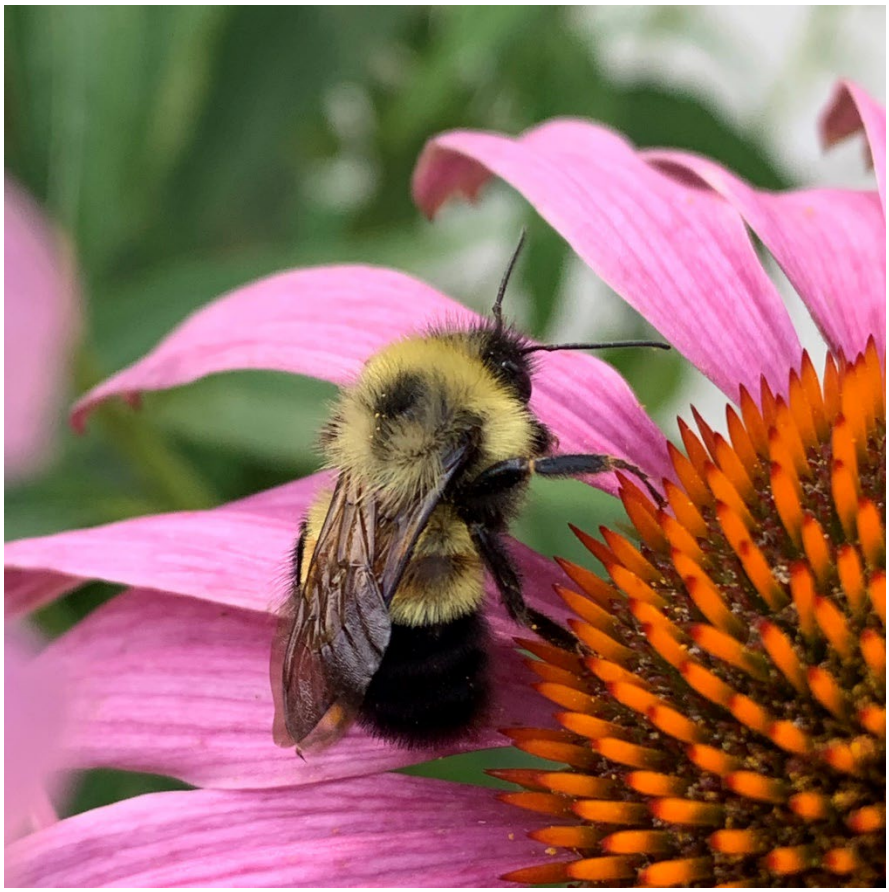
RECOVERY IMPLEMENTATION STRATEGY FOR THE RUSTY PATCHED BUMBLE BEE (BOMBUS AFFINIS) VERSION 1.0



October 2022

Midwest Region

U.S. Fish and Wildlife Service

Purpose

This recovery implementation strategy (RIS) supplements the Recovery Plan for the Rusty Patched Bumble Bee (U.S. Fish and Wildlife Service 2021) and describes in greater detail how the actions outlined in the recovery plan will be implemented. To maximize flexibility of recovery implementation, the RIS may be revised at any time during the recovery process, whenever experience and information gained call for a change in tactics. Recovery plan "actions" are broad measures that describe what needs to be done to accomplish the goal of long-term viability. The RIS outlines the "activities" that are the detailed, on-the-ground measures needed to implement the higher-level recovery actions.

The recovery strategy focuses on a sequence of first halting population/colony declines, then reversing population/colony declines, and ultimately securing the long-term viability of the species across a specified range (U.S. Fish and Wildlife Service 2021).

This document provides the process and structure of the rusty patched bumble bee RIS, guiding principles for reporting, and conservation unit (CU) specific near-term goals and measurable outcomes. Each CU will also use a standardized spreadsheet to track CU-specific activities.

Structure

The rusty patched bumble bee RIS consists of CU working groups, a science support working group, and an overarching coordination working group (Figure 1). The purpose, participants, and roles of each working group are described below. It is expected that the coordination group and representatives/leads of each CU group and the science support group will meet in person regularly and will have regular virtual meetings, as is deemed appropriate.

Each CU-specific RIS focuses on activities that will be implemented in a 2-to-5-year time frame, including those activities that are prerequisites for longer term activities that will need to occur within the next 10 years. Development and implementation of activities may be phased in as recovery progress is made (for example, CU5 may focus initially on surveys and outreach, and CU1 may focus on work in occupied areas and filling key uncertainties).

