Macfarlane et al. 1994, pp. 3-4). The new queens enter a form of hibernation to overwinter. The following spring, the queens (foundresses) emerge and search for suitable nest sites and collect nectar and pollen from flowers to support the production of eggs, which are fertilized by sperm she has stored since mating the previous fall. The queen is solely responsible for establishing the colony.

As the workers hatch and the colony grows, the workers assume the responsibility of food collection, colony defense, and care of the young, while the foundress remains within the nest and continues to lay eggs. During later stages of colony development, in mid-July, August, or September, the new queens and males hatch from eggs, disperse, and mate with individuals from other colonies. The newly mated queens overwinter for several months before emerging in the spring to start the cycle over. In Minnesota, for example, queens typically overwinter from October through March (E. Evans, U MN pers. comm. 2017) although they could remain active until November (Colla et al. 2011, p. 46, Figure 4).

**Rusty Patched Bumble Bee Habitat – Key Features**

The rusty patched bumble bee has been observed and collected in a variety of habitats, including prairies, woodlands, marshes, and gardens in parks and residential areas (Colla and Packer 2008, p. 1381; Colla and Dumesh 2010, p. 46; USFWS rusty patched bumble bee unpublished geodatabase 2016). It is a generalist forager for pollen and nectar like other bumble bees (Xerces 2013, pp. 27–28), but relies on diverse and abundant flowering plant species in proximity to areas that are predominantly free from ground-disturbing activities that may function as overwintering sites for hibernating queens (Goulson et al. 2015, p. 2; Potts et al. 2010, p. 349). Due to the early emergence of rusty patched bumble bees, woodlands and
other habitats that support diverse early blooming spring flowers are likely important habitats, especially when they are near open areas utilized for summer foraging.

**Active season habitat use (mid-March through mid-October)** Rusty patched bumble bee nests are typically in abandoned rodent nests or other similar underground cavities (Plath 1922, pp. 190–191; Macfarlane et al. 1994, p. 4). Foraging rusty patched bumble bees utilize open areas containing nectar and pollen sources that are nearby their colony nest site. The rusty patched bumble bee requires floral resources near its nest sites. Studies of other bumble bee species found that those species typically forage less than 0.6 miles (1 km) from their nests (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 rusty patched bumble bee is one of the first bumble bees to emerge early in the spring and among the last to go into hibernation. To meet its nutritional needs, therefore, the species requires a constant and diverse supply of flowers that bloom throughout the colony’s long life cycle, at least from April through September (MacFarlane et al. 1994, p. 5), perhaps longer. The rusty patched bumble bee may be dependent on woodland spring ephemeral flowers because of their early emergence (Colla and Dumesh 2010, p. 45-46).

**Overwintering habitat use (mid- October through mid-March)** - Characteristics of rusty patched bumble bee overwintering habitats have been described only anecdotally. Other species of bumble bees typically form a chamber in soft soil, a few centimeters deep and sometimes use compost or mole hills to overwinter (Goulson 2010, p. 11). In November of 2016, a rusty patched bumble bee queen was observed a few centimeters deep in soft soil under a layer of leaf litter (B. Herrick, UW- Madison Arboretum, pers. comm. Dec. 15, 2016). Overwintering sites may typically be in uncompacted and often sandy, moss-covered soils on northwest exposures (E. Evans, University of Minnesota, pers. comm. 2017). When first emerging in the spring, rusty patched bumble bee queens likely rely on early blooming spring ephemerals and they may overwinter in woodland areas near these important foraging resources.

For a more complete description of rusty patched bumble bee habitat and life history, see information available on the USFWS website, [https://www.fws.gov/midwest/endangered/insects/rusty patched bumble bee/](https://www.fws.gov/midwest/endangered/insects/rusty patched bumble bee/).
Habitats Where the Rusty Patched Bumble Bee is Unlikely to be Present

Areas that meet the following descriptions are not suitable for the rusty patched bumble bee for nesting, overwintering, or foraging:

- permanently flooded areas/open water;
- paved areas;
- areas planted to annual row crops, such as corn and soybeans;
- forest where invasive shrubs are dominant and spring ephemeral flowers are absent; and,
- areas mowed too frequently to allow development of diverse wildflower resources (e.g., road shoulders).

