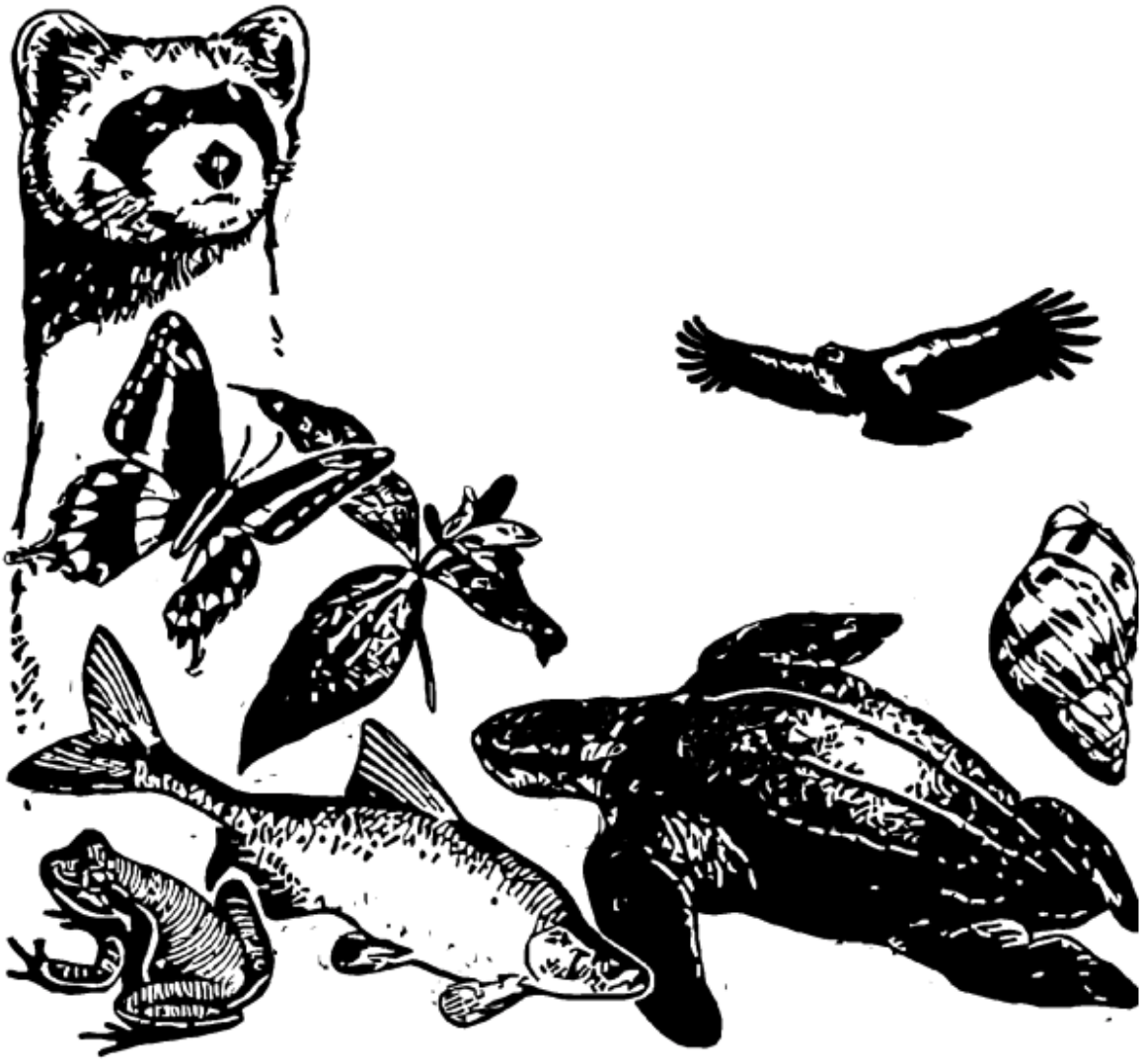
U.S. Fish & Wildlife Service

Section 7(a)(2) Consultation Technical Assistance

Rusty patched bumble bee

Generated July 17, 2026 05:06 AM UTC, IPaC v6.146.0-rc3



IPaC - Information for Planning and Consultation (https://ipac.ecosphere.fws.gov/): A project planning tool to help streamline the U.S. Fish and Wildlife Service environmental review process.

Rusty Patched Bumble Bee (*Bombus affinis*)

Endangered Species Act Section 7(a)(2) Voluntary Consultation Technical Assistance

Version 4

July 1, 2026

U.S. Fish & Wildlife Service

Rusty patched bumble bee
Photo courtesy of Tamara Smith, U.S. Fish and Wildlife Service

Recommended citation: U.S. Fish and Wildlife Service (USFWS). 2026. Rusty Patched Bumble Bee (*Bombus affinis*) Endangered Species Act Section 7(a)(2) Voluntary Implementation Technical Assistance. Version 4. USFWS, Bloomington, MN. 47pp. + Appendices.

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What's New in this Version

Significant updates to version 4 include:

1. **Incorporated critical habitat designation language throughout, including:**
    a. descriptions of the physical and biological features that are essential to the conservation of the rusty patched bumble bee and
    b. questions that can help project proponents with their analysis of the rusty patched bumble bee critical habitat.
2. **Clarified habitat descriptions, specifically we:**
    a. clearly defined the suitable habitats that the species uses for overwintering, nesting, and foraging,
    b. defined medium-high quality, low quality, and unsuitable overwintering, nesting, and foraging habitats.
    c. include a "habitat summary" section,
    d. added clarity to definitions of certain habitat types (e.g., forest). This includes:
        i. clarified habitat definitions in Table 1, including removal of overwintering as a likely use of forest edge habitat.
        ii. updated Table 1 to include interior forest nesting habitat for Central Appalachia-only.
3. **Included a voluntary habitat assessment that users can use to streamline use of the Determination Key. As such we:**
    a. added rational describing estimated disturbance acreage thresholds for low and medium to high quality foraging, nesting, and overwintering habitats,
    b. added tables that summarize medium-high- and low-quality nesting, overwintering, and foraging habitats (Tables 2, 4, and 5) and associated disturbance thresholds,
    c. added a voluntary habitat assessment form (Appendix E), and
    d. revised habitat disturbance thresholds for various habitat qualities. Specifically, we include:
        iii. medium-high quality nesting and overwintering habitat disturbances of 0.30 acres,
        iv. low-quality nesting and overwintering habitat disturbances of 1 acre,
        v. medium-high quality foraging habitat of 2 acres, and
        vi. low-quality foraging habitat disturbance thresholds of 10 acres.
4. **Added language to be consistent with other standing analyses that were developed by the Service, specifically we:**
    a. added standing analysis language (purpose, benefits, eligibility, ensuring accurate determinations, and updates),
    b. added a "Covered Area" section to clarify that this document and the Dkey covered areas delineated by high potential zones (HPZs) and delineated final critical habitat areas,
    c. added an "Excluded Areas" section, and
    d. strengthened effects to the species sections. Specifically, we:
        vii. included additional explanation regarding the potential impacts of both managed bees and pesticide use on rusty patched bumble bees, and
        viii. added assumptions for direct effects from ground disturbance –in medium-high quality and low-quality overwintering habitats.

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5. **Revised range-wide determination key (Appendix A) to include questions to address various habitat qualities Specifically, we:**
    a. added questions 2.1 and 2.2 for NRCS to ask if the user completed the voluntary habitat assessment form,
    b. added question 5.0.1 regarding USDA NRCS forestry practices and clarified other NRCS specific questions,
    c. added questions 21.1 and 21.2 to ask if the user completed the voluntary habitat assessment form,
    d. added questions 8.1.1,8.2.2, 11.01, 11.02, 36.1, 36.2, 39.1,39.2, 44, and 45 to allow users to assess habitat quality to determine appropriate levels of habitat disturbance thresholds,
    e. clarified question 20 regarding vehicle traffic, and
    f. revised other questions for clarity.
6. **Revised range-wide determination key (Appendix A) to include critical habitat questions and revised other questions for clarity. Specifically, we:**
    a. added questions 50-85 to assess effects to designated critical habitat, if present, in the action area,
    b. added questions 63-64, 71-72, 79-80 to allow users to assess habitat quality to determine appropriate levels of habitat disturbance thresholds,
    c. added questions 69, 77, and 85 to address effects to nesting, overwintering, or foraging physical and biological features that may have effects beyond the time(s) when the species may be present, within designated critical habitat.
7. **Miscellaneous**
    a. Removed Appendix B (from previous v.3.31).
    b. Moved Table 2 (from previous v.3.31) to Appendix B.
    c. Corrected a rounding error and rounded up from 0.27 acres to 0.30 acres, instead of rounding down to 0.25 acres.
    d. Made minor editorial changes (e.g., fixing typographical errors).

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Background and Purpose

In accordance with section 7(a)(2) of the Endangered Species Act (ESA), federal agencies must consult with the U.S. Fish and Wildlife Service (USFWS) on any action that may affect species listed as endangered or threatened to ensure they do not jeopardize the species' continued existence. We intend for this voluntary consultation technical assistance and the standing analysis within to help USFWS, action agencies, and applicants carry out efficient and effective 7(a)(2) consultations and to plan and implement actions that would conserve the species. The recommended approach provided in this document is voluntary and subject to periodic updates. Project proponents are encouraged to use this step-by-step approach to streamline compliance with the ESA and associated implementing regulations, but we recognize other compliance strategies are possible. We note that the Voluntary Consultation Technical Assistance does not create any new mandatory procedure or requirement for the public and any use of mandatory-type language in this consultation technical assistance refers only to lawful obligations present in statute or regulation. Other Federal agencies (other than USFWS) should not make this consultation technical assistance mandatory without first consulting with USFWS and following rulemaking processes under the Administrative Procedure Act as necessary.

Current Version of this Voluntary Consultation Technical Assistance.

Check to make sure that you have the most recent version by comparing the version number on the title page, above, to the consultation technical assistance version number at the website, https://www.fws.gov/media/esa-section-7a2-voluntary-implementation-technical-assistance-rusty-patched-bumble-bee.

Purpose of Standing Analysis

This technical assistance and standing analysis provides an optional, streamlined alternative consultation process for federal action agencies to address potential effects of future actions, pursuant to section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.)(Act), to the following species and critical habitat(s): rusty patched bumble bee (Bombus affinis) and rusty patched bumble bee critical habitat. The U.S. Fish and Wildlife Service (Service) developed this standing analysis to streamline the process of reviewing actions that would result in a "may affect, not likely to adversely affect" (NLAA) determination for the subject species and critical habitat(s). This standing analysis also provides proactive technical assistance to federal action agencies in making a "No Effect" determination.

This standing analysis provides an optional consultation process that is available to federal agencies for federal actions that meet the criteria described below as delivered through a Determination Key (DKey) in the Service's Information for Planning and Consultation (IPaC) application. To obtain consultation documents, including technical assistance for NE and concurrence with NLAA determinations, federal agencies must use the associated DKey in IPaC to answer questions about the proposed action. By screening the project through the DKey, all or part of the standing analysis is adopted by the federal action agency and used to submit a concurrence request to support their NLAA determination. It also provides technical information to help agencies determine whether an action will have no effect on the species or critical habitat. Formal consultation under ESA Section 7(a)(2) is required for actions that "may affect" a listed species and critical habitat, unless the Service concurs in writing that actions are not likely to adversely affect listed species and critical habitat. Actions which an action agency determines will have no effect on species or critical habitat do not require submittal to the Service.

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With the IPaC DKey established for this standing analysis, the action agency may receive a letter of concurrence for eligible projects by providing specific information requested by the DKey. Throughout the remainder of this document, statements regarding this standing analysis refer to both the standing analysis and the associated DKey.

Benefits of the Standing Analysis

For those federal actions that the Service has accumulated significant knowledge in analyzing previously, the Service is able to develop a standing analysis to streamline the consultation process for eligible federal actions. The streamlined process facilitated by this standing analysis will reduce the amount of Service staff time necessary to review actions requesting consultation and provide federal agencies, consultants, and other project proponents a predictable, consistent, and timely response for qualified actions. In addition, development of a standing analysis to assess the impacts of individual projects allows the Service to more efficiently track multiple independent actions on listed species and critical habitat.

Eligibility for use of the Standing Analysis

A standing analysis does not convey concurrence with NLAA determinations for individual projects. Rather, it serves as a streamlining tool. Action agencies may use it to develop their request for concurrence from the Service and support their finding that the action is not likely to adversely affect species and critical habitat. The standing analysis also allows the Service to quickly evaluate an action agency's analysis of effects to listed species and critical habitat. If the action agency's proposed action is consistent with covered[1] area and covered activities, including any required conservation measures in the standing analysis, the Service will concur that the action will have insignificant, discountable, or completely beneficial effects on the relevant listed species and critical habitat (i.e., NLAA).

The standing analysis may also provide technical information to help agencies identify actions that will have no effects to the listed species and critical habitat. For projects that do not qualify to use the standing analysis, action agencies/project proponents should coordinate directly with the local Ecological Services Field Office (ESFO) and address any consultation requirements, as appropriate.

Ensuring Accurate Determinations

As is true in all consultation procedures, the Service relies on complete and accurate information provided by federal action agencies during consultation. To apply this standing analysis to a project, it is the responsibility of the action agency/project proponent to provide information that is truthful and accurate and that fully represents the entire scope of the project in order to comply with the Act. Where appropriate in our analysis, we make note of which activities are expected to have no effects[2] on a species

[1] The term "covered" is used throughout this document to define the limits of use of a standing analysis. However, although the area, activities, and species are "covered" by the standing analysis, the future activities themselves are not "covered" by the standing analysis; there are additional steps (with or without a DKey) that take place for an action agency to utilize the information in the standing analysis and to request FWS concurrence that their proposed action is NLAA for listed species and critical habitat.

[2] A "no effect" determination is appropriate when either the species is not present in the action area or is not exposed to any possible stressors or impacts from the proposed action, or the proposed action would not result in any physical, chemical, biotic changes to the environment that are reasonably certain to occur and would not occur but for the action (i.e., no action area can be defined).

or critical habitat. This information is provided as technical assistance to action agencies making no effect/may affect determinations.

Updates to the Standing Analysis

This standing analysis will be reviewed and updated as needed to ensure the analysis contains the best scientific and commercial data available. This update process will include regular reviews to ensure that the analysis is accurate and valid, and that the standing analysis still meets the Act's requirements. All updates will also ensure that the logic is sound and determinations are appropriate for covered activities. Updates will be notated by version number on the cover page.

Projects reviewed under this standing analysis must rely on the version that is current on the date consultation is completed. For reference, both current and previous versions of the standing analysis will be maintained by the lead field office.

If we revise the standing analysis and determine reinitiation is required for any ongoing activities that used the previous standing analysis, the Services will contact the respective action agency and advise them of their need to reinitiate consultation.

Range, Status, and Recovery of the Rusty Patched Bumble Bee

The rusty patched bumble bee (*Bombus affinis*) occurs in the eastern and Midwestern United States and southern Canada. The species used to occur broadly across the eastern United States, upper Midwest, and southern Quebec and Ontario. Since about 2007 the species' distribution has declined across its range in the U.S. Similar declines have occurred in Canada where it was listed as Endangered on Schedule 1 of the Species at Risk Act in 2012 [U.S. Fish and Wildlife Service (USFWS) (USFWS 2016)]. For a map that shows the approximate current distribution of the species, refer to this USFWS website.

Section 7(a)(1) of the ESA directs each federal agency to carry out programs for the conservation of threatened and endangered species in consultation with USFWS. The USFWS recovery plan (USFWS 2021) and recovery implementation strategy for the species will provide a basis for agencies to plan and implement actions that will help it fulfill their section 7(a)(1) mandate.

The recovery plan includes a phased approach to the species' recovery that focuses initially on halting and then reversing declines and ultimately, on securing the species' long-term viability. The recovery strategy's specific objectives include:

1. Preventing further loss of populations by (a) identifying and ameliorating the threats driving the declines, (b) increasing the health of individuals and the number of colonies comprising populations, and (c) ensuring appropriate connectivity between populations.
2. Ameliorating pervasive threats, including those from pathogens, pesticides, habitat loss, managed bees, and effects of climate change.
3. Buffering against catastrophes and environmental stochasticity by increasing the number of genetically and demographically healthy populations and the spatial distribution of those populations.
4. Buffering against novel changes in the species' physical and biological environment by restoring populations across the breadth of its natural adaptive diversity.
5. Protecting populations and their habitats and abating threats into the foreseeable future.

Covered Area

This technical assistance document and standing analyses within applies within the area described below. In delineating the geographic scope of this document (coverage area), we determined the appropriate extent based on the species and critical habitat(s) included and the activities covered herein. To use this technical assistance, a project's action area should fall within the covered area.

Covered Area: Areas covered by this consultation technical assistance include the areas where the USFWS considers the rusty patched bumble bee to be present (rusty patched bumble bee High Potential Zone (HPZ)]) and areas designated as critical habitat for the species (https://ecos.fws.gov/ecp/report/table/critical-habitat.html).

Excluded Areas

Lands enrolled in the Nationwide Candidate Conservation Agreement for Monarch Butterfly on Energy and Transportation Lands (Monarch CCAA) were excluded from the final rusty patched bumble bee critical habitat designations. These exclusions apply **only** to the designated critical habitat - not to the species itself. The USFWS cannot exclude additional lands from the current critical habitat designation, including lands that may enroll in the future under either the Monarch CCAA or the Nationwide Conservation Benefit Agreement for Bumble Bees on Energy and Transportation Lands (Bumble Bee CBA). However, we can generally assume that the effects to habitat identified in the biological opinions for these agreements are similar to the expected impacts on the primary biological features of the designated critical habitat (U.S. Fish and Wildlife Service 2020, 2026).

Section 7 Consultation with USFWS

The recovery objectives for the rusty patched bumble bee provide an essential foundation for section 7(a) consultations. Under section 7(a)(2), federal agencies must ensure, in consultation and with the assistance of USFWS, that their actions are not likely to appreciably diminish the likelihood of a species' survival and recovery. The status of the rusty patched bumble bee as it relates to the recovery criteria and the way in which the proposed federal action is likely to affect the species' progress towards recovery are key factors that the action agency and the USFWS must consider when planning the project and assessing its effects, respectively. The first steps in this assessment are to evaluate whether and how the action may affect the species in the affected area.

Below we clarify steps that agencies and their representatives may take to meet ESA section 7(a)(2) requirements relative to the rusty patched bumble bee. We invite agencies to use any alternative methodologies that meet these same ends.

Step 1. Define the Action Area

The action area is not only the immediate area involved in the action, but all areas that the action will affect directly or indirectly (50 CFR § 402.02). It is not always limited to the "footprint" of the action, but encompasses the biotic, chemical, and physical impacts to the environment resulting directly or indirectly from the action.

Step 2. Determine whether the rusty patched bumble bee or its critical habitat is likely to be present in the action area.

Section 7 regulations require each Federal agency to review its actions at the earliest possible time to determine whether any action may affect listed species or critical habitat (50 CFR § 402.14). Below we provide two options for determining whether rusty patched bumble bee (RPBB) may be present in an action area. Option 1 involves the use of the USFWS Information for Planning and Conservation website (IPaC) website (https://ecos.fws.gov/ipac/). Agencies may use any alternative approach that accurately determines whether the species or its critical habitat may be present in the action area. Mapping updates in IPaC are done once every year for the species, but the critical habitat updates only would occur through a rule-making process. If you are aware of new information that indicates that RPBB may be present in the action area that may not yet be represented in IPaC, please coordinate with your local USFWS Ecological Services Field Office (Our Locations | U.S. Fish & Wildlife Service (fws.gov)).

Option 1 – Use the USFWS Information for Planning and Conservation (IPaC) Website

IPaC looks for overlap between the action area, as entered by the user, and underlying species distribution data, in this case, rusty patched bumble bee High Potential Zones (HPZ) (found online at (https://www.fws.gov/species/rusty-patched-bumble-bee-bombus-affinis) and the designated rusty patched bumble bee critical habitat areas (found online at https://ecos.fws.gov/ecp/report/table/critical-habitat.html). As shown below, users may enter coarse information for the area of interest – for example a state or a county – or a precisely defined action area.

Screen a Precisely Defined Action Area

Agencies may define the action area in the USFWS Information for Planning and Conservation website (IPaC) to determine if a federally listed species or critical habitat is present in their action area. The first step in the environmental review process is to enter a location to explore. IPaC will find species and resources that may be impacted by activities at that location. IPaC allows project proponents to draw a polygon or line that delineates their project area directly in the system to determine the project's potential overlap with federally listed species or designated critical habitats.

If the resulting IPaC query produces a species list that includes the rusty patched bumble bee, the species may be present in the action area [the action area overlaps with a rusty patched bumble bee High Potential Zone (HPZ), Figures 1 and 2]. The agency may contact the USFWS Ecological Services Field Office (Our Locations | U.S. Fish & Wildlife Service (fws.gov)) to obtain what information may be available regarding the location, extent, and quality of the species' habitat in the action area (refer to Step 3). Similarly, the agency may contact the USFWS Ecological Services Field Office (Our Locations | U.S. Fish & Wildlife Service (fws.gov)) if the list generated by IPaC includes rusty patched bumble bee critical habitat.