In addition to the above, wetlands, where standing water may be absent but near the ground surface, are unsuitable for nesting or overwintering. Some wetland areas, however, could function as important foraging habitat.

Timing of Habitat Use

Rusty patched bumble bee habitat needs may be divided roughly into two broad categories – underground habitats for overwintering queens and active-season nesting; and, nearby areas supporting diverse floral resources to ensure season-long access to pollen and nectar. In the spring, queens rely heavily on woodlands that support a variety of wildflowers before trees leaf-out and the canopy closes. After that, the species primarily uses open areas with floral resources through mid-October and nearby underground habitats (Fig. 4).

The species uses underground habitats throughout its life cycle. Due to the difficulty in finding the species when underground, nesting and overwintering habitats may only be described in a limited fashion (see above). Loose soils along forested edges and near open fields, however, may be especially important for overwintering habitat. During the active season (mid-March through mid-October, see Fig.4), however, the species searches actively for flowers. That drives its selection of habitats throughout the active season as the location and concentration of floral resources and their relative proximity to nests changes. As we state above, woodland habitats are especially important in the spring due to the blooming of spring ephemeral plants. When the forest canopy closes and floral resources decrease in late spring and summer, the species is dependent on flowers in forest openings, grasslands, and similar habitats.

Will the Species Be Exposed to Project-Related Stressors?

In some cases, project areas may overlap with high potential zones while affecting only habitat that is not suitable for the species upon closer inspection – for example, see the areas designated as “Unsuitable Habitat” in Fig. 2. In that event, the species is unlikely to be exposed
to stressors associated with the project and the project proponents should document this finding for its administrative record (Fig. 3). When making this determination, we caution project proponents and landowners to ensure that they consider any effects of the project that may extend outside of the immediate project footprint.

**Rusty Patched Bumble Bee - Potential Stressors**

**Evaluating Habitat-Related Stressors**

For any project that will affect an area where the rusty patched bumble bee is likely to be present, the project proponents and landowners may work with FWS (https://www.fws.gov/offices/) to assess whether – and how – the project is likely to affect key habitat features. Those features are summarized above. These stressors are only described here very briefly. For a thorough description of each stressor, refer to the *Rusty Patched Bumble Bee (Bombus affinis) Species Status Assessment* (https://www.fws.gov/midwest/endangered/insects/rusty patched bumble bee/pdf/SSAReportrusty patched bumble bee.pdf).

**Land Management Activities**

The timing, intensity, duration, and extent of land management activities likely play critical roles in determining the persistence of the rusty patched bumble bee within habitat patches. Haying, grazing, and fire, for example, maintain open meadows that may be suitable for foraging in the summer and fall, but may also degrade habitats or harm individuals if ill-timed, too intense, carried out over too broad of an area, or uninterrupted by periods of rest that facilitate diverse and abundant floral resources. Due to the low number of rusty patched bumble bees and the isolation of populations, it is essential that these practices are carried out in ways that minimize adverse impacts to early queens and that maintains a diversity of wildflowers throughout the period when the species is active (Fig. 4).

**Development and Land Clearing Activities**

Ground disturbing activities could affect the rusty patched bumble bee in any season except in areas where they are unlikely to nest or overwinter. (See *Habitats Where the Rusty Patched Bumble Bee is Unlikely to be Present*, above). The associated habitat loss could affect the rusty patched bumble bee indirectly, but would depend on the timing, intensity, location and nature of the project.

Bee species diversity is strongly linked to floral diversity and abundance over their entire active season (Hines and Hendrix 2005; others). This seems particularly relevant for short-tongued species like the rusty patched bumble bee, as they have limitations on the types of flowers they can access. Thus, the greatest impact of habitat loss on bees is the loss of floral resources.
necessary as food and nectar. Loss or degradation of floral resources has occurred primarily through conversion of lands to agriculture and urbanization, but also from factors such as suppression of natural fire regimes. Conversion of natural habitat that is rich in flowers to farmlands, urban and suburban areas, and other uses is the primary cause of bumble bee habitat loss (Goulson et al. 2015, p. 2). Ongoing urbanization also contributes to the loss and fragmentation of natural habitats. Bees, however, may be more resilient to loss due to urbanization, as many urban areas have gardens that provide floral resources for bees (Goulson et al. 2010, p. 1207; Goulson et al. 2015, p. 2; Frankie et al. 2005, entire).

Evaluating Insecticide & Herbicide Stressors

Here we present only a very brief summary with regard to the potential roles that pesticides may play as stressors for the rusty patched bumble bee. For a thorough review of the potential effects of pesticides on the species, please refer to the Rusty Patched Bumble Bee (Bombus affinis) Species Status Assessment ([https://www.fws.gov/midwest/endangered/insects/rusty patched bumble bee/pdf/SSAReportrusty patched bumble bee.pdf](https://www.fws.gov/midwest/endangered/insects/rusty patched bumble bee/pdf/SSAReportrusty patched bumble bee.pdf)).

In areas where the rusty patched bumble bee is likely to be present, project proponents and landowners should assess carefully any pesticide use and consider implementing conservation measures referenced below (in the Conservation Measures section) and other appropriate protective measures relative to the use of pesticides. Consideration should also be given to the potential for pesticides to extend beyond the footprint of the area where they are being applied.

A variety of pesticides are widely used in agricultural, urban, and even natural environments, and native bumble bees are often exposed to multiple agents, including insecticides, fungicides, and herbicides. Moreover, there is recent evidence that the interactive effects of pesticides and pathogens could be particularly harmful for bumble bees (Fauser-Misslin et al. 2014, pp. 453-455; Baron et al. 2014, pp. 463-465) and other bees (Alaux et al. 2010, pp. 775-777; Pettis et al. 2012, pp. 155-156; Vidau et al. 2011, pp. 3-5; Aufavre et al. 2012, pp. 2-3). A better understanding of how these interprojects may affect bumble bees in the environment is needed.

Although the toxicity of insecticides alone does not describe fully the potential harm that pesticides may cause, laboratory studies of pesticides have documented both lethal and sublethal effects to other bumble bee species (primarily B. terrestris and B. impatiens) and to European honey bees (e.g., Bortolotti et al. 2002, pp. 68-70; Gill et al. 2012, p. 107; Marletto et al. 2003, pp. 156-157; Mommaerts et al. 2006, pp. 3-4; Sanchez-Bayo and Goka 2014, pp. 7-8; Scott-Dupree et al. 2009, p. 179). Sublethal effects included reduced male production or no male production; reduced or no egg hatch; and, reduced queen production and longevity (e.g.,
Herbicides, when they may affect areas that are used by bumble bees for pollen or nectar gathering, could reduce available floral resources and may affect the rusty patched bumble bee indirectly. Therefore, any use of herbicides in a manner that may affect the rusty patched bumble bee should be assessed carefully to determine the species could be exposed to the effects of herbicide use.

Commercial Bumble Bees
Although cause and effect remain uncertain there is reason to think that the spread of one or more pathogens from commercial bumble bees may have played a role in the near disappearance of the previously widespread rusty patched bumble bee. Despite the uncertainty with regard to this association, project proponents and landowners should carefully assess any role that their projects may play with regard to commercial bumble bee use and consider implementing conservation measures referenced below in the Conservation Measures section (or others) relative to commercial bee use.

Honey Bees
Honey bees can compete with native bees for resources (e.g., Goulson and Sparrow 2009; Thompson 2004). We recommend that managers discourage the placement of honey bee 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.

Effects of the Project on the Species - Evaluating the Species Response to Stressors
After identifying the stressors that the rusty patched bumble bee will be exposed to, the project proponent should determine the species’ likely response to each relevant stressor to determine whether the project could result in the incidental take of the species. As with other aspects of project review, local FWS field office can assist with this analysis.