If the rusty patched bumble bee or its critical habitat is not on the list of species generated for the action area by IPaC, it is not likely to be present in the action area and we would advise the action agency to document this finding for its administrative record. Consultation under section 7(a)(2) is only required for federal actions that may affect listed species or their critical habitats. Mapping updates to the HPZs for the species are made once per year in IPaC. If you are aware of new information that indicates that RPBB may be present in the action area and may not yet have been incorporated into IPaC, please contact your local USFWS Ecological Services Field Office (Our Locations | U.S. Fish & Wildlife Service (fws.gov)).

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Critical habitat designations are not updated annually, and are updated only through a rule-making process.

Screening at the County or State Level

Agencies may first want to determine if a listed species and/or critical habitat is present in any county or state that their actions may affect. To obtain a list of endangered species that are likely to be present in a county or state, use the USFWS Information for Planning and Conservation website (IPaC). You may upload a state or county boundary shapefile or use the drawing function in IPaC to delineate the project area. Eventually you may also be able to select states or counties directly within IPaC in lieu of uploading a shapefile.

If the rusty patched bumble bee is *not* on the official species list you generate in IPaC, the species is not likely to be present. Consultation under section 7(a)(2) is only required for federal actions that may affect listed species. In this event, we would advise the action agency to document the findings for its administrative record. Similarly, if rusty patched bumble bee critical habitat is *not* on the list generated in IPaC, no critical habitat is present. Consultation under section 7(a)(2) is only required for federal actions that may affect listed species or its critical habitat. In this event, we would advise the action agency to document the finding for its administrative record

Option 2 – Work directly with the USFWS field office.

Agencies may sometimes prefer to work directly with USFWS field offices or may have other established methods for screening projects that do not yet include the use of IPaC. In those cases, agencies may work directly with the USFWS Ecological Services Field Office (Our Locations | U.S. Fish & Wildlife Service (fws.gov)) to determine whether their action area may overlap with the current distribution and/or critical habitat of the rusty patched bumble bee.

Surveys

If the action area overlaps with a HPZ, the agency may assume that the species is present in suitable habitat (Fig. 1) and proceed to Step 4 or it may complete a *Project Review* survey for the species. **Note that surveys for the species do not apply to the critical habitat designation**. Before planning or conducting surveys, check the USFWS website (https://www.fws.gov/media/survey-protocols-rusty-patched-bumble-bee) to be sure that you are using the most recent version of the survey protocols. Refer to the section, ***Rusty Patched Bumble Bee Habitat,*** below for a description of what constitutes habitat for the species. The results of a Project Review survey, if they are negative and are carried out in accordance with the Project Review survey protocol, could support an agency determination that the species is unlikely to occur in the action area. The action agency may conclude for any documented and valid reason that the species is not present in the action area. For example, an agency may document that their action area does not contain habitat for the species even when it overlaps with a HPZ (Fig. 1).

Among other things, USFWS survey protocols include surveys with sufficient effort to support a determination that the species is not likely present in the area surveyed (survey technical assistance is available online at https://www.fws.gov/media/survey-protocols-rusty-patched-bumble-bee). Negative survey results remain valid for projects initiated within one year of the survey. In those cases, USFWS considers the results valid for 2 years, or the duration of the project, whichever is shorter, unless new information (*e.g.*, new positive surveys) suggests that the species is likely to be present in the action area. In that case, action agencies and the USFWS Ecological Services Field Office (Our Locations | U.S. Fish

& Wildlife Service (fws.gov)) should work together to ensure that the best available information is considered.

Surveys for projects with duration less than 2 years

USFWS considers the results valid for two years or the duration of the project, whichever is shorter, unless new information (*e.g.*, new positive surveys) suggests that the species is likely to be present in the action area. In that case, action agencies and the USFWS Ecological Services Field Office (Our Locations | U.S. Fish & Wildlife Service (fws.gov)) should work together to ensure that the best available information is considered, and an appropriate determination of effects is made.

Surveys for projects with duration greater than 2 years

USFWS considers negative survey results valid for two years unless new information (*e.g.*, new positive surveys) suggests that the species is likely to be present in the action area. Agencies should either assume species presence in suitable habitat (Fig. 1) and proceed to Step 4 or complete a *Project Review* survey within the action area every two years for the duration of the project.

Surveys for long-term projects, that affect only smaller proportions of a larger total action area over time

For projects that affect only a smaller proportion of the total action area and that action area changes over time, USFWS recommends assuming species presence in suitable habitat (Fig 1) and proceed to Step 4 or it may complete *Project Review* surveys in those area(s) that will be affected within the next two years. USFWS considers negative survey results valid for two years unless new information (*e.g.*, new positive surveys) suggests that the species is likely to be present in the action area.

Surveys for long-term projects affecting the same area repeatedly

For projects that anticipate affecting the same action area repeatedly over time[3], agencies should either assume species presence in suitable habitat (Fig. 1) and proceed to Step 4 or complete *Project Review* surveys within the action area every two years for the duration of the project. USFWS considers negative survey results valid for two years unless new information (*e.g.*, new positive surveys) suggests that the species is likely to be present in the action area.

More complicated projects

For more complicated projects than described above, action agencies and the USFWS Ecological Services Field Office (Our Locations | U.S. Fish & Wildlife Service (fws.gov)) https://www.fws.gov/offices/should work together to understand if surveys are recommended, the frequency of surveys, and ensure that the best available information is considered and an appropriate determination of effects is made.

[3] This does not include projects that make suitable habitat permanently unsuitable (e.g., flowering prairie converted to a paved parking lot).

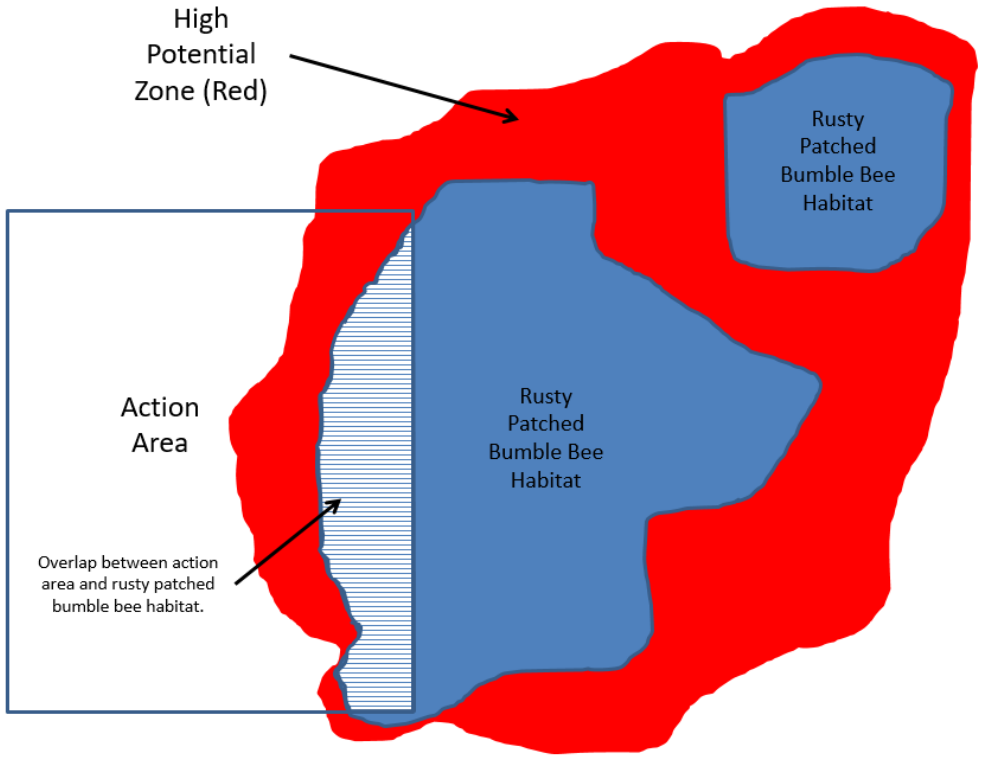

Figure 1. Example of a hypothetical High Potential Zone (HPZ) that, upon closer examination, is found to contain areas with and without rusty patched bumble bee (RPBB) habitat. In the area within the HPZ where RPBB habitat overlaps with the action area, the proposed action could directly affect individuals if they are present and may also indirectly affect the species through impacts to the resources it needs to fulfill its life cycle.

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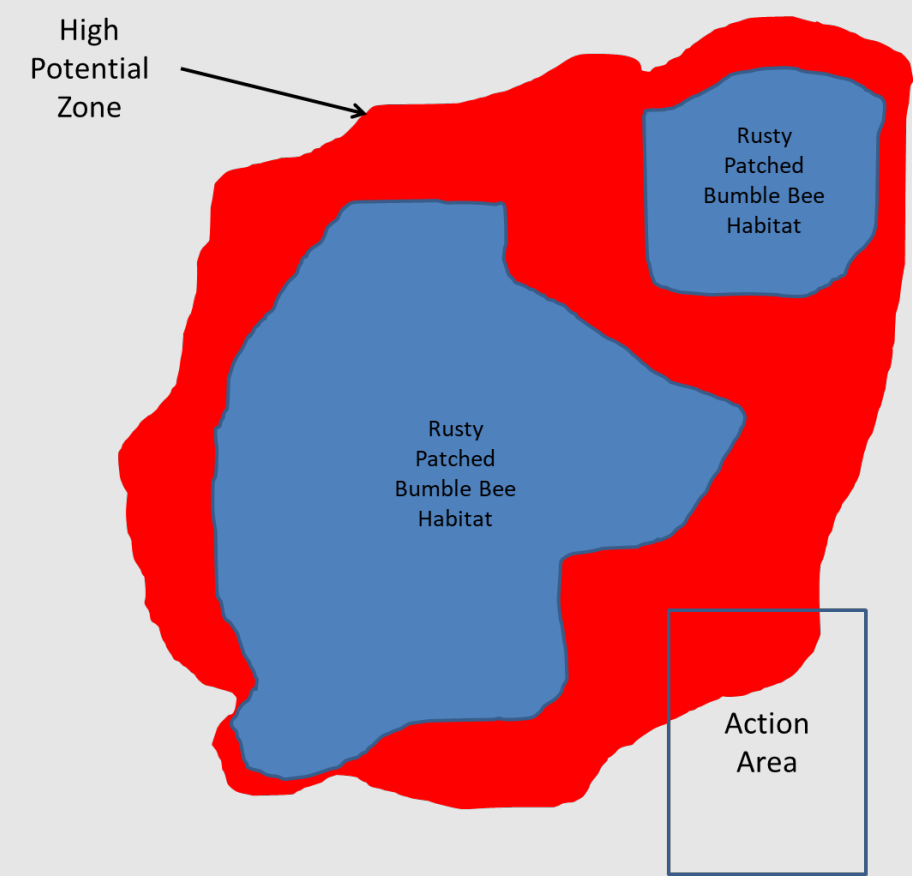

Figure 2. The same hypothetical High Potential Zone (HPZ) shown in Fig. 1. In this case, the area likely to be affected directly or indirectly by the proposed action – the action area – occurs partly inside the HPZ, but does not overlap rusty patched bumble bee habitat.

Step 3 – Evaluate the Potential Effects of the Action

If the rusty patched bumble bee occurs in the action area and/or the action area overlaps with critical habitat areas, the action agency should determine whether its action may affect the species and its critical habitat and whether those effects are likely to be adverse. The section 7 regulations (50 CFR 402.02) define effects of the action as "Effects of the action refers to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process. Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration."

Federal actions may affect the rusty patched bumble bee if any of its components affect a resource on which the species relies or if any component of the action may interact directly with the species. Effects to a species' resource needs that can lead to an adverse individual response are stressors (e.g., refer to Appendix C). Stressors act indirectly on a species through impacts to the resources it needs to fulfill its life cycle. Crushing an individual with heavy machinery is an example of a direct interaction.

Answers to these three sets of questions can help to frame up an analysis on the species:

1. Could the action affect the species' resource needs or interact directly with the species?
2. If the action could affect the species' resource needs, will that lead to an adverse individual response?
3. Is any individual of the species likely to interact directly with any feature or activity associated with the action? If so, will that lead to an adverse individual response?

Federal actions that may affect critical habitat require that agencies ensure their activities are not likely to adversely modify or destroy designated critical habitat. Regulations implementing these sections of the Act define "destruction or adverse modification" as: "a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of a listed species" (Refer to 50 CFR 402.02). Such alterations include, but are not limited to, alterations adversely modifying any of those physical or biological features that were the basis for determining the habitat to be critical. Critical habitat was designated in areas occupied by the species at the time of listing and that contain the physical or biological features essential to the conservation of the species and which may require special management considerations or protection. Activities associated with Federal actions that may be affected by designation of critical habitat for the rusty patched bumble bee include those that may affect the physical or biological features of the rusty patched bumble bee's critical habitat. The following physical or biological features are essential to the conservation of the rusty patched bumble bee

Physical or biological features for the rusty patched bumble bee:

(1) For overwintering, contiguous upland forest habitat, at least 82 feet (25 meters (m)) from a non-forested edge, with plants that provide spring pollen and nectar for spring queens foraging immediately after emergence from diapause, containing leaf litter or duff for burrowing, and without dense invasive plant understory vegetation.

(2) For nesting, upland grasslands, shrublands, savannas, and the forest edge interface between forested and non-forested natural habitats that extends approximately 30 meters into the forest.

(3) For nesting, abandoned rodent burrows, other mammal burrows, existing cavities with ample cover, or similar existing cavities at the soil surface or below to 4 feet underground.

(4) For nesting and overwintering, well-drained, uncompacted, loose soils sheltered from the elements.

(5) For foraging, diverse, abundant, native floral resources for the entire active flight season.

Answers to the following questions can help to frame up an analysis on rusty patched bumble bee critical habitat:

1. Are one or more of the critical habitat physical or biological features present in the action area?
2. Could the action affect these physical or biological features?

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3. If the action could affect the critical habitat physical or biological features, will that lead to a permanent modification or destruction of those features during the time when the species may be using them (e.g., will it destroy winter habitat for future winter use)?
4. If the action could affect the critical habitat physical or biological features, will that lead to a temporary modification or destruction that would adversely affect those features in the future times of use?

Assisted Determination Key

USFWS has developed an assisted determination key (Appendix A) that may be used to help to determine the effects of proposed actions on the rusty patched bumble bee and its critical habitat. USFWS also developed a partial list of stressors and responses (Appendix C), a list of not likely to adversely affect activities for USDA NRCS (Appendix D), and an optional habitat assessment form (Appendix E), which will assist users with determination key answers. Refer to the keys for instructions on their use.

Rusty Patched Bumble Bee Habitat, Ecology, and Life Cycle

Colony Establishment and Growth

Bumble bees live in colonies – cooperative groups that include the offspring of one female and one male. Healthy rusty patched bumble bee colonies are large and may include more than one thousand workers (non-reproductive females). The workers protect the colony, forage for nectar and pollen, and care for the young. Healthy colonies with many workers can produce dozens to hundreds of new queens (Macfarlane 1974, Macfarlane et al. 1994).

Initially, colonies include only foundress queens, but grow to include workers, males, and new queens. In spring, queens emerge from their overwintering chambers to initiate colonies, having stored sperm from mating the previous autumn to fertilize eggs. Access to blooming flowers and a suitable nesting site – typically a rodent burrow – enables the queen to rear the first workers on her own. A “continuous supply of floral resources is required to support the nest-founding stage…because each queen must forage for food as well as tend the nest, potentially limiting her mobility” (Lanterman et al. 2019). Colony survival and productivity relies on continual access to blooming plant species throughout the spring, summer, and early fall and protection from outside threats. Workers facilitate the production of the males and queens, which disperse from the nest to mate with reproductive progeny from other colonies that comprise the population (Plath 1922, Macfarlane et al. 1994, Colla and Dumesh 2010). Before winter, the original (foundress) queen, workers, and males all die. Only the new queens, referred to as gynes, can overwinter to initiate new colonies in the spring.

Nesting

Rusty patched bumble bee nests are typically one to four feet underground in abandoned rodent nests or other mammal burrows and occasionally at the soil surface or aboveground (Plath 1922, Macfarlane 1974, Boone et al. 2022, ESI 2024, Smith et al. 2025). Among the 43 rusty patched bumble bee nest records cited by Macfarlane (1974), 95% were underground. Queens may locate abandoned rodent burrows by using olfactory or chemical cues (Lanterman et al. 2019). Most recent rusty patched bumble bee nest observations were associated with rodent burrows (Boone et al. 2022, p. 381, ESI 2024, Smith et al. 2025, Smith and Sharer 2026) as were recently discovered nests of a closely related species, the western bumble

bee (*B. occidentalis*) (Everett et al. in process, entire), which is in the same subgenus as rusty patched bumble bee.

A recent paper by Lanterman et al. (2019) summarized 451 observations of nest-searching behavior by queens belonging to nine bumble bee species. Rusty patched bumble bee was not among the species observed, but their observations may shed some light on the manner by which the species searches for nest sites:

> "Several criteria by which bumble bee queens select nest sites have been proposed – that the site should require little preparation by the queen, be situated in well-drained soil, and be sheltered from the elements (Frison 1923, Alford 1969*a*). The greater abundance of nest seeking queens found in transitional zones between wooded and open habitats in our study, along with the large numbers of queens investigating areas with dense leaf litter, fallen logs and other features of woody habitats, supports these criteria."

The authors observed queens searching for nesting sites in open grassland habitats, but nest-seeking queens favored woody transitional habitats over open habitats (Lanterman et al. 2019). The transition zone between forest and grassland, as well as field boundaries, meadow margins, and forest edges, can be particularly valuable bumble bee nesting habitat due to the presence of abandoned rodent nests and undisturbed habitat with diverse floral resources (Hines and Hendrix 2005, p. 1483). Forests are ecosystems where trees are the dominant life form and forest edge is the interface between forested and non-forested habitats that extends approximately 30 meters into the forest (Harper et al. 2005, pp. 771, 774).

Described as a "forest bumble bee" in the heavily forested Central Appalachian portion of the range (within Virginia, West Virginia, and Maryland), rusty patched bumble bees are associated with cool, heavily forested, high elevation landscapes in the Central Appalachian Mountains (Hepner et al. 2023). In this part of the range, closed-canopy upland forests provide nesting habitat for the Appalachian Mountains rusty patched bumble bee populations (Harper et al. 2005; Hepner 2022, pers. comm.); thus, virtually all upland forested habitats are considered to be potential nesting habitat for the species, provided there are abandoned rodent burrows and suitable floristic resources exist throughout the nesting season. Open woodlands, glades, barrens, permanent grassland/shrublands, and early successional forest woody habitat patches within the matrix of closed-canopy forest types allow sunlight to reach ground level, creating additional nesting The duration of forest use varies due to the range in bloom period and variation in bloom cycle caused by the diversity of plant species composition and other environmental variables, such as elevation and latitude. For example, in some areas of the George Washington – Jefferson and Monongahela National Forests, local elevation and aspect may extend the blooming period of certain over and understory species into the summer and may therefore be suitable for nesting in those areas.

Overwintering - Locations of Wintering Queens

Little is known about the overwintering habitats of rusty patched bumble bee foundress queens, but based on one observation of rusty patched bumble bee and observations of other species we assume that rusty patched bumble bee queens overwinter in forested areas with well-drained, soft, loose soil – i.e., forested areas shaded by tree cover or aspect with native plants that provide springtime pollen and nectar, with uncompacted soils, and not dominated by invasive plant species, like buckthorn (Table 1). Forests are ecosystems where trees are the dominant life form and forest interiors are large blocks of unfragmented forest with continuous canopy that shows no detectable edge influences (Harper et al. 2005, p. 771). Forest edge is the interface between forested and non-forested habitats that extends approximately 25-30 meters into the forest (Harper et al. 2005, pp. 771, 774). Compacted soils are dense and occur when soil

particles are pressed together, resulting in few large pores and less total pore volume. Compacted soil has a reduced rate of water infiltration, water drainage, and gas exchange and are likely to be unsuitable for queens to burrow to an appropriate depth to survive winter (Waybright and Dillon 2025).

The only known documented overwintering rusty patched bumble bee queen, discovered in a hemlock grove within a maple oak-forest (about 0.5 km into the forest) in Wisconsin in 2016, was found on a level area near the bottom of a north-facing slope under a few centimeters of leaf litter and loose soil (B. Herrick, University of Wisconsin-Madison Landscape Arboretum, pers. comm. 2016; Herrick and Carpenter 2025).

Other species of *Bombus* typically form a chamber in loose, soft soil, a few centimeters deep in bare earth, moss, under tree litter, or in bare-patches within short grass" and may avoid areas with dense vegetation (Alford 1969*a* p. 156, Liczner and Colla 2019, p. 792). Overwintering habitat preferences may be species-specific and dependent on factors such as slope orientation and timing of emergence.

For example, *Bombus* queens have been found in well-drained soil that was shaded from direct sunlight in banks or under trees and was free from living ground vegetation (Alford 1969, pp.150–152). For underground sites, soil type is often described as sandy and well-drained (Alford 1969, p. 169), which suggests that maintaining a consistently low moisture level is important (Sladen 1912, p.p. 94-101, Colla and Dumesh 2010) Overwintering bumble bees have been found mostly in shaded areas, usually in soil near tree trunks or in banks without dense vegetation (Dave Goulson 2010, Liczner and Colla 2019). Because soil temperature influences diapause duration and emergence (Alford 1969, pp. 161–168; Beekman et al. 1998, p. 207), it has been hypothesized that the apparent preference for north-facing slopes and shaded areas is to prevent the overwintering queens from emerging too early on relatively warm days in the winter or early spring (Alford 1969, pp. 149–169), and more generally, it could suggest selection of sites that buffer hibernating bees from both temperature and moisture fluctuations (Williams et al. 2019, pp. 1-3).

Williams et al. (2019, pp. 2-3) provide the first paper on overwintering habitat for any bumble bee in western North America. They found all ten yellow-faced bumble bees (*B. vosnesenskii*) queens "burrowed beneath 3.5–5 cm of cypress tree litter in a thin layer of duff between needle litter and mineral soil". All were within 1.5 meters of tree trunks, directly shaded from sun, which is consistent with other bumble bees studied in Britain (e.g., Alford 1969*a*). The only North American bumble bee overwintering documented prior to the Williams et al. study and the 2016 UW Madison Arboretum observation (B. Herrick, University of Wisonsin-Madison Landscape Arboretum, pers. comm. 2016; Herrick and Carpenter 2025) was of the common eastern bumble bee (*B. impatien*s), which was found overwintering beneath sod in loose aggregations of individuals at a depth of 7 cm (Plath 1927, pp. 183-184). Some social bees, such as the common eastern bumble bee, have been observed overwintering in aggregations near the nesting sites (Alford 1969*a*, Pugesek et al. 2023), however there is no clear evidence that shows rusty patched bumble bees overwintering near nesting sites.

Based on these studies, we assume rusty patched bumble bees are overwintering in any contiguous forest patch (i.e., forested areas with native plants that provide springtime pollen and nectar, with leaf litter or duff for burrowing, with uncompacted, well drained soils and not dominated by invasive understory plant species, like common buckthorn) that contains forest greater than 82–98ft (25–30m) from a non-forested edge.

Nectar and Pollen Resources

Bumble bees are generalist foragers that collect nectar and pollen from a wide diversity of plants (Jepsen et al. 2013, pp. 27-28). The rusty patched bumble bee is one of the first bumble bee species to emerge early in the spring and last to go into diapause (hibernation) in the fall. To meet its nutritional needs, the species requires a constant and diverse supply of flowers that bloom throughout the colony's flight period from spring through the fall (Macfarlane et al. 1994, p. 5). Rusty patched bumble bees need access to both nectar and pollen from spring to fall to support all stages of colony development. The nectar from flowers provides carbohydrates (energy) and water, whereas the pollen provides protein, lipids (fatty acids), and micronutrients for the species (Di Pasquale et al. 2013, p. 4, USFWS 2016, p. 15, Vaudo et al. 2020, Lau et al. 2022, pp. 6-8).

Bumble bees rely on some plant species for pollen and others for nectar, even during single foraging bouts (Plowright and Laverty 1984, p. 187). Availability of pollen, may limit population growth more often than shortages of nectar (Plowright and Laverty 1984, p. 187, Colla 2016, p. 187) and the number of queens that a colony can produce is related directly to pollen availability (Burns 2004, p. 150). Production of sexual offspring (new queens and males) can be limited in simple landscapes with a low availability of diverse and high-quality pollen sources, even if nectar carbohydrates are present in abundance (Requier et al. 2020). Some plant species may hold special importance for bumble bees due to their especially high value nutritionally and for immune-support (refer to https://www.fws.gov/media/plants-favored-rusty-patched-bumble-bee).

The availability of floral resources is dependent on the proper soil and precipitation conditions to sustain them. Extended periods of drought, for instance, may lessen the availability and diversity of flowering plants in a given area because plant phenology is primarily driven by temperature, precipitation, and the timing of snowmelt in the spring (Inouye and Wielgolaski 2003*a*, p. 207, *b*, pp. 179-181, Pyke et al. 2016, p. 12).

Foraging and Dispersal

Based on other *Bombus* species, which typically exhibit foraging distances of less than 0.6 mi (1 km) from their nesting sites ((Dramstad 1996, pp.163-182, Osborne et al. 1999, pp. 524-526, Knight et al. 2005, p. 1816, Wolf and Moritz 2008 p. 422, Rao and Strange 2012, pp. 909-911) the rusty patched bumble bee may need floral resources in close proximity to its nest, although studies have not confirmed this to date. The rusty patched bumble bee may also be dependent on forest spring ephemeral flowers because of the species' early emergence in the spring and its association with forests and near forested habitats (Colla and Dumesh 2010, pp. 45-46, 48).

Readily available access to high-quality foraging habitats near nests allows other bumble bee species' workers to maintain short foraging distances (Crowther et al. 2019). In Wisconsin, detection probabilities of all bumble bee species, including rusty patched bumble bees, increased with floral abundance (Nunes et al. 2024, p. 221). Furthermore, colonies with low floral abundance around their nests may produce few workers, and males may fail to produce any new queens (Pelletier and McNeil 2003, pp. 691-692, Burns 2004, pp. 149, 155-156, Samuelson et al. 2018 p. 57, Timberlake et al. 2021, p. 1013). Workers of other bumble bee species can forage 0.6 mi (1 km) or more from nests but may predominantly forage within a few hundred meters (Dramstad 1996, pp. 170–175; Osborne et al. 1999, pp. 524–526, 529; Wolf and Moritz 2008, p. 422; Rao and Strange 2012, p. 911). A paucity of spring floral resources contributed to high pathogen loads in one bumble bee species studied in Pennsylvania and may exacerbate the threat posed by disease transmission from honeybee apiaries (McNeil et al. 2020, p. 3).

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Queens must locate nesting areas where plant species diversity is sufficient to ensure that forage will be available throughout its long active season, from mid-March into October (Macfarlane et al. 1994, p. 5, USFWS 2021 unpublished data). There is a brief period when the queen ceases to forage as she cares for the first batch of newly eclosed workers (Dave Goulson 2010, p. 7), however the exact timing of this pause may vary from one colony to the next. Floral resources close to the nest "might be especially important during the establishment phase of a colony, when only few workers are available for foraging" (Herrmann et al. 2007). Workers may forage up to about a kilometer from nests, but most likely stay within a few-hundred meters (Dramstad 1996, Osborne et al. 1999, Knight et al. 2005, Wolf and Moritz 2008, Rao and Strange 2012), if there are sufficient floral resources (i.e., lesser quality foraging habitat available). Bees will forage further from their nests if floral resources are insufficient or scarce, but forage bout frequencies show a steep drop beyond 500 m from nests (Wolf and Moritz 2008).

Forest spring ephemerals whose flowering period coincides with the species' early spring emergence during this phase and colony growth in the spring may play an outsized role in the production of males and new queens later in the season (Colla and Dumesh 2010, pp. 45 -46, Requier et al. 2020, p. 6. 9). Late-season flower abundance and diversity also helps maximize queen production (Bukovinszki et al. 2017, p. 316).

Late-season abundance and diversity of blooming flowers is likely critical to ensure successful reproduction and survival of new queens. Poor nutrition status of male bumble bees – which depend on summer and early fall flowers – for example, may have significant and negative effects on sperm counts and viability (Zhao et al. 2021). In addition, acquisition of nutrition by new queens late in summer or in early fall is likely to play a crucial role in their ability to survive about seven months of winter dormancy (Plath 1927, Treanore and Amsalem 2020). Weight at the start of overwintering, for example, determined "to a large extent whether" buff-tailed bumble queens were able to survive the winter (Beekman et al. 2003). Nectar may be especially important during this period whereas pollen may be more important for individuals during earlier life stages (Woodard et al. 2019).

Actions that reduce forage abundance or diversity for rusty patched bumble bees may adversely affect the species and the extent of such impacts may not have to be large to cause an adverse outcome if it occurs near a nest. In the spring, for example, a queen may not be able to optimize both foraging and brooding temperatures of nests if the diversity and abundance of forage species is low near the nest (Evans and Raine 2014). Later in the nesting cycle, rusty patched bumble bee workers may typically forage within about 200 m (656 feet) of their nest based on the study of the closely related buff-tailed bumble bee discussed above (Wolf and Moritz 2008, p. 422; see above)

Based on studies of closely related species, the buff-tailed bumblebee (*Bombus terrestris*) (Kraus et al. 2009, p. 249, Lepais et al. 2010, pp. 826-827) and the yellow-faced bumble bee (*B. vosnesenskii*) (Jha and Kremen 2013, p. 2492), the maximum dispersal distance of rusty patched bumble bee males and new queens is estimated to be up to 10 km (6.2 mi) to find mates in the autumn. Floral resource availability within dispersal areas is important for fueling flight, particularly for males and gynes (female bumble bees that will become queens).

In the Central Appalachians, rusty patched bumble bees may fly at canopy height, using the tree canopy to forage as well as move about the landscape from one forage patch to another when the understory or shrub layers lack suitable foraging species (M. Hepner, Metamorphic Ecological, pers. comm. to B. Smrekar, Service, June 2024). They also have been observed making very large movements between foraging sites, during which they fly directly between foraging patches on different mountains, high above the valley floor (M. Hepner, Metamorphic Ecological, pers. comm. to B. Smrekar, Service, June

2024). Therefore, we assume that suitable forage for Central Appalachian Mountains populations of rusty patched bumble bees includes all vegetative strata (groundcover, understory, midstory, and canopy), given their characteristic use of forest habitat. Upland forest functions as foraging habitat when and where suitable floristic resources exist (Hepner 2022, pers. comm.). Duration of use varies due to the range in bloom period and variation in bloom cycle caused by the diversity of plant species composition and other environmental variables, such as elevation and latitude. For example, in some areas of the George Washington – Jefferson and Monongahela National Forests, local elevation and aspect may extend the blooming period of certain over and understory species into the summer and may therefore be suitable for nesting in those areas.

Little is known about the use of riparian habitats by RPBB. However, based on floristic resource availability, it is expected that riparian habitat may be used for foraging anytime during the active season A riparian ecosystem is defined as a transition area between the aquatic ecosystem and adjacent terrestrial ecosystems, identified by soil characteristics or distinctive vegetation communities that require free or unbound water (i.e., undammed water) (https://www.fws.gov/glossary/riparian). Several plant species are noted as being important floristic resources for the species in riparian areas; for example, the rusty patched bumble bee has been documented using joe-pye weed along the north branch of the Potomac River, and is often found on wild hydrangea and rhododendron, which are both abundant in riparian corridors on the National Forests in West Virginia and Virginia (Hepner 2022, pers. comm.).

Behavioral Assumptions

Seasonal Activity

Based on a review of rusty patched bumble bee observation records, in most years, the rusty patched bumble bee may only be active above ground between about April 1 and October 10 and April 15 and October 10 south and north of 42º latitude, respectively (Figures 3-4; USA National Phenology Network 2020; USFWS, 2023, unpubl. data). Although air temperatures may be conducive to activity later in the fall, cessation of flight “appears to be timed with the passing of native fall flowers” (Schweitzer et al. 2012, p. 6).

A latitude map can be referenced here: https://www.arcgis.com/apps/mapviewer/index.html?layers=ece08608f53949a4a4ee827fd5c30da1. To understand where your action area is in relation to latitude, zoom in to the map to view the latitude lines in 1-degree increments. Selecting any of the latitude lines will highlight the line and display the degree label. To find the 42º latitude line quickly, click on the line that runs through the Chicago area.

Daily Activity

The rusty patched bumble bee is active under a broad range of conditions but remains inactive when conditions are too cold or rainy. A study that included four bumble bee species found minimum calculated air temperature for activities that ranged from 3.6 to 12.6°C. We don’t have similar data for the rusty patched bumble bee, but we think it’s reasonable to assume that the species could be active between dawn and dusk at temperatures as low as about 4°C (39°F) within the seasons described above. Male bumble bees typically do not return to the nest and may be found spending the night on flowers (Dave Goulson 2010). Bumble bees do not typically fly when conditions are foggy, rainy, or drizzling. Sunny days with low wind speeds (less than 8 mph) may be optimal, but they will fly during sub-optimal conditions.

Defining Rusty Patched Bumble Bee Habitat for Section 7 Purposes

To facilitate section 7 analyses, we divide rusty patched bumble bee habitat conceptually into nesting and overwintering habitats and into a variety of foraging habitat types based on relative timing of pollen and nectar availability (Table 1). The locations of pollen and nectar sources for the rusty patched bumble bee may vary throughout the growing season. In a HPZ or critical habitat unit that contains both forest and grassland, for example, the species may forage primarily in forest in the spring and in grassland habitats in the summer and fall. We assume that the rusty patched bumble bee nests in upland grasslands and shrublands that contain forage during the summer and fall and also as far as 30 meters into the edges of forest (Table 1). In the Central Appalachians, nesting can extend into the forest interior (Table 1).

We also assume that the species winters exclusively beneath trees in upland forests. Palustrine wetlands – vegetated wetlands traditionally called by such names as marsh, swamp, bog, and fen (Federal Geographic Data Committee 2013) – provide nectar and pollen, but are not suitable for nesting or overwintering (Table 1) due to their flooded or saturated soils. Seasonally flooded wetlands may be used as nesting habitat; in 2023, one rusty patched bumble bee nest was documented in a palustrine, forested, broadleaf deciduous, and seasonally flooded site within a floodplain in Wisconsin (J. Arneson, USFWS, pers. comm. 2023). There is evidence that *B. impatiens*, the common Eastern bumble bee, can survive underwater for seven days (Rondeau and Raine 2024), although this has not been studied for rusty patched bumble bee.

Natural or semi-natural vegetation[4] typifies rusty patched bumble bee habitats. We typically expect the species to nest only in habitats that contain natural or semi-natural vegetation (Table 1), but the species also forages in certain 'cultivated' habitats – sunflower (*Helianthus annuus*) fields, gardens, plant nurseries, etc. – and has been documented to nest in other areas where there was evidence of rodent activity (Boone et al. 2022). Reconstruction of a variety of natural habitats – e.g., native prairie (Tonietto et al. 2017, p. 711)– appears to hold significant potential to provide areas for foraging, nesting, and overwintering, depending on the habitat type restored. If forage species are present, for example, reconstructed prairies can become important nesting and foraging habitat for the species as soon as 2-3 years after seeding (Griffin et al. 2017, p. 650).

[4] Vegetation where ecological processes primarily determine species and site characteristics; that is, vegetation comprised of a largely spontaneously growing set of plant species. Human activities influence these characteristics to varying degrees (e.g., logging, livestock grazing, fire), but do not eliminate or dominate the spontaneous processes. Wherever doubt exists as to the naturalness of a vegetation type (e.g., old fields, various forest plantations), it is classified as part of the natural/semi-natural vegetation. Semi-natural vegetation typically encompasses vegetation types where the species composition and/or vegetation growth forms have been altered through anthropogenic disturbances such that no clear natural analogue is known, but they are a largely spontaneous set of plants shaped by ecological processes. Includes areas planted to restore native plant communities. National Vegetation Classification Standard (Federal Geographic Data Committee 2008, p. 9).

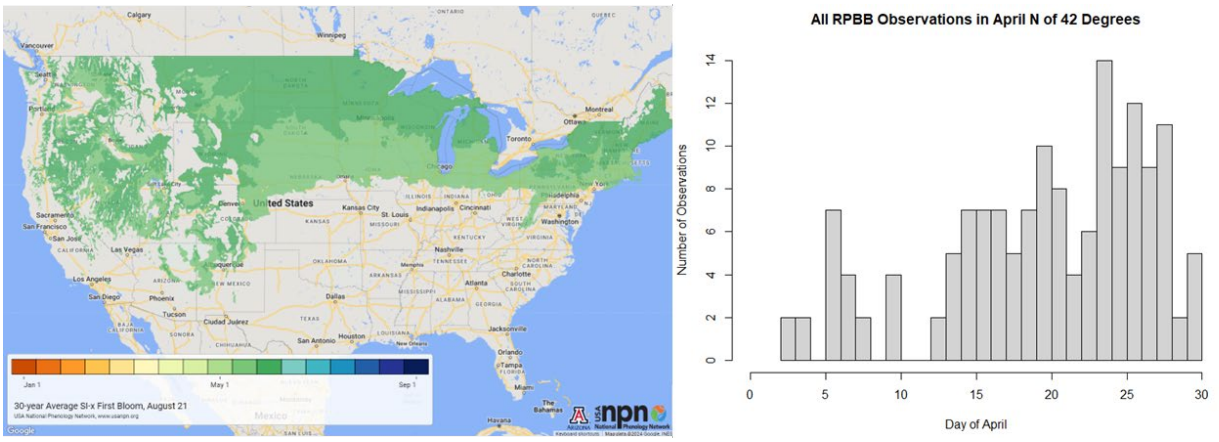

Figure 3. USA National Phenology Network First Bloom Spring Index (30-Year Average from 08/21/2024) for May 1- May 31 (USA National Phenology Network 2020) and distribution of all known rusty patched bumblebee observations north of 42° latitude in April by day (USFWS 2023 unpubl. data. R Core Team 2021).

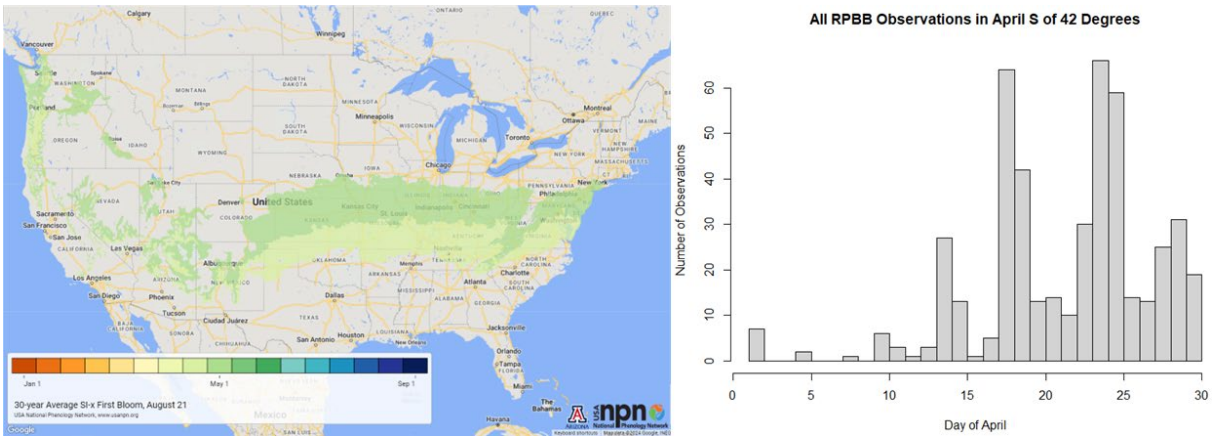

Figure 4. USA National Phenology Network First Bloom Spring Index (30-Year Average from 08/21/2024) for April 1- April 30 (USA National Phenology Network 2020) and distribution of all known rusty patched bumblebee observations south of 42° latitude in April by day (USFWS 2023 unpubl. data. R Core Team 2021).

Habitat Summary

Natural or semi-natural vegetation typifies rusty patched bumble bee habitats. The following summary is meant to help project proponents assess habitat suitability. Refer to the habitat assessment form (Appendix E). If you are unsure or cannot assess the habitat suitability, please default to the medium to high quality category.

Overwintering habitat - Contiguous upland forest habitat, at least 82 feet (25 meters (m)) from a non-forested edge (i.e., a minimum patch size of 0.75 acres), with herbaceous and woody plants that provide spring pollen and nectar for spring queen foraging immediately after emergence from diapause, leaf litter or duff for burrowing, and without dense invasive plant understory vegetation. For overwintering, rusty patched bumble bees also need well-drained, uncompacted, loose soils sheltered from the elements.

Medium to high quality overwintering habitat would contain all of the above elements: upland forest greater than 25 m from a non-forested edge and a minimum patch size greater than 0.75 acres, at least 25% coverage of forage plants, and/or at least 4 species of spring flowering shrubs, trees and/or

herbaceous native plants (species preferred by the rusty patched bumble bee, such as Serviceberry, gooseberry, willows, Virginia waterleaf, wild geranium, shooting star, wood betony, wild lupine, Dutchman's breeches, native Rhododendron spp., and Virginia bluebells), absent to sparse coverage of invasive vegetation in understory (<25%), abundant leaf litter, and dominated by well-drained, uncompacted soils.