Step 3 - Review Measures to Avoid Incidental Take of the Rusty Patched Bumble Bee
When the rusty patched bumble bee is likely to respond negatively to one or more stressors associated with the project, the project proponent may implement measures to avoid or minimize the adverse effects. Below, in the section Conservation Measures, we outline a variety of actions that could be taken to avoid exposure of the species to stressors or to ensure
that the species does not respond negatively to the relevant stressors. The measures presented here are general, in nature, and we encourage project proponents to work directly with FWS field offices to adjust them to the specific project under consideration.

When it is not feasible to implement all measures that would make incidental take of the rusty patched bumble bee unlikely, the landowner or project proponent should work with the FWS to assess the potential for the issuance of an incidental take permit (ITP) under section 10(a)(1)(B) (Fig. 3). See the section **Incidental Take Permits**, below.

**Conservation Measures**

Since the late 1990s, marked and precipitous declines have been recorded in spatial extent and in the number of extant populations of the rusty patched bumble bee. Although the ultimate source of the acute and widespread decline is debated, and despite that the relative role and interacting effects of the primary stressors are unknown, the decline in the species is undisputable. Therefore, projects to avoid and reduce stressors to the species are needed urgently.

The guidance described above is intended to assist project proponents and landowners to determine whether their actions may incidentally take the rusty patched bumble bee. Project proponents and landowners may have significant opportunities, however, to use their programs to proactively contribute to the conservation of the rusty patched bumble bee in cooperation with the FWS. In addition, the conservation measures discussed below may be incorporated into projects to make incidental take unlikely (Fig. 3).

Opportunities to conserve the rusty patched bumble bee may be most beneficial in the high potential zones where the species’ presence should be initially assumed (Fig. 1), but there is significant likelihood that certain projects may benefit the species when implemented outside of these zones. We recommend that project proponents and landowners look for opportunities anywhere within about 6 miles (10 km) of recent rusty patched bumble bee records. Six miles is the approximate maximum dispersal distance for the species, based on studies of a closely related species, *B. terrestris* (Kraus et al. 2009, p. 249; Lepais et al. 2010, pp. 826-827). The FWS can provide project proponents and landowners with maps or GIS data to help identify opportunities and to plan activities in these areas (*e.g.*, see Fig. 5).
Projects that benefit bumble bees, in general, are likely to benefit the rusty patched bumble bee when they are carried out in areas where the species is likely to be present (Fig. 1) or within potential dispersal distances (Fig. 5). The Xerces Society’s, *Conserving Bumble Bees* ([http://www.xerces.org/bumblebeeguidelines/](http://www.xerces.org/bumblebeeguidelines/)) provides a variety of options for projects to conserve the rusty patched bumble bee when implemented in these areas.

**Restore and Maintain High Quality Habitat**

As stated above, bee diversity is strongly linked to floral diversity and abundance over their entire active season (*e.g.*, Hines and Hendrix 2005; for others, see USFWS 2016). Projects to
Projects to restore or maintain high quality habitats include the control of invasive species to maintain or restore native plant diversity and the restoration of natural habitats by planting species that are appropriate for the geographic region and local characteristics of each site.

**Carefully Plan and Implement Land Management**

Where the rusty patched bumble bee is likely to occur, vegetation management (haying, mowing, grazing, and burning) should be limited in high quality habitat during the active season (March through September) to minimize adverse effects to rusty patched bumble bee populations. For example, we recommend that managers leave one or more areas of unmowed habitat for the entire year in management areas. If mowing during the active flight season, create a mosaic of patches with variable vegetation structure, which have been found to support a diverse suite of bumble bees (Mader et al. 2011). If possible, use a high cutting height to prevent the disturbance of overwintering queens or nesting sites. We recommend a minimum of 8-10 inches, but 12-16 inches is ideal. In habitats managed with fire, prescribed burns should be rotated to ensure that there are substantial unburned refugia every year.

The Xerces Society’s, Conserving Bumble Bees ([http://www.xerces.org/bumblebeeguidelines/](http://www.xerces.org/bumblebeeguidelines/)) provides useful information to help plan and implement land management projects to facilitate conservation of bumble bees.