Low quality overwintering habitat would be slightly smaller upland forest patches, at least 25 m from a non-forested edge and a minimum patch size of 0.75 acres, less than 25% coverage of forage plants, and/or less than 4 species of spring flowering shrubs, trees and/or understory native plants (such as Serviceberry, gooseberry, willows, Virginia waterleaf, wild geranium, shooting star, wood betony, wild lupine, Dutchman's breeches, native Rhododendron spp ,and Virginia bluebells), leaf litter, sparse to moderate coverage of invasive vegetation (<50%) in the understory, and well-drained, uncompacted soils, but some compaction can be evident (e.g., pre-existing trails or logging skid roads and landings).

Unsuitable overwintering habitat - isolated trees, dense coverage of invasive vegetation (>50%), compacted or perpetually wet soils, no evidence of spring floral resources (<10%; as evaluated during spring bloom season). For example, trees found in highly developed urban areas (e.g., street trees, downtown areas); forest patches less than 25 m from a non-forested edge and a patch size less than 0.75 acres forested habitat dominated by invasive vegetation like buckthorn; or floodplain forests.

Nesting habitat - Upland grasslands, shrublands, savannas, and the forest edge interface between forested and non-forested natural habitats that extends approximately 30 meters (98 feet) into the forest. Rusty patched bumble bees also need abandoned rodent burrows, other mammal burrows, or cavities with ample cover, or similar existing cavities at the soil surface or below to roughly 4 feet underground for nesting. For nesting, rusty patched bumble bees also need well-drained, uncompacted, loose soils sheltered from the elements. In the Central Appalachians (WV, VA, MD), interior forests with these elements are also considered suitable for nesting.

Medium to high quality nesting habitat contains the following elements: Open grasslands, shrublands, savanna with native grasses, abundant (>25% coverage) of at least 4 species of flowering shrubs, trees and/or rusty patched bumble bee preferred understory native plants (such as hyssop, Joe pye weed, wild bergamot, mountain mint, Culvers root, New England asters, coneflowers, milkweed, jewelweed, leadplant, spiraea, hyssop, native Ranunculaceae spp., and native Hydrangea spp.), and dominated by uncompacted soils. Medium-high quality nesting habitat can also be forested edges adjacent to open areas, with at least 4 species of flowering plants, zero to sparse coverage of invasive vegetation in understory (<25%), dominated by well-drained, uncompacted soils, and evidence of rodent activity or pre-existing cavities. In the Central Appalachians, interior forest with at least 4 species of flowering plants and trees, zero to sparse coverage of invasive vegetation in understory (<25%), dominated by uncompacted soils, and evidence of rodent activity or pre-existing cavities is also considered medium-high quality nesting habitat.

Low quality nesting habitat contains the following elements: Open grasslands, shrublands, savanna with native grasses, 2-3 species, sparse to moderate coverage (10-25%) of flowering shrubs, trees and/or understory native plants (such as hyssop, Joe pye weed, wild bergamot, mountain mint, Culvers root, New England asters, coneflowers, milkweed, jewelweed, leadplant, spiraea, hyssop, native Ranunculaceae spp., and native Hydrangea spp.), with some uncompacted soils present that are well-drained. Low quality nesting habitat can also be forested edges adjacent to open areas, with 2-3 species of flowering plants, sparse to moderate coverage of invasive vegetation in the understory (<50%), combination of compacted and uncompacted soils, and some evidence of rodent activity or pre-existing cavities. In the Central Appalachians, interior forests with at least 3 species of flowering plants and trees,

moderate coverage of invasive vegetation in the understory (<50%), combination of compacted and uncompacted soils, and some evidence of rodent activity or pre-existing cavities is also considered low quality nesting habitat.

Unsuitable nesting habitat -primarily disturbed areas with compacted or perpetually wet soils, no or very little evidence of summer floral resources (as evaluated during summer bloom season) within the action area, dense coverage of invasive vegetation (>50%), and no evidence of rodent activity or pre-existing cavities. For example, frequently mowed turf grass; wind pollinated monoculture row crops (e.g., corn); and wet meadows.

Foraging habitat – are areas that contain nectar and pollen resources during rusty patched bumble bee flight season. Rusty patched bumble bees are generalist foragers (meaning they collect nectar and pollen from a wide variety of flowers), but need diverse, abundant, native floral resources for their entire active flight season (North of 42° April 15th until October 10th or when forage senesces; South of 42° April 1st until October 10th, or when forage senesces) to sustain colonies.

Medium to high quality foraging habitat contain the following elements: Open grasslands, shrublands, savanna, specific flowering cultivated areas (i.e., plums, cherries, blueberries and cranberries), riparian areas, and/or palustrine wetlands and seasonally-flooded wetlands with at least 25% flowering vegetative cover, including at least 4 species of flowering shrubs, trees and/or understory native plants (such as hyssop, Joe pye weed, wild bergamot, mountain mint, Culvers root, New England asters, coneflowers, milkweed, jewelweed, leadplant, spiraea, hyssop, American basswood, Serviceberry, willow trees, certain flowering crops like plums, cherries, blueberries and cranberries). Or forested edge habitats adjacent to open areas with at least 4 species of flowering plants (e.g., Virginia bluebells, native Ranunculaceae spp., and native Hydrangea spp.) and over 25% vegetative cover. Foraging resources in bloom during at least two seasons during the active flight season (e.g., during the summer and fall). Ideally, foraging resources should be in bloom throughout the three active flight seasons (spring, summer and fall), however this may not be possible given the habitat type. Sparse coverage of invasive vegetation in the understory (<25%).

Low quality foraging habitat contains the following elements: Open grasslands, shrublands, savanna, , specific flowering cultivated areas (i.e., plums, cherries, blueberries and cranberries), riparian areas, and/or palustrine wetlands and seasonally -flooded wetlands with at least 10-25% flowering vegetative cover, including 1-3 species of flowering shrubs, trees and/or understory native plants (such as hyssop, Joe pye weed, wild bergamot, mountain mint, Culvers root, New England asters, coneflowers, milkweed, jewelweed, leadplant, spiraea, American basswood, certain flowering crops like blueberries and cranberries). Low quality foraging habitat also includes forested edges adjacent to open areas, with 1-3 species of flowering plants and between 10-25% vegetative cover. Foraging resources in bloom during at least one season during the active flight season (e.g., only during the fall). Sparse to moderate coverage of invasive vegetation in the understory (<50%).

Unsuitable foraging habitat - no or very little evidence (i.e., only a few scattered forage plants or floral resources the species is unlikely to use for nectar or pollen) of floral resources (during active flight season) within the action area. Dominate understory invasive species coverage (>50%). For example, turf grass; frequently mowed roadsides (e.g., such that flowers do not bloom); cultivated vegetation that does not provide floral resources, and wetlands without flowering emergent vegetation.

Table 1. Habitats and their typical seasons of use by the rusty patched bumble bee (RPBB). Rusty patched bumble bee habitat is typified by natural or semi-natural vegetation and often contains plants used by the species (https://www.fws.gov/media/plants-favored-rusty-patched-bumble-bee). The species' use of flower gardens, certain flowering cultivated cropland (e.g., sunflower fields), and similar areas in which forage is concentrated are exceptions to this rule. Refer to above text for additional information on habitat types (overwintering, nesting, and foraging).

Habitat Category	Nesting	Overwintering	Spring Foraging	Summer and Fall Foraging	When RPBB May be Present North of 42°	When RPBB May be Present South of 42°	Comments and Examples
Upland Forest– Interior (at least 25 m from non-forested edge, i.e., a minimum patch size of 0.75 ac)		X			October 11 – April 14	October 11 – March 31	Includes Maple-Basswood; Oak-Hickory and other forests; observations of overwintering bumble bee queens are mostly in shaded areas usually near trees and in banks without dense vegetation (Liczner and Colla 2019).
Upland Forest –Interior (at least25 m from non-forested edge (i.e., a minimum patch size of 0.75 ac)	X (Central Appalachia forests only)		X	(X) Refer to Comments and Examples	April 15 until forage senesces	April 1 until forage senesces	Functions as foraging habitat when forage species are present and blooming. Duration of use varies due to a range in plant species composition and other variables. In some areas of the eastern U.S., for example, the blooming period of understory species may extend well into summer due to local elevation and aspect.
Upland Forest Edge Interface that extends 30 m into the forest	X		X	X	All year	All year	The interface between forested and non-forested habitats (Harper et al. 2005). We assume the edge influence extends 30 meters into the forest.
Upland grasslands, shrublands, and savannas. In Central Appalachia this includes open forests, glades, barrens, and early successional (0-19 years old) forest	X		X	X	April 15 – October 10	April 1- October 10	Native meadows, prairie, etc. – remnants and reconstructed grassland habitats; other examples include oak savanna, pine and oak barrens and old fields.
Palustrine wetlands and seasonally flooded wetlands, and riparian areas			X	X	April 15 – October 10	April 1 – October 10	Marsh, swamp, bog, fen, wet meadow, etc.; forested wetlands (e.g., Silver Maple - Floodplain Forest). RPBB is likely only present if, and when, nectar or pollen are available. Excludes wetland and other areas without flowering emergent vegetation.
Flower gardens, certain flowering cropland (e.g., sunflower, cranberry, and, blueberry fields), and similar areas within 1km of natural or semi-natural vegetation.			X	X	April 15 – October 10	April 1 – October 10	Cultivated vegetation that provides floral resources; accessed by RPBB from nearby natural and semi-natural areas where they may nest or overwinter; RPBB is likely only present if, and when, nectar or pollen are available.

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Assuming Presence and Interpreting Species Records

When an action area overlaps with a HPZ and includes components that could interact directly with RPBBs or expose the species to stressors, USFWS recommends that an agency conduct a survey to develop information adequate to assess effects of the project to the species (refer to ***Surveys***, above). If survey data are not available or inconclusive, we recommend that agencies evaluate the nature, extent, and quality of habitat types present in the action area (refer to Table 1) to help assess the effects of the proposed action. If surveys were conducted, agencies should consider implications of the methods used, including the extent of the area that was surveyed. Project proponents may also use Robinson (2024) to help assess habitat in the action area. If possible, please assess the habitat during the season it may offer habitat for the species; in other words, assess spring foraging in the spring and assess summer-fall foraging and nesting habitat during the active flight season.

The rusty patched bumble bee may be present anywhere within High Potential Zones where there is suitable habitat, but the timing and nature of its presence and activities in these areas is dependent on habitat type (Table 1). Refer to the section, *Rusty Patched Bumble Bee Habitat, Ecology, and Life Cycle*, above, for a description of suitable habitat.

Analyzing Effects of Actions

The USFWS recommends a two-step process to determine whether and how an action may affect a species: 1) determine whether the species will be exposed to one or more stressors caused by the action and whether it will interact directly with any component of the project; and, 2) determine how the species will respond when exposed to the stressors or as a result of the direct interactions. A stressor is any physical, chemical, or biological alteration of the environment (i.e., increase, decrease, introduction, or removal) that can lead to an adverse individual response. Stressors act indirectly on a species through impacts to the resources it needs to fulfill its life cycle. Direct interactions are methods or means by which an activity or structure acts directly upon individuals of a species. Examples include crushing, collection, vehicle strikes, burial, disease, or displacement.

USFWS has identified several factors that pose a risk to the rusty patched bumble bee and that agencies and their representatives should consider when evaluating potential stressors associated with federal actions. Refer to Appendix C for a brief summary, Appendix D for USDA NRCS-specific actions, and USFWS (2016) for additional details.

Portions of HPZs may be unsuitable for the rusty patched bumble bee (Fig. 2). A project would not affect the rusty patched bumble bee if it only affects areas that lack suitable habitat (Table 1) and if none of the project's components will interact directly with the species. When this is the case, the action agency may conclude that their action will have no effect to the species and document this finding for its administrative record. When making this determination, we caution action agencies to define carefully the full extent of the action area to ensure they consider any effects of the action that may extend outside of the immediate project footprint.

Similarly, the USFWS recommends a process to determine whether and how an action may affect critical habitat, which will look similar to how the species may be affected, in terms of effects to their habitat. Similar to HPZs, there may be portions of critical habitat designations that are not suitable for rusty patched bumble bees. For example, the critical habitat overlaps a great deal of developed areas, such as lands covered by buildings, pavement, and other structures. These structures are not designated as critical habitat themselves because such structures lack the physical or biological features essential to the

conservation of the rusty patched bumble bee. Any such structures left inside critical habitat boundaries have been excluded by text in the critical habitat rule and are not designated as critical habitat.

Covered Activities

The activities described herein include all activities addressed in this technical assistance document. The activity description, conservation measures, and covered area inform analyses and describe which specific activities are appropriate for various determination outcomes. The description of activities and their inclusion in this document should not be construed to indicate that these activities will always result in effects to the species or its critical habitat, nor is it meant to cover activities that fall outside of the analysis as described below. Action agencies are not required to use this analysis; they continue to have the option to request individual consultation on a project; however, in most cases, we anticipate that use of this technical assistance document will substantially decrease consultation timeframes.

The following types of activities are described below (and further detailed in Appendices C and D) and include activities that may change the amount of foraging habitat available for the species (e.g., mowing, use of herbicides, prescribed fire), ground disturbing activities, resource competition and disease from managed bees, and direct impacts to the species from roads and pesticides. Other activities that may cause direct and indirect effects to rusty patched bumble bee include surface flooding or soil saturation in suitable nesting or overwintering habitat. Likewise, rodent control in suitable nesting habitat could decrease the number of rodents and, by extension, the number of burrows and potential nest sites for rusty patched bumble bees.

Intentional take for scientific research and recovery is not covered by this document, those analyses can be found in USFWS Biological Opinions (USFWS 2019*b*, 2025).

Potential for Effects from Temporary or Permanent Forage Removal

Bumble bees do not store much pollen and nectar in their nests and, thus, must have continuous access to flowers with available pollen and nectar during their entire active season to maximize production of new queens (Williams et al. 2012, p. 1055).

A wide variety of factors can lead to reductions in the abundance and diversity of forage available to bumble bees. Conversion of natural habitat that is rich in floral abundance and diversity to farmlands, urban and suburban development, and other land uses are the primary causes of the loss of bumble bee habitat (Goulson et al. 2015, p. 2). In addition, spring forage critical to foundress queens has declined in existing forests in the Midwest (Mola et al. 2021*a*, p. 1431) and similar declines could be occurring elsewhere. Similar declines of primarily mid-summer forage resources in grassland and wetland habitats was not evident, but the overall extent of grassland habitats has declined (Mola et al. 2021*a*, p. 1431). Even well-intentioned activities such as seed collection from native flowering species for habitat restoration may also result in loss of forage if seeds are overharvested (Nevill et al. 2018, p. 1387).

Actions that reduce forage abundance or diversity for rusty patched bumble bees may adversely affect the species and the extent of such impacts may not have to be large to cause an adverse outcome if it occurs near a nest. In the spring, for example, a queen may not be able to optimize both foraging and brooding temperatures of nests if the diversity and abundance of forage species is low near the nest (Evans and Raine 2014). Later in the nesting cycle, rusty patched bumble bee workers may typically forage within about 200 m (656 feet) of their nest based on the study of the closely related buff-tailed bumble bee discussed above (Wolf and Moritz 2008, p. 422; refer to the discussion above).

Foraging assumptions

Given that bumble bee foraging decisions are heavily influenced by patch quality (Wolf and Moritz 2008), foraging range may vary (refer to discussion above in the rusty patched bumble bee habitat section) (Dramstad 1996, Osborne et al. 1999, Knight et al. 2005, Wolf and Moritz 2008, Rao and Strange 2012). We assume rusty patched bumble bee foraging range of 200 meters (656 feet) around nests (31-acre 'home range') in medium-high quality foraging habitat (Wolf and Moritz 2008). We assume rusty patched bumble bee foraging range of 500 meters (1640 feet) around nests (194-acre 'home range') in low quality foraging habitat, where the bees may need to travel further to meet their nutritional needs. Temporary or permanent removal of 2 acres of medium-high quality foraging habitat would reach a 5% significance threshold[5] whereas removal or 10 acres of low-quality foraging would reach the same significance threshold (Table 2).

Note that sometimes foraging resources are removed only temporarily and this should also be taken into account when assessing effects to the species. In those cases, any adverse effects may only be temporary. Management of foraging habitat carried out at some times of the year would not result in a reduction in foraging resources – for example, when summer foraging habitat is burned in the autumn after October 10.

Additionally, management of prairie or grassland foraging habitat using prescribed fire specifically may not result in a significant reduction of pollen and nectar resources for RPBB if completed early in spring before RPBB queens establish nests with active foraging workers that need floral resources (i.e., before April 15 north of 42°N and before April 1 south of 42°N) or in late fall when nests have been abandoned for the season (i.e., after October 10th north of 42°N and south of 42°N, refer to Table 1 for habitat exceptions in the Central Appalachians) Most forage plant species in open habitats are not yet flowering at this time and queens are more likely to be found in upland forests foraging on spring ephemerals (Appendix D; Mola et al. 2021*a*, *b*, Wolf et al. 2022). Therefore, the probability of adverse effects to RPBB from prescribed burns in open habitats directly through interactions with fire or indirectly through the temporary loss of foraging habitat are low. Further, spring prescribed burns have been shown to increase floral genus richness and density without negative impacts to pollinator activity or abundance (Adedoja et al. 2022, Tai et al. 2022).

The likelihood of adverse effects is likely to increase based on the extent of the area where foraging habitat is degraded or removed and the proportion of the area around nests that is suitable for foraging (e.g., refer to Appendix B Tables B.1 and B.2). Removal or degradation of suitable medium to high quality foraging habitat in more than 0.6 ha (2 acres) of foraging habitat within a 31 acre home range will reduce foraging by more than 5%, even if the entire area (100%) is suitable foraging habitat, whereas removal or degradation of 0.4 ha (1 ac) of foraging habitat in a similar medium-high quality foraging area (i.e., 100% of area is suitable foraging) does not reach the 5% significance threshold (e.g., refer to Appendix B Tables B.1 and B.2).

[5] We use the 5% level as the conventional maximum acceptable probability for determining statistical significance (Cowles and Davis 1982).

Table 2. Descriptions of medium - high, low, and unsuitable foraging habitats for the rusty patched bumble bee, with estimated disturbance acreage thresholds for each. For foraging, the thresholds refer to loss in forage acreages (see Appendix F for calculations). Foraging habitat are areas that contain nectar and pollen resources during rusty patched bumble bee flight season. Preferred forage species can be found at (https://www.fws.gov/media/plants-favored-rusty-patched-bumble-bee, and also includes (but not limited to) Virginia bluebells, native Ranunculaceae spp., and native Hydrangea spp.

Foraging Habitat Quality	**Floral Resources (% Coverage**	**Preferred Forage Species Presence** (e.g., https://www.fws.gov/media/plants-favored-rusty-patched-bumble-bee)	**Seasons Floral Species in Bloom (Spring/Summer/Fall)**	**Invasive Species (% Coverage)**	**Disturbance Threshold (acres)**
Medium-High	Moderate to Abundant (>25%)	Moderate to Abundant (at least 4 species)	At least 2 seasons	Absent or Sparse (<25%)	2
Low	Sparse (10-25%)	Sparse (1-3 species)	At least 1 season	Sparse to Moderate (25-50%)	10
Unsuitable	Absent or Very Sparse (0-10%)	Absent or Very Sparse (0-1 species)	0-1 seasons	Dense (>50%)	N/A

Potential for Direct Effects from Ground Disturbance – Nest Density Assumptions

When site-specific information for the rusty patched bumble bee is insufficient to estimate abundance, it may be useful to apply nest density estimates derived for another member of the subgenus *Bombus sensu stricto*, the buff-tailed bumble bee, to develop useful assumptions. These assumptions can help to analyze effects of federal actions that are likely to cause ground disturbance in a structured and transparent way.

Researchers have used genetic analyses of tissue samples collected from wild workers to estimate nest density of several bumble bee species, including the closely related buff-tailed bumble bee (Darvill et al. 2004, Knight et al. 2005, Kraus et al. 2009, Chapman et al. 2003 (as cited in Charman et al. 2010), Wolf et al. 2012, Dreier et al. 2014, Wood et al. 2015). Current colony density estimates of rusty patched bumble bee have not yet been determined, although recent genetic analyses were used to estimate the number of unique colonies for twelve extant sites (Mola et al. 2024*a*, p. 9).

Due to the uncertainty with applying estimates derived for another species, we propose considering a range of assumed nest densities as opposed to a single estimate (Table 3; refer to Table 1 for an overview of nesting habitat). This may increase the odds that our analysis accurately reflects the actual density of the rusty patched bumble bee in the action area. The species is now rare at continental and regional scales, but was abundant and widespread historically (USFWS 2016, p. 4). By basing our analyses on a range of assumed nest densities, we may capture the possibility that nests occur at what may be relatively high densities in the action area.

Table 3. Quartiles for ten nest density estimates for the buff-tailed bumble bee (*B. terrestris*) (Darvill et al. 2004, Knight et al. 2005, Kraus et al. 2009, Chapman et al. 2003 (as cited in Charman et al. 2010), Wolf et al. 2012, Dreier et al. 2014, Wood et al. 2015). As a basis for analyzing the effects of actions on the rusty patched bumble bee, we will assume that their nests may occur in nesting habitat at any of the three densities shown.

Quartile	Nest Density Category	Nest Density (Nests/km^2)
First/25th Percentile	Low	14
Median/50th Percentile	Medium	34
Third/75th Percentile	High	45

Data from another rare bumble bee species – the precipitously declining great yellow bumble bee (*B. distinguendus*) – may indicate that our proposed assumptions for the rusty patched bumble bee are reasonable. The great yellow bumblebee relies "on the continued presence of flower-rich, unimproved grassland that provides floral resources throughout the colony cycle (June to September) and contains, or is close to, suitable sites for nesting, mating and hibernation." (Charman et al. 2010, p. 2671). Its nests occurred at an estimated density of 19/km^2 in a coastal grassland landscape (Charman et al. 2010). As with the studies conducted on the buff-tailed bumble bee, the authors estimated nest density for the great yellow bumble bee at the landscape scale. Estimated nest density would have been higher if it were estimated only for the specific portions of the landscape that were suitable for nesting. The nest density most appropriate for evaluating a project may depend on the nature of the habitat likely to be affected by the proposed activities.

Potential for Direct Effects from Ground Disturbance – Overwintering Assumptions

Due a lack of empirical information on overwintering queen densities, we make several assumptions.

We use the same nest density assumptions for overwintering queen densities. This will allow an estimate of the likelihood that an overwintering queen is likely to be harmed or killed, based this model and the extent of ground disturbance that will occur in overwintering habitat when the species is present (refer to Table 1) and the quality of that overwintering habitat.

Depending on the quality of the nesting habitat, the Low or High level of queen production may be most appropriate. However, it is reasonable to assume that the quality of the overwintering habitat also affects the density of overwintering queens.

For example, when assessing a project that will include ground disturbance during the overwintering period, in medium-high quality overwintering habitat, we recommend that you base your analyses on the highest reasonable level of estimated queen density as described above (45/km^2, Table 3). When assessing a project that will include ground disturbance during the overwintering period, in low quality overwintering habitat, we recommend that you base your analyses on the reasonable level of estimated queen density as described above (14/km^2, Table 3).

To model the number of overwintering queens present in an HPZ and to facilitate analyses, we recommend assuming that all queens produced in the HPZ remain there to overwinter and that the queens occur uniformly within the overwintering habitat.

Using Empirical Data to Estimate Site-Specific Nest and Overwintering Density

Agencies may use the methods summarized above to estimate nest density for the rusty patched bumble bee in an action area. This would require capture of rusty patched bumble bees, removal of a leg tip, and genetic analyses. Action agencies who are interested in carrying out such a study should contact the USFWS.

Effects of Ground Disturbance on Rusty Patched Bumble Bee Nests and Overwintering Queens

Medium-high quality nesting and/or overwintering habitats - If ground disturbance[6] is likely to be sufficient to collapse underground rodent burrows or to close their entrances on more than 0.1 hectare (0.30 acre) of medium- high quality nesting habitat within an HPZ during the nesting season, USFWS will work with the action agency to assess the likelihood that a rusty patched bumble bee nest will be affected. Key factors in this analysis, in addition to timing, are the anticipated extent of such disturbance, whether it affects areas where we think nests may be present, and the likely nest density (e.g., refer to Table 3). This is based on the assumption that rusty patched bumble bee nest in rodent burrows and may be present in nesting habitat at a density as high as 45/km^2 (Table 3). That density is equivalent to one nest for every 2.2 ha (5.5 acres) of nesting habitat. At that density, and assuming that rusty patched bumble bees are equally likely to nest anywhere in the available nesting habitat, ground disturbance that exceeds 0.1 ha (0.30 acre)[7] during the nesting season in nesting habitat would have a >5% probability of destroying a nest and may no longer be a discountable effect (Table 4). Similarly, the 0.1 ha (0.30 acre) threshold in medium-high quality overwintering habitat would have a >5% probability of destroying an overwintering queen and may no longer be a discountable effect (Table 5).

Low quality nesting and/or overwintering habitat- If ground disturbance is likely to be sufficient to collapse underground rodent burrows or to close their entrances on more than 0.4 ha (1 acre) (rounded up from 0.88) of low quality nesting habitat within an HPZ during the nesting season, USFWS will work with the action agency to assess the likelihood that a rusty patched bumble bee nest will be affected. Key factors in this analysis, in addition to timing, are the anticipated extent of such disturbance, whether it affects areas where we think nests may be present, and the likely nest density (e.g., refer to Table 3). This is based on the assumption that rusty patched bumble bees nest in rodent burrows and may be present in nesting habitat at approximately 14/km^2 (Table 3) in lower quality nesting habitat. That density is equivalent to one nest for every 7.1 ha (17.7 acres) of nesting habitat. At that density, and assuming that rusty patched bumble bees are equally likely to nest anywhere in the available low quality nesting habitat, ground disturbance that exceeds 0.4 ha (1 acre) (rounded up from 0.88) during the nesting season in low quality nesting habitat would have a >5% probability of destroying a nest and may no longer be a discountable effect (Table 4). Similarly, the 0.4 ha (1 acre) (rounded up from 0.88) threshold in low

[6] We define ground disturbance as any activity that compacts or disturbs the soil and is intense enough to either (1) collapse underground rodent burrows or to close their entrances (nesting season) or (2) crush, harm, or expose queens in overwintering chambers (overwintering period). This could occur as a result outrigging, seismic surveys, directional drilling, use of heavy equipment, grading, disturbance related to the construction, alteration, trenching, borrow pits, utility lines, bridges, development, some forestry activities, the placement of fill or spoil dirt, material stockpiling, blasting, cultivation, or rodent control if rodent burrows are intentionally collapsed or filled in. A project may cause ground disturbance sufficient to harm or kill rusty patched bumble bees if it will leave depressions or wheel tracks on the soil, remove forest floor layers, or displace, compact, or erode soil.

[7] A density of 45 nests/km^2 is equal to 0.45 nests/ha. The probability that ground disturbance to 0.1 ha of nesting habitat would affect a rusty patched bumble bee nest in high quality habitat, therefore, would be 0.045, assuming that nests are distributed uniformly in nesting habitat. Ground disturbance with a 5% probability of destroying a nest would be 0.27acres, rounded up to 0.3acres.

quality overwintering habitat would have a >5% probability of destroying an overwintering queen and may no longer be a discountable effect (Table 5).

Summary of thresholds for probable impacts to nesting, overwintering, or foraging habitats

If your overwintering, nesting, and/or habitat assessment indicates that the habitat quality in your project area is lesser quality, you may consider lower nesting density thresholds. Similarly, if your overwintering habitat or foraging habitat assessments indicate that the overwintering habitat in the project area is low or medium-high quality, you may use thresholds that correspond to your assessment (refer to Tables 2, 4, and 5). If you are unsure, default to medium-high quality habitat and associated thresholds.

Table 4. Descriptions of medium - high, low, and unsuitable nesting habitats for the rusty patched bumble bee, with estimated ground disturbance acreage thresholds for each that would reach a 5% probability of destroying a nest. For nesting, the thresholds refer to ground disturbance acreages (see Appendix F for calculations). Nesting habitats include upland open grasslands, shrublands, savanna with native grasses, and upland forested edges adjacent to open areas. Nesting habitat includes upland interior forest in the Central Appalachians. Preferred forage species can be found at (https://www.fws.gov/media/plants-favored-rusty-patched-bumble-bee), and also includes (but not limited to) Virginia bluebells, native Ranunculaceae spp., and native Hydrangea spp.

Nesting Habitat Quality	**Floral Resources (% Coverage)**	**Preferred Forage Species Presence** (e.g.,https://www.fws.gov/media/plants-favored-rusty-patched-bumble-bee)	**Soils**	**Cavities**	**Invasive Species (% Coverage)**	**Disturbance Threshold (acres)**
Medium-High	Moderate to Abundant (>25%)	Moderate to Abundant (at least 4 species)	Uncompacted and well-drained	Evidence of rodent activity or pre-existing cavities	Absent or Sparse (<25%)	0.30
Low	Sparse (10-25%)	Sparse (2-3 species)	Combination of compacted and uncompacted and well-drained	Some evidence of rodent activity or pre-existing cavities	Sparse to Moderate (25-50%)	1
Unsuitable	Absent or Very Sparse (0-10%)	Absent or Very Sparse (0-1 species)	Compacted and well drained or perpetually wet	No evidence of rodent activity or pre-existing cavities	Dense (>50%)	N/A

Table 5. Descriptions of medium - high, and low overwintering habitats for the rusty patched bumble bee, with estimated ground disturbance acreage thresholds for each that would reach a 5% probability of destroying an overwintering queen. For overwintering, the thresholds refer to ground disturbance acreages (see Appendix F for calculations). Overwintering habitats are defined as contiguous upland forest habitat, at least 82 feet (25 meters (m)) from a non-forested edge (i.e., a minimum patch size of 0.75 acres), with herbaceous and woody plants that provide spring pollen and nectar for spring queen foraging immediately after emergence from diapause, leaf litter or duff for burrowing, and without dense invasive plant understory vegetation. For overwintering, rusty patched bumble bees also need well-drained, uncompacted, loose soils sheltered from the elements. Preferred forage species can be found at (https://www.fws.gov/media/plants-favored-rusty-patched-bumble-bee, and includes (but not limited to) Virginia bluebells, native Ranunculaceae spp., and native Hydrangea spp.

Overwintering Habitat Quality	**Spring Floral Resources (% Coverage)**	**Preferred Forage Species Presence** (e.g.,https://www.fws.gov/media/plants-favored-rusty-patched-bumble-bee)	**Soils**	**Leaf Litter/Duff**	**Invasive Species (% Coverage)**	**Disturbance Threshold (acres)**
Medium-High	Moderate to Abundant (>25%)	Moderate to Abundant (at least 4 species)	Uncompacted and well-drained	Abundant	Absent or Sparse (<25%)	0.30
Low	Sparse (10-25%)	Sparse (2-3 species)	Combination of compacted and uncompacted and well-drained	Moderate to Abundant	Sparse to Moderate (25-50%)	1
Unsuitable	Absent or Very Sparse (0-10%)	Absent or Very Sparse (0-1 species)	Compacted and well-drained or perpetually wet	Absent	Dense (>50%)	N/A

Other Effects to the Species

Road Effects

The construction of new roads or the addition of new travel lanes within a HPZ may result in direct effects and indirect effects to rusty patched bumble bees. Bumble bees have demonstrated high foraging site fidelity alongside roads and rail lines, rarely crossing these barriers if suitable floral resources were already available (Bhattacharya et al. 2003, p. 42, Hopwood et al. 2010). Barriers to movement may result in indirect effects due to decreased availability in foraging resources. However, direct effects via collision mortality for bees and other bumble bee species has been documented (Keilsohn 2018, p. 3, Dániel-Ferreira 2022, p. 5) and may be more likely to occur in areas with greater speed limits, increase in traffic, and fewer foraging resources. There is one recorded instance of a mortality of a rusty patched bumble bee queen along a highway in Minnesota with a 55mph speed limit (C. Smith, MNDOT pers comm, July 2024).

Managed and/or Commercial Bees

The term managed bees is a broad term inclusive to a wide variety of bee species and management practices. Generally, the term managed bees represents hives or colonies of bees that are used

commercially to provide pollination services for a wide variety of crops over the growing season, with some hives or colonies moved within and between states multiple times throughout any one growing season. Managed bees also include hobby or backyard bee keeping, as well as small-scale greenhouse operations. Managed bees include many different species of bees, including European honeybees (*Apis mellifera*, alkaline bees (*Nomia melanderi*), and leaf-cutting bees (*Megachile rotundata*). Blue orchard bees (*Osmia lignaria*) are used to pollinate early-bloom tree fruit, such as apples (Ratti et al. 2008:3, 5). Managed bees are a threat to the rusty patched bumble bee through competition for resources and as a pathway for pathogen introduction and spread (Thomson 2004:467, Winter et al. 2006:entire, Goulson et al. 2008:193, 2015, D. Goulson 2010:10, Furst et al. 2014:365). Reduced availability of nectar and pollen can cause negative effects on the reproductive success (Burns 2004, p. 150, Williams et al. 2012, p. 1055, USFWS 2016, p. 15, Requier et al. 2020, Vaudo et al. 2020).

Bumble bees are susceptible to a variety of pathogens and parasites including fungi, viruses, bacteria, protozoa, tracheal mites, and nematodes, some of which can be spread from other bees, including managed bees. Many of these pathogens and parasites are widespread and cause lethal and sublethal effects for one or more *Bombus* species. For example, *Crithidia bombi* is a trypanosome protozoan parasite that affects the intestines of bumble bees (Schmid-Hempel 2001:150) and is transmitted when ingested through fecal-oral contact and then spread when bees share flowers (Schmid-Hempel 2001:150, Otterstatter and Thomson 2008:2, Kissinger et al. 2011:223, Cordes et al. 2012:210) or when the next host comes into contact with infected cells on the brood comb or other nest materials (Schmid-Hempel 2001:150). Bees from commercial rearing facilities have tested positive for this pathogen upon delivery (Otterstatter et al. 2005:388, Murray et al. 2013:274). The prevalence and intensity of *C. bombi* infections in wild bumble bees has been found to decrease with increasing distance from greenhouses with commercial bumble bee colonies (Colla et al. 2006:462–466, Otterstatter and Thomson 2008:2–7, Graystock et al. 2016:69), although infected bumble bees in the eastern United States have also been found in relatively isolated areas that were not near commercial greenhouses (Gillespie 2010:743, Malfi and Roulston 2014:24).

Effects of *C. bombi* infection include reduced colony founding success, lower colony fitness and growth, delayed reproduction, and inadequate fat reserves in hibernating queens (Shykoff and Schmid-Hempel 1991:242, Schmid-Hempel 2001:148, 150–154, Brown et al. 2003:995–1000). Nutritionally stressed worker bees infected with *C. bombi* were found to have a 50 percent higher mortality rate than well-fed bees infected with *C. bombi*, which contributed to colony stress and decline, and emergent queens infected with the parasite have delayed colony initiation in the spring (Brown et al. 2000:424–425, 2003:997–1000, Kissinger et al. 2011:223).

Pesticides

Pesticides is a broad term inclusive to a wide variety of human-made chemicals that are generally used to control plant and animal pests. Pesticides include herbicides, insecticides, fungicides, miticides, rodenticides, and adjuvants. Lethal and sub-lethal effects on bumble bee eggs, larvae, and adults have been well documented for many different pesticides under various scenarios (refer to USFWS 2016). Rusty patched bumble bees, which nest underground, are exposed to pesticide residues in the soil which can accumulate higher toxicity levels when treated with pesticides multiple times (DiBartolomeis et al. 2019, p. 21). Bumble bee larvae consume large amounts of unprocessed pollen, which pose another source of exposure to pesticide residues (Arena and Sgolastra 2014, p. 333). Studies have also found evidence of adverse impacts to bumble bee habitat associated with herbicide use. Specifically, they found

changes in vegetation and the loss or reduction of flowers needed to provide consistent sources of pollen, nectar, and nesting material (Johansen 1977, p. 188, Plowright et al. 1978, p. 1145, Kearns and Inouye 1997, p. 302, Smallidge and Leopold 1997, p. 264, Kearns et al. 1998, p. 91-92). Rodenticides such as aluminum phosphide, zinc phosphide, diphacinone, chlorophacinone, and strychnine may reduce rodent populations in some habitats, which in turn could limit nesting habitat (Witmer et al. 2012, p. 210).

Potential for Effects from Flooding, Soil Saturation, and Rodent Control

Other activities that may cause direct and indirect effects to rusty patched bumble bees include surface flooding or soil saturation in suitable nesting habitat, whether intentional or not. Rusty patched bumble bees typically nest in abandoned rodent nests or at the soil surface (Plath 1922, Macfarlane 1974, Boone et al. 2022) and surface flooding or soil saturation could inundate existing nests, causing abandonment or mortality. Likewise, rodent control in suitable nesting habitat could decrease the number of rodents and, by extension, the number of burrows and potential nest sites for rusty patched bumble bees.

Synergestic Effects

It is likely that several of these risk factors are acting additively and synergistically on bumble bees (Goulson et al. 2015, p. 5) and the combination of multiple stressors is likely more harmful than a stressor acting alone (Sih et al. 2004, Coors and De Meester 2008, Gill et al. 2012). 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. 2017, 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). Nutritional stress may compromise the ability of bumble bees to survive parasitic infections as evidenced by a significant difference in mortality in bumble bees on a restricted diet than well fed bees infected with *Crithidia bombi* (Brown et al. 2000, pp. 424-425). Bumble bees with activated immunity may have metabolic costs, such as increased food consumption (Cameron et al. 2011, p. 665)(Tyler et al. 2006, p. 2; Moret and Schmid-Hempel 2008, pp. 1166-1167). Furthermore, exposure to pesticides may increase with increased food consumption in infected bees (Goulson et al. 2015, p. 5). There is evidence that activating immunity impairs learning in bumble bees (Riddelland Mallon 2006, Alghamdi et al. 2008, p. 480). Impaired learning is thought to reduce the ability of bees to locate floral resources and extract nectar and pollen, therefore, exacerbating nutritional stresses (Goulson et al. 2015, p. 5).

Since the rusty patched bumble bee has low genetic diversity (Mola et al. 2024*b*), it may be more susceptible to disease and other stochastic stressors. For example, evidence of the relationship between low genetic diversity and disease susceptibility was discussed in Cameron et al. (2011, p. 665), who stated that declining North American species with low genetic diversity have higher prevalence of the pathogen *Nosema (Varipomorpha) bombi.*

Rusty Patched Bumble Bee - Potential Stressors

In addition to the potential for direct interactions with the species, agencies must also determine whether components of their actions could cause effects to a species' resource needs that can lead to an adverse individual response (i.e., *stressors*). Agencies must base this determination on the best available information on the nature and extent of habitats in the action area and a full examination of the effect of the action. For any action that will affect an HPZ, the action agency can work with USFWS Ecological Services Field Office (Our Locations | U.S. Fish & Wildlife Service (fws.gov)) to assess whether – and how – the action is likely to affect the species' resource needs. (refer to Appendix C and the next paragraph for an example brief review of important risk factors for the rusty patched bumble bee and related stressors.) For a detailed review of the major stressors that agencies should consider when

evaluating the effects of proposed federal activities on the rusty patched bumble bee, refer to the section **Risk Factors** in the *Rusty Patched Bumble Bee (Bombus affinis) Species Status Assessment* (USFWS 2016). For additional information regarding these stressors and measures to avoid or reduce relevant adverse effects, refer to the Rusty Patched Bumble Bee Conservation Technical Assistance (USFWS 2018, or as updated) and the Rusty Patched Bumble Bee Conservation Measures (U.S. Fish and Wildlife Service (USFWS) 2026, or as updated) available online at (https://www.fws.gov/media/voluntary-conservation-measures-rusty-patched-bumble-bee-bombus-affinis).

Effects of the Action on the Species - Evaluating the Species Response to Stressors

After identifying the stressors and direct interactions to which the rusty patched bumble bee will be exposed, the action agency should determine the species' likely response to each relevant factor – that is, the likely effects of the action on the species and its critical habitat. The section 7 regulations (50 CFR 402.02) define effects of the action as "Effects of the action refers to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process. Indirect effects are those that are caused by the proposed action and are later in time but still are reasonably certain to occur. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration." This analysis of effects is the primary responsibility of the action agency, but USFWS field office personnel can assist with this analysis. For a discussion of how a reduction in available forage – a common stressor – may affect the rusty patched bumble bee, refer to the section *Potential for Effects from Temporary or Permanent Forage Removal*, above.

Step 4 - Incorporate Measures to Avoid or Minimize Effects to the Rusty Patched Bumble Bee and its Critical Habitat

When the rusty patched bumble bee or its critical habitat is likely to respond negatively to one or more stressors or direct interactions associated with the federal action, the action agency or applicant may implement measures to avoid or minimize the adverse effects. Please refer to the Voluntary Conservation Measures for the Rusty Patched Bumble Bee (U.S. Fish and Wildlife Service (USFWS) 2026, or as updated) for a list of conservation measures (available online at (https://www.fws.gov/media/voluntary-conservation-measures-rusty-patched-bumble-bee-bombus-affinis).

When Adverse Effects are not likely to Occur – Informal Consultation

When an action agency determines that its action may affect the rusty patched bumble bee and/or its critical habitat but is not likely to affect the species or critical habitat adversely, it may request concurrence from USFWS. Informal consultation would conclude with the written concurrence of the USFWS [50 CFR § 402.13(a)].