**Address Pesticide Use**

Careful and targeted pesticide use can be a useful management tool to control pests and invasive species, but pesticide use – especially insecticides – can adversely affect the rusty patched bumble bee if used improperly. In addition, other significant and interacting stressors can compound the effects of pesticides, as detailed in the species status assessment (USFWS 2016; [https://www.fws.gov/midwest/endangered/insects/rpbb/pdf/SSAReportRPBB.pdf](https://www.fws.gov/midwest/endangered/insects/rpbb/pdf/SSAReportRPBB.pdf)). This includes increased toxicity due to exposure to multiple agents; decreased resistance to disease; and, increased vulnerability to toxins due to food shortages that may result habitat degradation and a shortage of wildflower resources.

When pesticides must be used, we recommend the following measures:

- Follow the label and manufacturer’s directions and use the least toxic options. Use low concentrations, if possible. Following label directions is required by law and is necessary to ensure safe use.
● Apply the pesticide as locally and directly as possible. Avoid broadcast applications of insecticides or herbicides that may be harmful to rusty patched bumble bee or their nectar plants in areas where the species is likely to be found.
● Ensure that field crews recognize target weeds to avoid adverse effects to important native species.

Rusty patched bumble bees can fly at relatively cold temperatures and are active in early spring (late March or April) and during the morning hours. It is essential to consider this period of activity when assessing the potential effects of any pesticide use, including herbicides that may affect the species indirectly by decreasing the abundance or diversity of wildflower resources.

**Prevent Release of Commercial Bumble Bees into the Wild**
Because of the potential for pathogen transmission, the use of commercial bumble bees should be carried out in a manner that minimizes exposure to rusty patched bumble bee populations. The following recommendations will help minimize exposure.

● Do not release commercially acquired bumble bees into the wild after use.
● If possible, use commercial bumble bees only in greenhouses and take preventative measures to minimize escape, such as installing screens over windows, vents and other openings.

**Minimize Competition from Non-native honey bees**
Honey bees can compete with native bees for resources (e.g., Goulson and Sparrow 2009; Thompson 2004). We recommend that managers discourage the placement of honey bee 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; to try to keep their honey bee hives disease and pest free; and, to avoid placing honey bee hives in areas where the rusty patched bumble bee is likely to be present (Fig. 1 and see the section, Screening and Evaluation of Federal Project proponents and landowner Projects – A Stepwise Approach).

**Conduct Surveys to Locate Unknown Colonies**
Identifying the areas where the rusty patched bumble bee occurs is important to our efforts to prevent the species’ extinction. The FWS survey protocol [http://www.fws.gov/midwest/endangered/insects/rpbb/guidance.html](http://www.fws.gov/midwest/endangered/insects/rpbb/guidance.html) explains how surveys in areas outside of the known high potential zones may be used to find unknown occurrences of the species whose conservation could contribute to efforts to prevent the extinction of the rusty patched bumble bee.
Incidental Take Permits

If a project is likely to cause the incidental take of the rusty patched bumble bee and it is infeasible to make such take unlikely, even after the addition of conservation measures, we recommend that the project proponent or landowner apply for an incidental take permit under section 10(a)(1)(B) of the ESA. Section 10(a)(1)(B) of the ESA contains provisions for issuing incidental take permits to non-Federal entities for the take of endangered and threatened species, provided the following criteria are met: (1) The taking will be incidental; (2) the applicant will, to the maximum extent practicable, minimize and mitigate the impact of such taking; (3) the applicant will develop an HCP and ensure that adequate funding for the plan will be provided; (4) the taking will not appreciably reduce the likelihood of the survival and recovery of the species in the wild; and (5) the applicant will carry out any other measures that the Service may require as being necessary or appropriate for the purposes of the HCP.

Technical assistance on the incidental take permitting process is available from FWS field offices (https://www.fws.gov/offices/) and information about the process is also available online (https://www.fws.gov/endangered/what-we-do/hcp-overview.html).

Check to make sure that you have the most recent version by comparing to the guidance version number at the following website – www.fws.gov/midwest/endangered/insects/rpbb/guidance.html.
Literature Cited