When Adverse Effects Are Likely – Formal Consultation

When an action is likely to affect adversely the species and/or its critical habitat, the action agency should contact the local USFWS Ecological Services Field Office (Our Locations | U.S. Fish & Wildlife Service (fws.gov)). This is appropriate, for example, when agencies incorporate conservation measures into a project to minimize its effects, but some adverse effects are still likely. If the effects of the action are reasonably certain to include incidental take of the species, USFWS would include an incidental take statement (ITS) with the biological opinion. The ITS would include terms and conditions that the agency or the applicant must follow to ensure that any take is not a violation of the ESA's section 9 prohibitions.

Conservation Measures

This technical assistance document applies conservation measures as design features to avoid adverse effects on an individual, population, or species. The USFWS has previously found that incorporation of certain conservation measures, while voluntarily adopted by action agencies, has reduced effects to the extent that the actions do not require formal consultation and the USFWS and the action agency have found that actions are not likely to adversely affect species and/or its critical habitat. Refer to the Voluntary Conservation Measures for the Rusty Patched Bumble Bee (U.S. Fish and Wildlife Service (USFWS) 2026, or as updated) for a list of conservation measures (available online at (https://www.fws.gov/media/voluntary-conservation-measures-rusty-patched-bumble-bee-bombus-affinis).

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Appendix A. Rusty patched bumble bee and rusty patched bumble bee critical habitat assisted determination keys.

Rusty-Patched Bumble Bee Assisted Determination Key

U.S. Fish and Wildlife Service, Version 1.2

Updated June 29, 2026

Purpose of the Key

The primary purpose of this assisted determination key is to help federal agencies and their non-federal representatives to determine whether their proposed actions may affect the rusty patched bumble bee (*Bombus affinis*); and, if they might, to facilitate consultation with U.S. Fish and Wildlife Service (USFWS) under section 7 of the Endangered Species Act. Although intended primarily for federal agency actions and section 7, it may also be useful for reviewing non-federal actions.

Use of the Key

The key is intended to function range-wide for any type of project. For some projects, it will allow the user to reach a determination of 'no effect' or 'may affect, not likely to adversely affect.' For others, the key directs the user to coordinate with a U.S. Fish and Wildlife Service Ecological Services field office. Contact the local USFWS Ecological Services Field Office (Our Locations | U.S. Fish & Wildlife Service (fws.gov)) if you have any questions, concerns, or suggestions regarding the key.

*If working in IPaC, note that the answer to some questions will be automatically generated according to the proposed project polygon drawn in IPaC. Those questions are marked with an asterisk.

Definitions of acronyms within the Key

NE = no effect determination

NLAA = not likely to adversely affect

MA = may affect. Please contact the local USFWS Ecological Services Field Office (Our Locations | U.S. Fish & Wildlife Service (fws.gov)) to discuss the specifics of this project. This may or may not result in a "may affect" determination.

How to Request Concurrence – Use of the Concurrence Request Form

To request concurrence from the USFWS on a determination of '*may affect, not likely to adversely affect'*, submit a completed copy of the attached form to the local USFWS Ecological Services Field Office (Our Locations | U.S. Fish & Wildlife Service (fws.gov)).

Versions of the Key

If you have accessed this key on the USFWS RPBB website, you are using the most recent version. If you are not, check our website (https://www.fws.gov/media/esa-section-7a2-voluntary-implementation-technical assistance-rusty-patched-bumble-bee) for the most recent version. We intend for the key to be incorporated into the USFWS Information for Planning and Consultation (IPaC) webpage. We will aim to keep this key and the IPaC Determination Key functionally identical.

Determination Keys

*If working in IPaC, note that the answer to some questions will be automatically generated according to the proposed project polygon drawn in IPaC. Those questions are marked here with an asterisk. Steps: 1) answer the questions for the species and after you have reached a determination, follow instructions and 2) answer the questions regarding rusty patched bumble bee critical habitat (starting at question 50).

Number	Rusty Patched Bumble Bee Range-wide Determination Key	If Yes, then proceed to the number as indicated	If No, then proceed to the number as indicated
1.0	Is the action authorized, funded, or being carried out by a Federal agency?	1.1	1.1
1.1	Are you the Federal agency or designated non-federal representative?	1.2	1.2
1.2	For non-Federal representatives: Please note that when a project requires consultation under section 7 of the Act, the USFWS must consult directly with the Federal action agency unless that agency formally designates a non-Federal representative (50 CFR 402.08). Non-Federal representatives may prepare analyses or conduct informal consultations; however, the ultimate responsibility for section 7 compliance under the Act remains with the Federal agency. Please include the Federal action agency in additional correspondence regarding this project.	1.2.1	1.2.1
1.2.1	Does the proposed action intersect the south of 42N geometry?*	1.3	1.3
1.3	Does the action area overlap with a rusty patched bumble bee high potential zone?* Use the most up to date map as available on the RPBB website (https://www.fws.gov/species/rusty-patched-bumble-bee-bombus-affinis).	1.4	14.0
1.4	Is the proposed action within the NRCS State Boundaries? *	1.7	13
1.7	Is the action being implemented under one of the following Natural Resources Conservation Service (NRCS) or Farm Service Agency (FSA) conservation programs: Conservation Reserve Program, Environmental Quality Incentive Program, NRCS Easement Program, Farm Loan Program, or Farm Storage Facility Loan Program?	2	13

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2	Does the action area overlap with a rusty patched bumble bee high potential zone? Use the most up to date map as available on the RPBB website (https://www.fws.gov/species/rusty-patched-bumble-bee-bombus-affinis)?	2.1	17.1
2.1	Have you conducted a voluntary habitat assessment (Appendix E) for nesting, overwintering, and/or foraging habitat suitability in your action area? (Note, conducting a habitat assessment will expedite our review and assist you with answering the questions below and may be reviewed by USFWS).	2.2	3.0
2.2	Do you certify that the habitat assessment was accurate to the best your knowledge upon reviewing the habitat descriptions above. If you answer Yes, you are certifying that you have acted in good faith to conduct an appropriate assessment of suitable habitat, using the voluntary assessment form in Appendix E and the definitions of habitat provided in Tables 2,4, and 5, to make your determinations.	3.0	3.0
3.0	Is there habitat suitable for nesting, foraging, and/or overwintering for the rusty patched bumble bee in the action area? Note: Please refer to Tables 1, 2, 4, and 5 and habitat descriptions above. If the current cover within the action area is exclusively non-habitat (e.g. monoculture row cropland, mowed turf grass, or water), answer ‘NO’. If the action area currently contains RPBB habitat (i.e., refer to habitat definitions, native grassland with flowering species or forest), or if you are unsure, answer ‘YES’.	5.0	4.0
4.0	Will a relevant conservation practice under the Programmatic Biological Opinion, "NRCS and FSA Programs in Illinois, Minnesota, and Wisconsin and Their Effects on the Rusty Patched Bumble Bee" be implemented that results in the creation of pollinator habitat? Refer to Appendix F for relevant conservation practices.	4.2	No Effect

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4.2	Will any forestry practices be implemented in pollinator habitat as a part of a relevant conservation practice to manage or maintain pollinator habitat?	May Affect, Contact your local field office to discuss the details of the project	5
5	Will a relevant conservation practice under the Programmatic Biological Opinion, "NRCS and FSA Programs in Illinois, Minnesota, and Wisconsin and Their Effects on the Rusty Patched Bumble Bee" be implemented that includes creation, management, or maintenance of pollinator habitat? Please see Appendix F for relevant conservation practices.	5.01	6
5.01	Will any forestry practices be implemented as a part of a relevant conservation practice to create, manage, or maintain pollinator habitat?	May Affect, Contact your local field office to discuss the details of the project	May Affect (covered under the NRCS pBO of IL, MN, and WI)[8]

[8] As described in the biological opinion, the proposed Action is part of a program of activities that is not likely to jeopardize the continued existence of the species. The Service provided an incidental take statement with the biological opinion that exempts a limited amount of incidental take anticipated to occur due to implementation of the proposed Action. You may proceed with the Action at this time subject to the terms and conditions of the incidental take statement and pending your review of effects to other federally listed species. Attach to your review this USFWS Verification Letter and FSA-850 or NRCS CPA-52.

6.0	Will the action involve one or more "Not Likely to Adversely Affect" (NLAA)[1] actions ONLY? [1] The proposed Action consists only of activities USFWS has analyzed and made the determination that implementation may affect but is not likely to adversely affect (NLAA) rusty patched bumble bee based on Appendix H of the Programmatic Biological Opinion: Natural Resources Conservation Service and Farm Service Agency Programs in Illinois, Minnesota, and Wisconsin, and Their Effects on the Rusty Patched Bumble Bee (PBO or standing analysis). These NLAA actions are also provided in Appendix D of the section 7(a)(2) Voluntary Implementation Technical Assistance for Rusty Patched Bumble Bee. If we do not notify you within 30 calendar days indicating otherwise, you may proceed with the Action under the terms of the NLAA concurrence provided here and pending your review of effects to other federally listed species. Attach to your review this USFWS Concurrence Letter and FSA-850 or NRCS CPA-52.	Not Likely to Adversely Affect	7.0
7.0	Will the action result in ground disturbance in forested habitat that is suitable for RPBB overwintering , (i.e., patches of forested areas greater than 82 feet (25 meters) from at least one non-forested edge with native plants that provide springtime pollen and nectar for spring queen foraging immediately after emergence from diapause, with leaf litter or duff for burrowing, with uncompacted soils and not dominated by invasive understory plant species, like buckthorn)? Note: Forests are ecosystems where trees are the dominant life form. Forest interiors are large blocks of unfragmented forest with continuous canopy that shows no detectable edge influences. Forest edge is the interface between forested and non-forested habitats that extends approximately 25-30 meters into the forest. We assume RPBB are overwintering in any contiguous forest patch (i.e., forested areas with native plants that provide springtime pollen and nectar, with uncompacted soils and not dominated by invasive plant species, like buckthorn) that contains forest greater than 25-30m from a non-forested edge. Note: Compacted soils are dense and occur when soil particles are pressed together, resulting in few large pores and less total pore volume. Compacted soil has a reduced rate of water infiltration, water drainage, and gas exchange. Use of heavy equipment, for example, may increase soil compaction.	7.01	9.0

7.01	Will the impacts to habitat occur in medium-high quality overwintering habitat? (If you are unsure or are unable to assess the quality, answer YES. Please see additional instructions in Appendix E.)	7.1	7.02
7.02	Will the impacts to habitat occur in low quality overwintering habitat?	7.1.1	7.1.1
7.1	Will the ground disturbance be greater than 0.30 acres (0.1 hectares)?	8.0	9.0
7.1.1	Will the ground disturbance be greater than 1 acre (0.4 hectares)?	8.0	9.0
8.0	Does the proposed action intersect the south of 42N geometry?*	8.1	8.2
8.1	Will the ground disturbance occur during the overwintering season **(October 11 to March 31)**?	May Affect, Contact your local field office to discuss the details of the project	8.1.1
8.2	Will the ground disturbance occur during the overwintering season **(October 11 to April 14)**?	May Affect, Contact your local field office to discuss the details of the project	8.1.1
8.1.1	Will the impacts to habitat occur in medium-high quality nesting habitat? (If you are unsure or are unable to assess the quality, answer YES. Please see additional instructions in Appendix E.)	9.0	8.2.2
8.2.2	Will the impacts to habitat occur in low quality nesting habitat?	9.1	11.0
9.0	Will the action result in ground disturbance greater than 0.30 acres (0.1 hectares) in nesting habitat?	10.0	11
9.1	Will the ground disturbance be greater than 1 acre (0.4 hectares)?	10.0	11
10.0	Does the proposed action intersect the south of 42N geometry?*	10.1	10.2

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10.1	Will the ground disturbance occur during the active flight period (**April 1 to October 10**)?	May Affect, Contact your local field office to discuss the details of the project	11.0
10.2	Will the ground disturbance occur during the active flight period **(April 15 to October 10)**?	May Affect,- Contact your local field office to discuss the details of the project	11.0
11.0	Will the action result in vegetation disturbance resulting in loss of foraging habitat? Note: Disturbance may be from any activity, such as herbicide application, prescribed fire, grazing, mowing, or haying.	11.01	Not Likely to Adversely Affect
11.01	Will the impacts to habitat occur in medium-high-quality foraging habitat? (If you are unsure or are unable to assess the quality, answer YES. Please see additional instructions in Appendix E.)	11.1	11.02
11.02	Will the impacts to habitat occur in low-quality foraging habitat?	11.1.1	12.0
11.1	Will the vegetation disturbance affect greater than two acres (0.8 hectares) of suitable foraging habitat? Note: Disturbance may be from any activity, including application herbicide, prescribed fire, grazing, mowing, or haying.	12.0	NLAA

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11.1.1	Will the vegetation disturbance affect greater than ten acres (4 hectares) of suitable foraging habitat? Note: Disturbance may be from any activity, including application herbicide, prescribed fire, grazing, mowing, or haying.	12.0	13.0
12.0	Does the proposed action intersect the south of 42N geometry?*	12.1	12.2
12.1	Will the action occur during the active flight period (**April 1 to October 10**)?	May Affect, Contact your local field office to discuss the details of the project	Not Likely to Adversely Affect
12.2	Will the action occur during the active flight period (**April 15 to October 10**)?	May Affect, Contact your local field office to discuss the details of the project	Not Likely to Adversely Affect
13.0	Does the action include - or is it reasonably certain to cause - intentional take of rusty patched bumble bee (RPBB)? Note: This could include, for example, surveys or studies that include handling or capture of the species.	May Affect, Contact your local field office to discuss the details of the project	14.0
14.0	Does the action area overlap with the Monongahela, George Washington, or Jefferson National Forest?*	14.1	17.0

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14.1	Will the action be authorized, funded, or carried out by the U.S. Forest Service for implementation on the Monongahela, George Washington, or Jefferson National Forest?	15.0	17.0
15.0	Does the action area overlap with a rusty patched bumble bee high potential zone? * Note: A map that shows the locations of the HPZs is available on the RPBB website. Use the most up to date map as available on the RPBB website (https://www.fws.gov/species/rusty-patched-bumble-bee-bombus-affinis).	18.0	16.0
16.0	Does the action include activities that the U.S. Fish and Wildlife Service and U.S, Forest Service have agreed will have wholly beneficial effects to the rusty patched bumble bee?	Not Likely to Adversely Affect	No Effect
17.0	Does the action area overlap with a rusty patched bumble bee high potential zone?* Note: A map that shows the locations of the HPZs is available on the RPBB website. Use the most up to date map as available on the RPBB website (https://www.fws.gov/species/rusty-patched-bumble-bee-bombus-affinis).	18.0	No Effect
17.1	A ‘no effect’ determination was reached because the Action Area does not overlap with a High Potential Zone for the rusty patched bumble bee. Your agency has met its ESA section 7 consultation requirements for rusty patched bumble bee for the Action and no further coordination is required for this species. Please review the proposed Action for effects to other federally listed species and RPBB Critical habitat (start with Q 49.1 below).	No Effect	No Effect
18.0	Does the action include – or is it reasonably certain to result in – construction of one or more new roads or rail lines that will result in vehicle traffic speeds at 45mph or higher in a rusty patched bumble bee HPZ? For example, answer ‘NO’ if the project will construct a low speed (< 30 mph) road (Such as Forest Service Road Maintenance Levels 1 -3 (refer to https://www.fs.usda.gov/eng/pubs/pdf/05771205.pdf).	May Affect, Contact your local field office to discuss the details of the project	19.0

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19.0	Does the action include – or is it reasonably certain to result in – the addition of travel lanes that are likely to increase vehicle traffic on one or more existing roads that will increase vehicle traffic in a rusty patched bumble bee HPZ? For example, answer NO if considering a travel lane addition that maintains road with low speeds (< 30 mph).	May Affect, Contact your local field office to discuss the details of the project	20.0
20.0	Is an increase in vehicular traffic speeds to over 45mph to an existing road in one or more HPZs a likely outcome of the federal action? For example, answer 'NO' if traffic speeds would stay relatively low (e.g., 30 mph).	May Affect, Contact your local field office to discuss the details of the project53	21.0
21.0	Does the action include – or is it reasonably certain to cause – the use of commercial/managed bees (e.g., the use of honeybees or managed bumble bees to pollinate crops)?	May Affect, Contact your local field office to discuss the details of the project	21.1
21.1	Have you conducted a voluntary habitat assessment (Appendix E) for nesting, overwintering, and/or foraging habitat suitability in your action area? (Note, conducting a habitat assessment will expediate our review and assist you with answering the questions below and may be reviewed by USFWS.)	21.1.1	22
21.1.1	Do you certify that the habitat assessment was accurate to the best your knowledge upon reviewing the habitat descriptions above. If you answer 'YES', you are certifying that you have acted in good faith to conduct an appropriate assessment of suitable habitat, using the definitions of habitat provided in Appendix E and Tables 2, 4, and 5, to make your determinations.	22	22

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22.0	Is there suitable habitat for nesting, foraging, and/or overwintering for the rusty patched bumble bee in the action area? Note: Please refer to Appendix E and/or Tables 1, 2, 4, and 5 and habitat descriptions above.	24.0	23.0
23.0	Will the proposed action create suitable habitat for the species in the action area? For a description of rusty patched bumble bee overwintering, nesting, and foraging habitats, refer to Tables 1,2,4, and 5 and the habitat descriptions above. Note that if the action may affect areas outside of the immediate project footprint that contain rusty patched bumble bee habitat, answer 'YES.' This may include, for example, use of application of any pesticide (e.g., insecticide, herbicide, or fungicide) that may drift or be otherwise transported outside of the targeted area.	24.0	No Effect
24.0	Have "Project Review" surveys for rusty patched bumble bees already been conducted in the action area according to Service-approved protocols? If you do not know, answer 'NO'.	25.0	26.0
25.0	Were rusty patched bumble bees observed during "Project Review" surveys? Note: Surveys must be consistent with USFWS-approved protocols with emphasis on recommended survey effort, timing, site selection, and survey technique and methods. Surveys must be conducted within a year before the project initiation for negative survey results to remain valid. USFWS considers the results valid for two years or the duration of the project, whichever is shorter, unless new information (*e.g.*, new positive surveys) suggests that the species is likely to be present in the action area.	26.0	Not Likely to Adversely Affect
26.0	Does the action include collection of seed from native species?	27.0	29.0

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27.0	Will the seed collection be carried out more frequently than once every three years across the same 2.0 acre (0.8 hectares) or larger area?	May Affect, Contact your local field office to discuss the details of the project	28.0
28.0	Does the action include only seed collection -and no other activities that could affect the rusty patched bumble bee or its habitat?	Not Likely to Adversely Affect	29.0
29.0	Does the action include, or will it cause the application of insecticides or fungicides?	May Affect, Contact your local field office to discuss the details of the project	30.0
30.0	Does the action include, or will it cause activities to control native rodent species (such that it may cause a reduction in available nesting cavities) ?	May Affect, Contact your local field office to discuss the details of the project	31.0
31.0	Does the action include, or will it cause planting or seeding of non-native plant species?	31.1	32.0
31.1	Will the non-native plant species degrade the quality of existing RPBB foraging habitat in the action area? Note: Decreasing the abundance or diversity of native RPBB forage plant species can affect the RPBB.	May Affect, Contact your local field office to discuss the details of the project	32.0
32.0	Will the action include or cause herbicide use?	33.0	35.0

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33.0	Will herbicide application methods include only wiping individual plants with a wick or glove, cut-stump, spot-spraying, or basal bark treatments?	35.0	34.0
34.0	Will herbicides be applied when the rusty patched bumble bee is likely to be foraging on the affected plants in a manner that could result in direct exposure of individuals to the herbicide mixture?	May Affect, Contact your local field office to discuss the details of the project	35.0
35.0	Will the action cause an increase in the extent or duration of surface flooding or soil saturation in rusty patched bumble bee habitat in a High Potential Zone? Note: This may occur, for example, as a result of activities or structures that impound water, otherwise alter or interrupt existing drainage patterns, or that affect surface runoff.	May Affect, Contact your local field office to discuss the details of the project	36.0
36.0	Will the action cause ground disturbance in suitable rusty patched bumble bee nesting habitat?	36.1	39.0
36.1	Will the impacts to habitat occur in medium-high quality nesting habitat? (If you are unsure or are unable to assess the quality, answer YES. Please see additional instructions in Appendix E.)	37.0	36.2
36.2	Will the impacts to habitat occur in low quality nesting habitat?	37.1	39
37.0	Will the ground disturbance within the High Potential Zone affect more than 0.30 acre (0.1 hectare) of rusty patched bumble bee nesting habitat (upland grasslands, shrublands, and forest edges that contain native sources of pollen and nectar)? Note: Please refer to Tables 2, 4 , and 5 and habitat descriptions above.	38.0	39
37.1	Will the ground disturbance in suitable nesting habitat be greater than 1 acre (0.4 hectares)?	38.0	39

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38.0	Does the proposed action intersect the south of 42N geometry?*	38.1	38.2
38.1	Will the ground disturbance occur during the active flight period (**April 1 to October 10**)?	May Affect, Contact your local field office to discuss the details of the project	39
38.2	Will the ground disturbance occur during the active flight period **(April 15 to October 10)**?	May Affect,- Contact your local field office to discuss the details of the project	39
39.0	Will the action cause ground disturbance in suitable rusty patched bumble bee overwintering habitat?	39.1	43
39.1	Will the impacts to habitat occur in medium-high quality overwintering habitat? (If you are unsure or are unable to assess the quality, answer YES. Please see additional instructions in Appendix E.)	40	39.2
39.2	Will the impacts to habitat occur in low quality overwintering habitat?	40.1	43
40.0	Will the ground disturbance within the High Potential Zone affect more than 0.30 acre (0.1 hectare) of rusty patched bumble bee overwintering habitat?	41.0	43
40.1	Will the ground disturbance be greater than 1 acre (0.4 hectares)?	42	43
42	Does the proposed action intersect the south of 42N geometry?*	42.1	42.2

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42.1	Will the ground disturbance occur during the overwintering period (**October 11 – March 31**)?	May Affect, Contact your local field office to discuss the details of the project	43
42.2	Will the ground disturbance occur during the overwintering period **(October 11 – April 14)**?	May Affect,- Contact your local field office to discuss the details of the project	43
43	Will the action include or cause effects to native vegetation in rusty patched bumble bee habitat that will result in a loss of foraging resources? Note: Effects could occur as a result of mowing, cutting, grazing, prescribed fire, tree removal, spot-application of herbicide, tree clearing, and/or other activities. Effects could occur as a result of activities carried out outside of the foraging period if they result in reduced forage availability during a subsequent flight season.	44.0	No Effect to
44.0	Will the impacts to habitat occur in medium-high quality foraging habitat? (If you are unsure or are unable to assess the quality, answer YES. Please see additional instructions in Appendix E.)	46	45
45.0	Will the impacts to habitat occur in low quality foraging habitat?	47.0	50
46.0	Will the foraging loss within the affect more than 2 acres (0.8 hectares) of rusty patched bumble bee foraging habitat ?	48.0	50
47.0	Will the foraging loss within the affect more than 10 acres (4 hectares) of rusty patched bumble bee foraging habitat ?	48	50
48.0	Does the proposed action intersect the south of 42N geometry?*	49.1	49.2

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49.1	Will the foraging loss occur during the active flight period (**April 1 to October 10**)?	May Affect, Contact your local field office to discuss the details of the project	Not Likely to Adversely Affect
49.2	Will the ground disturbance occur during the active flight period **(April 15 to October 10)**?	May Affect,- Contact your local field office to discuss the details of the project	Not Likely to Adversely Affect

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Number	Rusty Patched Bumble Bee Critical Habitat Determination Key	If Yes, then proceed to the number as indicated	If No, then proceed to the number as indicated
	You are now answering questions about critical habitat		
50	Does the action area overlap with rusty patched bumble bee critical habitat?*	50.1	No Effect to RPBB Critical Habitat
50.1	Is the action authorized, funded, or being carried out by a federal agency?*	**50.2**	No Effect to RPBB Critical Habitat
50.2	Are you the Federal agency or designated non-federal representative?*	**51**	**50.3**
50.3	For non-Federal representatives: Please note that when a project requires consultation under section 7 of the Act, the USFWS must consult directly with the Federal action agency unless that agency formally designates a non-Federal representative (50 CFR 402.08). Non-Federal representatives may prepare analyses or conduct informal consultations; however, the ultimate responsibility for section 7 compliance under the Act remains with the Federal agency. Please include the Federal action agency in additional correspondence regarding this project.		
51	Have you conducted a habitat assessment for nesting, overwintering, and/or foraging habitat suitability in your action area? (Note, conducting a habitat assessment will expediate our review and assist you with answering the questions below and may be reviewed by USFWS.)	51.1	52

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51.1	Do you certify that the habitat assessment was accurate to the best your knowledge upon reviewing the habitat descriptions above. If you answer 'YES', you are certifying that you have acted in good faith to conduct an appropriate assessment of suitable habitat, using the definitions of habitat provided in Appendix E, to make your determinations.	52	52
52	Are the critical habitat physical and biological features (pbfs) present in the action area? (i.e., Is there suitable critical habitat for nesting, foraging, and/or overwintering for the rusty patched bumble bee in the action area?) Note: Please refer to the pbfs descriptions above (Habitat Summary - Physical and Biological Features) .	53	No Effect to RPBB Critical Habitat
53	Will the proposed action only create suitable habitat (physical and biological features essential to the conservation of the rusty patched bumble bee or restore unsuitable habitat in the action area? For a description of rusty patched bumble bee nesting and foraging, nesting, and overwintering habitats, see the note.	Not Likely to Adversely Affect RPBB Critical Habitat	54
54	Does the action include collection of seed from native species?	55	57
55	Will the seed collection be carried out more frequently than once every three years across the same 2.0-acre (0.8 hectare), (or larger) area?	May Affect RPBB Critical Habitat,- Contact your local field office to discuss the details of the project	56
56	Does the action include only seed collection and no other activities that could affect the rusty patched bumble bee critical habitat physical and biological features?	Not Likely to Adversely Affect RPBB Critical Habitat	57

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57	Does the action include, or will it cause activities to control native rodent species such that it reduces the availability of physical and biological features (i.e., nesting cavities)?	May Affect RPBB Critical Habitat,- Contact your local field office to discuss the details of the project	58
58	Does the action include, or will it cause planting or seeding of non-native plant species such that it affects the availability of RPBB physical and biological features (e.g., foraging)?	59	60
59	Will the non-native plant species degrade the quality of existing RPBB foraging habitat physical and biological features in the action area? Note: Decreasing the abundance or diversity of native RPBB forage plant species can affect the RPBB critical habitat physical and biological features	May Affect RPBB Critical Habitat,- Contact your local field office to discuss the details of the project	60
60	Will the action include or cause herbicide use? Note that if the action may affect areas outside of the immediate project footprint that contain rusty patched bumble bee critical habitat, answer ‘YES.’ This may include, for example, use of application of herbicides that may drift or be otherwise transported outside of the targeted area."	61	62

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61	Will herbicide application methods include only wiping individual plants with a wick or glove, cut-stump, spot-spraying, or basal bark treatments?	62	May Affect, Contact your local field office to discuss the details of the project
62	Will the action cause ground disturbance in **suitable** rusty patched bumble bee nesting critical habitat?	63	70
63	Will the impacts to habitat occur in **medium-high** quality nesting critical habitat? (if you are unsure or are unable to assess the quality, answer yes).	65	64
64	Will the impacts to habitat occur in **low** quality nesting critical habitat?	66	70
65	Will the ground disturbance within RPBB critical habitat affect more than 0.30 acre (0.1 hectare) of rusty patched bumble bee nesting critical habitat (upland grasslands, shrublands, and forest edges that contain native sources of pollen and nectar)? Note: Please refer to physical and biological features descriptions above.	67	70
66	Will the ground disturbance in **suitable** nesting habitat within the critical habitat be greater than 1 acre (0.4 hectares)?	67	70
67	Does the proposed action intersect the south of 42N geometry?*	68.1	68.2

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68.1	Will the ground disturbance occur during the active flight period (**April 1 to October 10**)?	May Affect RPBB Critical Habitat,- Contact your local field office to discuss the details of the project	69
68.2	Will the ground disturbance occur during the active flight period **(April 15 to October 10)**?	May Affect RPBB Critical Habitat,- Contact your local field office to discuss the details of the project	69
69	Will the effects of ground disturbance on the physical and biological features of nesting habitat still be present during the nesting season? (if you are unsure, answer 'YES')	May Affect RPBB Critical Habitat,- Contact your local field office to discuss the details of the project	70

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70	Will the action cause ground disturbance in **suitable** rusty patched bumble bee overwintering critical habitat?	71	78
71	Will the impacts to habitat occur in **medium-high** quality overwintering critical habitat? (if you are unsure or are unable to assess the quality, answer YES).	73	72
72	Will the impacts to habitat occur in **low** quality overwintering critical habitat?	74	78
73	Will the ground disturbance within the critical habitat affect more than 0.30 acre (0.1 hectare) of rusty patched bumble bee overwintering critical habitat?	75	78
74	Will the ground disturbance be greater than 1 acre (0.4 hectare)?	75	78
75	Does the proposed action intersect the south of 42N geometry?*	76.1	76.2
76.1	Will the ground disturbance occur during the overwintering period (**October 11 – March 31**)?	May Affect RPBB Critical Habitat,- Contact your local field office to discuss the details of the project	77

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76.2	Will the ground disturbance occur during the overwintering period **(October 11 – April 14)**?	May Affect RPBB Critical Habitat,- Contact your local field office to discuss the details of the project	77
77	Will the effects of ground disturbance on the physical and biological features of overwintering critical habitat still be present during the overwintering season? (If you are unsure, answer 'YES'.)	May Affect RPBB Critical Habitat,- Contact your local field office to discuss the details of the project	78
78	Will the action include or cause effects to native vegetation in rusty patched bumble bee critical habitat that will result in a loss of foraging resources? Note: Effects could occur as a result of mowing, cutting, grazing, prescribed fire, tree removal, spot-application of herbicide, tree clearing, and/or other activities. Effects could occur as a result of activities carried out outside of the foraging period if they result in reduced forage availability during a subsequent flight season.	79	Not Likely to Adversely Affect RPBB Critical Habitat
79	Will the impacts to habitat occur in **medium-high** quality foraging critical habitat? (if you are unsure or are unable to assess the quality, answer YES).	81	80
80	Will the impacts to habitat occur in **low** quality foraging critical habitat?	82	Not Likely to Adversely Affect RPBB Critical Habitat

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81	Will the foraging loss within the affect more than 2 acres (0.8 hectare) of rusty patched bumble bee foraging critical habitat?	83	Not Likely to Adversely Affect RPBB Critical Habitat
82	Will the foraging loss within the affect more than 10 acres (4 hectares) of rusty patched bumble bee foraging critical habitat?	83	Not Likely to Adversely Affect RPBB Critical Habitat
83	Does the proposed action intersect the south of 42N geometry?*	84.1	84.2
84.1	Will the foraging loss occur during the active flight period (**April 1 to October 10**)?	May Affect RPBB Critical Habitat,- Contact your local field office to discuss the details of the project	85
84.2	Will the ground disturbance occur during the active flight period **(April 15 to October 10)**?	May Affect RPBB Critical Habitat,- Contact your local field office to discuss the details of the project	85

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85	Will the effects of vegetation disturbance on the physical and biological features of foraging critical habitat still be present during the foraging season? (if you are unsure, answer 'YES'.)	May Affect RPBB Critical Habitat,- Contact your local field office to discuss the details of the project	No Effect to RPBB Critical Habitat

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Appendix B. Percentage reductions in foraging habitat based on an assumed rusty patched bumble bee foraging ranges

Table B.1. Percentage reductions in foraging habitat based on an assumed rusty patched bumble bee foraging range of 200 meters (656 feet) around nests (31-acre 'home range') in medium-high quality foraging habitat and varying proportions of pre-project foraging habitat and foraging habitat removal. The purpose of this table is to help project proponents and reviewers think about foraging loss in the context of the project.

Proportion of Home Range Covered by Foraging Habitat - Before Project	Extent of Foraging Habitat Removed (acres)	% Reduction in Foraging Habitat
100%	2	6.4%
66%	2	9.8%
33%	2	19.5%
100%	10	32.2%
66%	10	48.8%
33%	10	97.6%

Table 2. Percentage reductions in foraging habitat based on an assumed rusty patched bumble bee foraging range of 500 meters (1640 feet) around nests 194-acre 'home range') in low quality foraging habitat and varying proportions of pre-project foraging habitat and foraging habitat removal. The purpose of this table is to help project proponents and reviewers think about foraging loss in the context of the project.

Proportion of Home Range Covered by Foraging Habitat - Before Project	Extent of Foraging Habitat Removed (acres)	% Reduction in Foraging Habitat
100%	10	5.15%
66%	10	7.81%
33%	10	15.62%
100%	20	10.31%
66%	20	15.62%
33%	20	31.24%

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Appendix C. Partial list of potential stressors and responses associated with important rusty patched bumble bee risk factors.

We based Potential Responses in part on studies of other bumble bee species with similar life history traits - generalist foragers that collect pollen from the same food sources. For more details on some of the following risk factors, refer to USFWS 2016.

Table C.1.Potential stressors to rusty patched bumble bee. Note, this list contains some, but not all potential risk factors.

Risk Factor	Potential Stressor(s)	Potential mode(s) of exposure	Potential Response(s)	Reference(s)
Pathogens and Parasites	Introduction, expansion, or increased abundance of honeybees or commercial bumble or other managed bees that carry pathogens	Collection and consumption of infected pollen	Larval mortality; queen sterility; deformed wings, abdomen distension in queens and inability to mate; reduced body fat and increased mortality of overwintering queens	(USFWS 2016, p. 40-43)
Insecticides	Insecticide applications	Consumption of contaminated nectar or collection of contaminated pollen	Decreased brain function; reduced feeding; decreased queen production; decrease male production; decreased worker production; increased worker mortality; decreased colony weight; decrease foraging efficiency (pollen delivery to nest); diminished defensive behavior; decreased worker weight; decreased egg production; decreased larval production; delayed nest building; impaired ovary development; increased susceptibility to parasite infection in queens	(Feltham et al. 2014, Larson et al. 2014, p. 1, USFWS 2016, pp. 43, 90-93)
Insecticides	Insecticide applications	Direct contact/absorption	Contact mortality; Sub-lethal effects – e.g., reduced or no male production; egg infertility; reduced queen production	
Insecticides	Insecticide – Seed treatments	Consumption of contaminated nectar	Decreased queen production; decreased worker production; lower colony density; decreased colony weight	(USFWS 2016, p. 90, Rundlöf et al. 2022, p. 79)
Fungicides	Fungicide use	Reduced availability of nectar and pollen	Nutritional stress that leads to increased susceptibility to pathogens	(Brown et al. 2000, p. 421, USFWS 2016, p. 42)
Fungicides	Fungicide use	Increased transmission and prevalence of parasites due to reduced genetic diversity.	Refer to responses to collection and consumption of infected pollen, above.	(USFWS 2016, p. 42)

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Risk Factor	Potential Stressor(s)	Potential mode(s) of exposure	Potential Response(s)	Reference(s)
Herbicides	Herbicide Use	Reduced availability of nectar and pollen	Nutritional stress that leads to increased susceptibility to pathogens; direct mortality	(Brown et al. 2000, p. 421, USFWS 2016, p. 42, Straw et al. 2021, p. 5)
Loss or Alteration of Vegetation or Leaf Litter	Loss of bunchgrasses and other vegetation that supports suitable nesting habitat	Limited or no nesting sites in proximity to summer foraging areas	Avoidance of area; deterioration in body condition and reduced reproductive output due to need to find appropriate nesting habitat elsewhere	
Loss or Alteration of Vegetation or Leaf Litter	Actions that directly or indirectly reduce or eliminate nectar plant density or diversity; examples include plowing, growing season fire; mowing; herbicide application; collection of seeds from native plant species	Inability to find suitable amounts of nectar and pollen.	Avoidance of area; potential deterioration of body condition and reduced or no reproductive output for affected queens; increased mortality of immature life stages already present in nests; reduced overwinter survival of queens	(Burns 2004, p. 150, Williams et al. 2012, p. 1055, USFWS 2016, p. 15, Nevill et al. 2018, Requier et al. 2020, Vaudo et al. 2020)
Ground Disturbance or Compaction	Direct disturbance	Direct disturbance	Immediate death or harm of individuals present in nests or overwintering sites (queens);	(Hatfield et al. 2012, p. 18)
Ground Disturbance or Compaction	Compaction of soils by heavy equipment	Loss of potential nesting sites	Avoidance of area; deterioration in body condition and reduced reproductive output due to need to find appropriate nesting habitat elsewhere	
Ground Disturbance or Compaction	Construction matting or other temporary covering of ground surfaces	Temporary loss of potential nesting sites	Avoidance of area; deterioration in body condition and reduced reproductive output due to need to find appropriate nesting habitat elsewhere	
Competition for Resources from Commercial or managed bees	Reduced availability of nectar and pollen	Reduced availability of nectar and pollen	Negative effects on the reproductive success; Nutritional stress that leads to increased susceptibility to pathogens	(Burns 2004, p. 150, Williams et al. 2012, p. 1055, USFWS 2016, p. 15, Requier et al. 2020, Vaudo et al. 2020)
Competition for Resources from Commercial or managed bees	Disease transmission	Refer to Pathogens and Parasites, above	Refer to Pathogens and Parasites, above	

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Risk Factor	Potential Stressor(s)	Potential mode(s) of exposure	Potential Response(s)	Reference(s)
Loss of Potential Nesting Sites	Rodent control in suitable nesting habitat	Loss of rodent burrows that could provide nest sites	Avoidance of area; deterioration in body condition and reduced reproductive output due to need to find appropriate nesting habitat elsewhere	
Surface Flooding or Soil Saturation	Inundation of existing nest sites or suitable nesting habitat	Direct disturbance	Mortality; Avoidance of area; deterioration in body condition and reduced reproductive output due to need to find appropriate nesting habitat elsewhere	

Appendix D. Example - Concurrence for activities that may affect but are not likely to adversely affect rusty patched bumble bees.

This example concurrence is from the Programmatic Biological Opinion Natural Resources Conservation Service and Farm Service Agency Programs in Illinois, Minnesota, and Wisconsin, and Their Effects on the Rusty Patched Bumble Bee (USFWS 2024). ***Note that some refinements have been made to the section 7 consultation technical assistance since the issuance of this 2024 Biological Opinion (e.g., phenology dates). Also note that the last two rows of this table should read "increased forage and improved fitness" in the expected change and response columns, respectively.*** *Additionally, minor editorial changes have been made to this table for accessibility purposes (e.g., split merged cells).*

Activity	Expected Change to Land, Water, or Air (Stressors) and Response	Response	Rationale
Prescribed burning of foraging habitat if under two acres during the nesting season	Loss of forage	Reduction in fitness	RPBB require a high diversity and abundance of blooming forbs to meet nutritional requirements and maintain healthy colonies; prescribed burning may temporarily reduce the availability of blooming forbs; less than 5% of the assumed foraging range of RPBB would be affected if the action area is 2 acres or less; we anticipate the effects to be insignificant
Prescribed burning of foraging habitat if under two acres during the nesting season	Heat, smoke, ash	Mortality of adults outside of nests	RPBB may be killed by heat, smoke, and ash from prescribed burns; adult RPBB outside of nests would be able to evade fire, smoke, and ash produced by prescribed burns if the action area is 2 acres or less; we anticipate the effects to be discountable
Prescribed burning of foraging habitat if under two acres during the nesting season	Heat, smoke, ash	Mortality of eggs, larvae, and adults in nests	RPBB may be killed by heat, smoke, and ash from prescribed burns; RPBB nests are typically constructed in rodent burrows 1-4' underground and eggs, larvae, and adults in nest would be protected from heat, smoke and ash from fire; we anticipate the effects to be discountable

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Activity	Expected Change to Land, Water, or Air (Stressors) and Response	Response	Rationale
Prescribed burning of foraging habitat during the overwintering season	Heat, smoke, ash	Mortality of eggs, larvae, and adults in nests	RPBB may be killed by heat, smoke, and ash from prescribed burns; burning foraging habitat when RPBB are not present is not likely to adversely affect RPBB; we anticipate effects to be discountable
Grazing of foraging habitat if under two acres during the nesting season	Loss of forage	Reduction in fitness	RPBB require a high diversity and abundance of blooming forbs to meet nutritional requirements and maintain healthy colonies; grazing may temporarily reduce the availability of blooming forbs; less than 5% of the assumed foraging range of RPBB would be affected if the action area is 2 acres or less; we anticipate the effects to be insignificant
Grazing of foraging habitat during the overwintering season	Loss of forage	Reduction in fitness	RPBB require a high diversity and abundance of blooming forbs to meet nutritional requirements and maintain healthy colonies; grazing may temporarily reduce the availability of bloomig forbs; grazing foraging habitat when RPBB are not present is not likely to adversely affect RPBB; we anticipate the effects to be discountable
Haying of foraging habitat if under two acres during the nesting season	Loss of forage	Reduction in fitness	RPBB require a high diversity and abundance of blooming forbs to meet nutritional requirements and maintain healthy colonies; haying may temporarily reduce the availability of bloomig forbs; less than 5% of the assumed foraging range of RPBB would be affected if the action area is 2 acres or less; we anticipate the effects to be insignificant
Haying of foraging habitat during the overwintering season	Loss of forage	Reduction in fitness	RPBB require a high diversity and abundance of blooming forbs to meet nutritional requirements and maintain healthy colonies; haying may temporarily reduce the availability of blooming

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Activity	Expected Change to Land, Water, or Air (Stressors) and Response	Response	Rationale
			forbs; haying foraging habitat when RPBB are not present is not likely to adversely affect RPBB; we anticipate the effects to be discountable
Mowing of foraging habitat if during the first year following conservation practice establishment	Loss of forage	Reduction in fitness	RPBB require a high diversity and abundance of blooming forbs to meet nutritional requirements and maintain healthy colonies; mowing may temporarily reduce the availability of blooming forbs; most forage species will not be flowering during the first year following practice establishment and therefore forage would not be available to begin with and RPBB are not likely to be present; we anticipate the effects to be insignificant and discountable
Mowing of foraging habitat if under two acres during the nesting season	Loss of forage	Reduction in fitness	RPBB require a high diversity and abundance of blooming forbs to meet nutritional requirements and maintain healthy colonies; mowing may temporarily reduce the availability of blooming forbs; less than 5% of the assumed foraging range of RPBB would be affected if the action area is 2 acres or less; we anticipate the effects to be insignificant
Mowing of foraging habitat during the overwintering season	Loss of forage	Reduction in fitness	RPBB require a high diversity and abundance of blooming forbs to meet nutritional requirements and maintain healthy colonies; mowing may temporarily reduce the availability of blooming forbs; mowing foraging habitat when RPBB are not present is not likely to adversely affect RPBB; we anticipate the effects to be discountable

Activity	Expected Change to Land, Water, or Air (Stressors) and Response	Response	Rationale
Mowing fire breaks during the nesting season immediately before a burn is planned if less than two acres of RPBB foraging habitat is affected or the mowing is conducted outside of the nesting period, March 15 to October 10 (south of 42˚ N) or April 10 to October 10 (north of 42˚N).	Loss of forage	Reduction in fitness	RPBB require a high diversity and abundance of blooming forbs to meet nutritional requirements and maintain healthy colonies; mowing may temporarily reduce the availability of blooming forbs; less than 5% of the assumed foraging range of RPBB would be affected if the action area is 2 acres or less and mowing foraging habitat when RPBB are not present is not likely to adversely affect RPBB; we anticipate the effects to be insignificant and discountable
Spot-treatment of non-native weeds by mowing or spot applications of herbicide.	Exposure to pesticides	Reduction in fitness; mortality	RPBB may be killed or exhibit sub-lethal effects from exposure to pesticides; spot treatments will minimize exposure to RPBB; we anticipate the effects to be insignificant and discountable
Spot-treatment of non-native weeds by mowing or spot applications of herbicide	Loss of forage	Reduction in fitness	RPBB require a high diversity and abundance of blooming forbs to meet nutritional requirements and maintain healthy colonies; herbicide application may reduce the availability of blooming forbs; spot treatments will minimize effects to non-target plant species; we anticipate the effects to be insignificant and discountable
Mowing or clipping of weeds or companion crops during the first three years of practice establishment. This may include mowing or clipping of entire fields, depending on the extent of the area where weeds or companion crops may be shading or otherwise competing with planted native species.	Loss of forage	Reduction in fitness	RPBB require a high diversity and abundance of blooming forbs to meet nutritional requirements and maintain healthy colonies; mowing may temporarily reduce the availability of blooming forbs; weeds and companion crops are not high quality sources of nectar and pollen for RPBB and RPBB are not likely to be present in fields of weeds or companion crops; we anticipate the effects to be insignificant
Control of competing plants up to four feet around trees and shrubs by using cultivation, mulch, or chemical control	Exposure to pesticides	Reduction in fitness; mortality	RPBB may be killed or exhibit sub-lethal effects from exposure to pesticides; spot treatments will minimize exposure to RPBB; we anticipate the

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Activity	Expected Change to Land, Water, or Air (Stressors) and Response	Response	Rationale
[i.e., as described in Minnesota NRCS Job Sheets for CP4 and CP31 (NRCS 2017; 2020)]. Further consultation with USFWS would be necessary if the activity is proposed in a tree/shrub planting that was carried out in an area where native grasses or wildflowers were established (e.g., in a CP25 planting).			effects to be insignificant and discountable
Control of competing plants up to four feet around trees and shrubs by using cultivation, mulch, or chemical control [i.e., as described in Minnesota NRCS Job Sheets for CP4 and CP31 (NRCS 2017; 2020)]. Further consultation with USFWS would be necessary if the activity is proposed in a tree/shrub planting that was carried out in an area where native grasses or wildflowers were established (e.g., in a CP25 planting).	Loss of forage	Reduction in fitness	RPBB require a high diversity and abundance of blooming forbs to meet nutritional requirements and maintain healthy colonies; cultivation may reduce the availability of blooming forbs; impacts to 4 foot areas around trees would not likely significantly reduce the amount of available forage; we anticipate the effects to be insignificant
Repair of gullies (i.e., in filter strips).	Loss of forage	Reduction in fitness	RPBB require a high diversity and abundance of blooming forbs to meet nutritional requirements and maintain healthy colonies; repair of gullies (i.e., in filter strips) may temporarily reduce the availability of blooming forbs; filter strips typically contain non-pollinator seed mixes and are not of high value to RPBB (Horton, pers. comm. 6/27/23); we anticipate the effects to be insignificant
Periodic removal of accumulated sediment and regrading in filter strips if it is done outside of the nesting period, March 15 to October 10 (south of 42˚ N) or April 10 to October 10 (north of 42˚N)	Ground disturbance	Mortality	RPBB may be killed due to ground disturbance; ground disturbance when RPBB are not present or to 0.25 acres or less of nesting habitat has a low (<5%) probability of destroying a nest based on assumptions about nest density and is not

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Activity	Expected Change to Land, Water, or Air (Stressors) and Response	Response	Rationale
or affects less than 0.25 acre of RPBB nesting habitat.			likely to adversely affect RPBB; we anticipate the effects to be discountable
Periodic removal of accumulated sediment and regrading in filter strips if it is done outside of the nesting period, March 15 to October 10 (south of 42˚ N) or April 10 to October 10 (north of 42˚N) or affects less than 0.25 acre of RPBB nesting habitat.	Loss of forage	Reduction in fitness	RPBB require a high diversity and abundance of blooming forbs to meet nutritional requirements and maintain healthy colonies; removal of accumulated sediment and regrading in filter strips may temporarily reduce the availability of blooming forbs; removal of accumulated sediment and regrading in filter strips when RPBB are not present is not likely to adversely affect RPBB; we anticipate the effects to be discountable
Mechanical or manual control of brush in filter strips and in other herbaceous plantings.	Ground disturbance	Mortality	Mechanical or manual control of brush in filter strips and in other herbaceous plantings may cause mortality to RPBB through crushing if the ground is disturbed; filter strips are designed to capture runoff from the landscape and would most likely not be suitable nesting or overwintering habitat for RPBB; we anticipate the effects to be discountable
Mechanical or manual control of brush in filter strips and in other herbaceous plantings.	Loss of forage	Reduction in fitness	RPBB require a high diversity and abundance of blooming forbs to meet nutritional requirements and maintain healthy colonies; mechanical or manual control of brush in filter strips and in other herbaceous plantings may temporarily reduce the availability of blooming forbs; filter strips typically contain non-pollinator seed mixes and are not of high value to RPBB (Horton, pers. comm. 6/27/23); we anticipate the effects to be insignificant
Woody plant control with the use of cut-stump or basal bark herbicide treatments.	Exposure to pesticides	Reduction in fitness	RPBB may be killed or exhibit sub-lethal effects from exposure to pesticides; spot treatments will

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Activity	Expected Change to Land, Water, or Air (Stressors) and Response	Response	Rationale
			minimize exposure to RPBB; we anticipate the effects to be insignificant and discountable
Woody plant control with the use of cut-stump or basal bark herbicide treatments.	Loss of forage	Reduction in fitness	RPBB require a high diversity and abundance of blooming forbs to meet nutritional requirements and maintain healthy colonies; herbicide application may reduce the availability of blooming forbs; spot treatments will minimize effects to non-target plant species; we anticipate the effects to be insignificant and discountable
Mechanical cultivation for weed control in herbaceous cover if it is done outside of the nesting period, March 15 to October 10 (south of 42˚ N) or April 10 to October 10 (north of 42˚N) or affects less than 0.25 acre of RPBB habitat.	Ground disturbance	Mortality	RPBB may be killed due to ground disturbance; ground disturbance when RPBB are not present or to 0.25 acres or less of nesting habitat has a low (<5%) probability of destroying a nest based on assumptions about nest density and is not likely to adversely affect RPBB; we anticipate the effects to be discountable
Mechanical cultivation for weed control in herbaceous cover if it is done outside of the nesting period, March 15 to October 10 (south of 42˚ N) or April 10 to October 10 (north of 42˚N) or affects less than 0.25 acre of RPBB habitat.	Loss of forage	Reduction in fitness	RPBB require a high diversity and abundance of blooming forbs to meet nutritional requirements and maintain healthy colonies; mechanical cultivation for weed control may temporarily reduce the availability of blooming forbs; mechanical cultivation for weed control when RPBB are not present or to less than 0.25 acres of habitat is not likely to adversely affect RPBB; we anticipate the effects to be discountable and insignificant
Mowing or haying during August on land that has less than 2% coverage of nectar-bearing plants – for example, in areas dominated by reed canary grass (Phalaris arundinacea), nettles (Urtica dioica or *Laportea canadensis*) or ragweed (*Ambrosia* spp.).	Loss of forage	Reduction in fitness	RPBB require a high diversity and abundance of blooming forbs to meet nutritional requirements and maintain healthy colonies; mowing or haying may temporarily reduce the availability of blooming forbs; land with less than 2% coverage of nectar-bearing plants are not considered high quality habitat; we anticipate the

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Activity	Expected Change to Land, Water, or Air (Stressors) and Response	Response	Rationale
			effects to be discountable and insignificant
Installing or replacing fence. Fencing plan cannot include grubbing and clearing of existing fence-line containing suitable foraging habitat.	Ground disturbance	Mortality	RPBB may be killed due to grubbing; excluding grubbing and clearing of existing fence-line in suitable foraging habitat from fencing plans will minimize ground disturbance; we anticipate the effects to be discountable
Installing or replacing fence. Fencing plan cannot include grubbing and clearing of existing fence-line containing suitable foraging habitat.	Loss of forage	Reduction in fitness	RPBB require a high diversity and abundance of blooming forbs to meet nutritional requirements and maintain healthy colonies; installing or replacing fence may reduce the availability of blooming forbs if grubbing or clearing occurs in suitable foraging habitat; excluding grubbing and clearing of existing fence-line in suitable foraging habitat from fencing plans will minimize loss of forage; we anticipate the effects to be discountable and insignificant
Grazing according to an NRCS plan except when it is likely to affect more than two acres of RPBB foraging habitat during the period, March 15 to October 10 (south of 42˚ N) or April 10 to October 10 (north of 42˚N).	Loss of forage	Reduction in fitness	RPBB require a high diversity and abundance of blooming forbs to meet nutritional requirements and maintain healthy colonies; grazing may temporarily reduce the availability of blooming forbs; less than 5% of the assumed foraging range of RPBB would be affected if the action area is 2 acres or less; we anticipate the effects to be insignificant
Pruning activities on tree contracts completed after August 1 or before May 15, unless spring-blooming trees are pruned. If spring-blooming trees are pruned, activity may only be likely to avoid adverse effects to the RPBB if it is carried out after trees have ceased	Loss of forage	Reduction in fitness	RPBB require a high diversity and abundance of nectar and pollen sources to meet nutritional requirements and maintain healthy colonies; pruning spring-bloom trees temporarily reduce the availability of nectar and pollen; pruning non-blooming trees between August 1 and May 15 or after trees have ceased flowering will

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Activity	Expected Change to Land, Water, or Air (Stressors) and Response	Response	Rationale
flowering.			minimize loss of nectar and pollen sources; we anticipate the effects to be insignificant
Interplanting to add diversity to shrub/tree contracts.	Loss of forage	Reduction in fitness	We anticipate effects to RPBB from interplanting to be neutral or positive
Dormant seeding on grass contracts.	Loss of forage	Reduction in fitness	We anticipate effects to RPBB from dormant seeding on grass contracts to be neutral or positive

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Appendix E. Voluntary Habitat Assessment Form

While voluntary, use of this form will provide the user with information that will accelerate use of the range-wide determination key and expediate USFWS reviews. For quick reference, refer to the habitat summary table, below. Circle one answer for each of the questions per habitat type (if applicable) in your project area that will be impacted by the proposed action and choose the appropriate habitat quality based on your assessment (unsuitable, low, or medium to high quality). If your project contains habitats of varying qualities based on your assessment, choose the quality of habitat with the greatest quantity of acres that will be impacted by the proposed action. If you are wavering between two qualities based on your assessment, choose the higher quality of the two.

Habitat Type	Questions to Consider	Unsuitable	Low Quality	Medium-High Quality	Document Your Action Area Habitat Assessment
Nesting	What is the percentage of habitat covered with flowering shrubs, trees or preferred understory native plants?	0-10% coverage of flowering plants	10-25% coverage of flowering plants	Greater than 25% coverage of flowering plants	
	How many species of flowering shrubs, trees or preferred understory native plants are present?	0 to 1 flowering plants	2 to 3 flowering species	At least 4 flowering species	
	Is the potential habitat dominated by uncompacted, well-drained soils?	Compacted and well-drained or perpetually wet	Combination of compacted and uncompacted and well-drained	Primarily uncompacted and well-drained	
	Is the potential habitat dominated by invasive species?	Dense (>50%) coverage of invasive plant species	Sparse to Moderate (25-50%) coverage of invasive plant species	Absent or Sparse (<25%) coverage of invasive plant species	
	Is there evidence of rodent activity or pre-existing cavities?	No	Yes (some)	Yes	

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Overwintering	What is the percentage of habitat covered with flowering shrubs, trees or preferred understory native plants that will be flowering in spring?	0-10% coverage of spring flowering plants	10-25% coverage of spring flowering plants	Greater than 25% coverage of spring flowering plants	
	How many species of flowering shrubs, trees or preferred understory native plants that will be flowering in spring are present?	0 to 1 flowering species	2 to 3 flowering species	At least 4 or more flowering species	
	Is the potential habitat dominated by uncompacted, well-drained soils?	Compacted and well-drained or perpetually wet	Combination of compacted and uncompacted and well-drained	Primarily uncompacted and well-drained	
	Is the potential habitat dominated by invasive species?	Dense (>50%) coverage of invasive plant species	Sparse to Moderate (25-50%) coverage of invasive plant species	Absent or Sparse (<25%) coverage of invasive species	
	Is there leaf litter present?	No	Yes (some)	Yes	
Foraging	What is the percentage of habitat covered with flowering shrubs, trees or preferred understory native plants ?	0-10% coverage of flowering plants	10 to 25% coverage of flowering plants	Greater than 25% coverage of flowering plants	
	How many species of flowering shrubs, trees or preferred understory native plants are present?	0 to 1 flowering species	1 to 3 flowering species	At least 4 or mor flowering species	
	Is the potential habitat dominated by invasive species?	Dense (>50%) coverage of invasive plant species	Sparse to Moderate (25-50%) coverage of invasive plant species	Absent or Sparse (<25%) coverage of invasive species	

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Summary descriptions of medium - high, and low nesting, overwintering, and foraging habitats for the rusty patched bumble bee, with estimated disturbance acreage thresholds for each that would reach a 5% probability of destroying a nest, overwintering queen, or no longer be discountable foraging loss. For nesting and overwintering, the thresholds refer to ground disturbance, whereas the forage loss acreages are for foraging habitat.

Habitat Type	Medium -High Quality Habitat Description	Medium-High Quality Habitat Disturbance Threshold (acres)	Low Quality Habitat Description	Low Quality Habitat Disturbance Threshold (acres)
Nesting	Upland open grasslands, shrublands, savanna with native grasses, moderate to abundant coverage (>25%) of at least 4 species of flowering shrubs, trees and/or rusty patched bumble bee preferred understory native plants (such as hyssop, Joe pye weed, wild bergamot, mountain mint, Culvers root, New England asters, coneflowers, milkweed, jewelweed, leadplant, spiraea, native Ranunculaceae spp., and native Hydrangea spp.), and dominated by uncompacted, well-drained soils. Or upland forested edge habitats adjacent to open areas with at least 4 species of flowering plants, absent or very sparse coverage of invasive vegetation in understory (<25%), dominated by uncompacted and well-drained soils, and evidence of rodent activity or pre-existing cavities. In Central Appalachian Forests (MD, VA, WV), interior forest with flowering trees with the soil, cavities and invasive species elements as described above.	0.30	Upland open grasslands, shrublands, savanna native grasses, sparse coverage (10-25%) of 2-3 species flowering shrubs, trees and/or understory native plants (such as hyssop, Joe pye weed, wild bergamot, mountain mint, Culvers root, New England asters, coneflowers, milkweed, jewelweed, leadplant, spiraea, , native Ranunculaceae spp., and native Hydrangea spp.), with a combination of compacted and uncompacted soils that are well-drained. Or upland forested edge habitats adjacent to open areas less than 2-3 species of flowering plants, sparse to moderate coverage of invasive vegetation in the understory (<50%), combination of compacted and uncompacted well-drained soils, and some evidence of rodent activity or pre-existing cavities. In Central Appalachian Forests (MD, VA, WV), interior forest with flowering trees with the soil, cavities and invasive species elements as described above.	1
Overwintering	Upland forest at least 25 m from a non-forested edge and a minimum patch size greater than 0.75 acres, moderate to abundant coverage (>25%) of at least 4 species of spring flowering shrubs, trees and/or herbaceous native plants (species preferred by the rusty patched bumble bee, such as Serviceberry, gooseberry, willows, Virginia waterleaf, wild geranium, shooting star, wood betony, wild lupine, Dutchman’s breeches,	0.30	Upland forest patches at least 25 m from a non-forested edge and a minimum patch size of 0.75 acres, sparse coverage (10-25%) of at least 2-3 species of spring flowering shrubs, trees and/or understory native plants (such as Serviceberry, gooseberry, willows, Virginia waterleaf, wild geranium, shooting star, wood betony, wild lupine, Dutchman’s breeches, native Rhododendron spp ,and Virginia bluebells), some leaf	1

	native Rhododendron spp., and Virginia bluebells), absent or sparse coverage of invasive vegetation in understory, abundant leaf litter, and uncompacted and well-drained soils.		litter, sparse to moderate coverage of invasive vegetation (present but not dense) in the understory, and primarily uncompacted and well-drained soils, but some compaction is evident (e.g., pre-existing trails or logging skid roads and landings).	
Foraging	Open grasslands, shrublands, savanna, riparian areas, and/or palustrine wetlands and seasonally -flooded wetlands with moderate to abundant coverage (>25%) of at least 4 species of flowering shrubs, trees and/or understory native plants (such as hyssop, Joe pye weed, wild bergamot, mountain mint, Culvers root, New England asters, coneflowers, milkweed, jewelweed, leadplant, spiraea, Serviceberry, American basswood, certain flowering crops like blueberries and cranberries). Or forested edge habitats adjacent to open areas with at least 4 species of flowering plants (e.g., Virginia bluebells, native Ranunculaceae spp., and native Hydrangea spp.) and over 25% vegetative cover. Ideally, foraging resources should be present throughout the active flight season (spring, summer and fall), however this may not be possible given the habitat type. Foraging resources available during at least two seasons. Absent or sparse coverage (<25%) of invasive vegetation in understory.	2	Open grasslands, shrublands, savanna, riparian areas, and/or palustrine wetlands and seasonally -flooded wetlands with sparse coverage (10-25%) of 1-3 species of flowering shrubs, trees and/or understory native plants (such as hyssop, Joe pye weed, wild bergamot, mountain mint, Culvers root, New England asters, coneflowers, milkweed, jewelweed, leadplant, spiraea, Serviceberry, American basswood, certain flowering crops like blueberries and cranberries). Or forested edge habitats adjacent to open areas with 1-3 species of flowering plants and between 10-25% vegetative cover. Foraging resources available during at least one season during the active flight season (e.g., only fall). Sparse to moderate understory invasive species coverage (25-50%).	10

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Appendix F. Calculations for disturbance thresholds

Table F.1. Estimated nest and overwintering queen densities (refer to Table 3) and associated ground disturbance thresholds based on habitat quality.

	Medium- High Quality	**Low Quality**
Density assumed throughout entire HPZ	45/ km^2	14/ km^2
Which equals a density of:	0.18/ac (0.45/ha)	0.06/ac (0.14/ha)
Which is equivalent to one nest every:	5.49/ac (2.22/ha)	17.65/ac (7.14/ha)
Size of ground disturbance with 5% probability of destroying a nest or overwintering queen	0.30 ac (rounded from 0.27ac)	1 ac (rounded up from 0.88ac)

Table F.2. Estimated foraging habitat disturbance thresholds for medium-high quality and low-quality forging habitat.

	Medium-High Quality	**Low Quality**
Estimated foraging radius from nest	200 m	500 m
Which equals a home range of:	31.05 ac (12.57 ha)	194.08 ac (78.54 ha)
Size of foraging habitat loss that reaches a 5% significance threshold	2 ac (rounded from 1.55ac)	10 ac (rounded from 9.7ac)