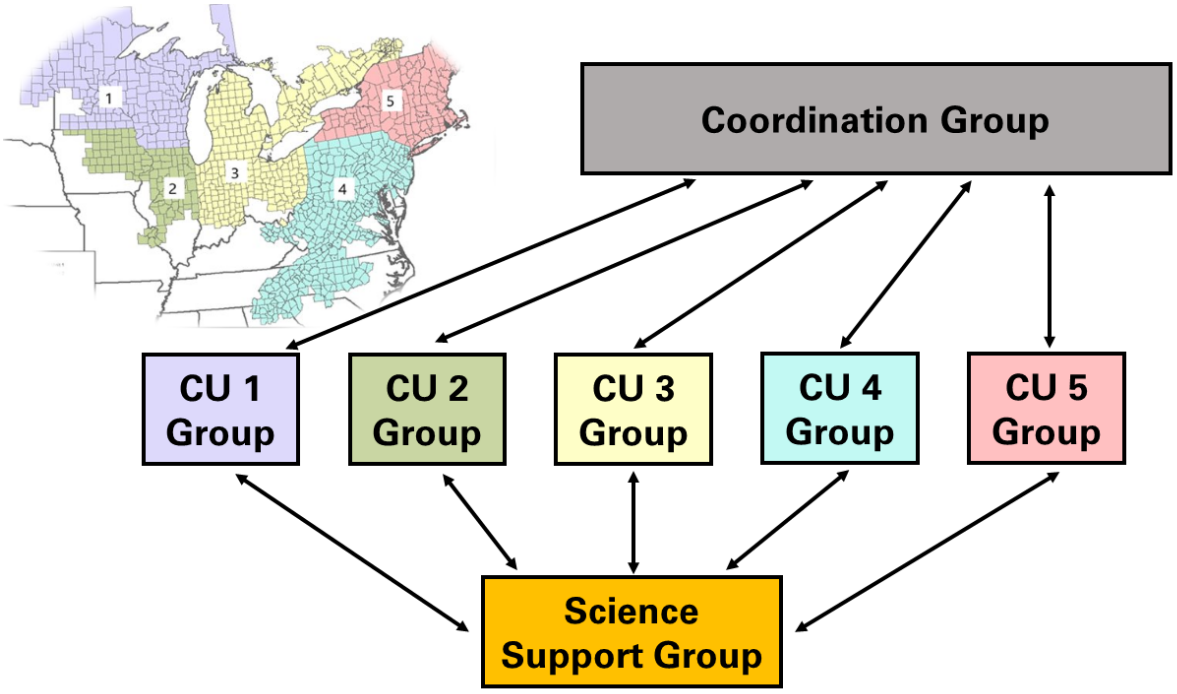


Figure 1. Structure of the rusty patched bumble bee RIS. Arrows depict the main pathways of communication; however, informal coordination among Conservation Unit (CU) working groups and between CU working groups and the science support working group is also expected to occur. The map shows the conservation units from the Recovery Plan for Rusty Patched Bumble Bee.

Coordination Working Group

Participants: U.S. Fish and Wildlife Service (FWS) rusty patched bumble bee lead biologist, FWS Recovery Coordinator, and the CU and science support working group leads.

Purpose and Roles: The purpose of the coordination working group is to ensure continuity among the CU RIS efforts. The coordination group coordinates information sharing and RIS monitoring and compiles information on the progress of range-wide recovery activities and status of the species. The coordination group will also revise the RIS framework document as necessary. Additional responsibilities may be added as needed.

In addition, the coordination working group will:

- Initiate CU working groups and establish interim CU group leads.
- Provide guidance to facilitate initial CU RIS development.
- Facilitate international coordination with Canada.
- Coordinate the rusty patched bumble bee activities with other large-scale (range-wide or multiple CU) pollinator efforts.
- Identify, prioritize, and implement overarching or range-wide activities (e.g., research, outreach, and education) in coordination with the CU working groups.

- Assure that overarching threats affecting rusty patched bumble bees range-wide or in multiple CUs are addressed.
- Establish a communication structure between and among CU groups, the science support group, and the coordination group.
- Seek sources of funding to accomplish recovery activities.

Science Support Working Group

Participants: FWS rusty patched bumble bee lead biologist, FWS science support biologists, and technical expert scientists.

Purpose and Roles: The purpose of the science support working group is to provide support to the CU groups and the coordination group on technical and scientific issues needed to achieve recovery. Issue-focused sub-groups may form as needed.

Additional responsibilities may include the following:

- Conduct landscape scale habitat and threat assessments.
- Develop protocols and best practices for certain range-wide activities (e.g., non-lethal pathogen and genetics sampling) to allow for efficient and consistent data collection and minimize harm to the species.

Conservation Unit (CU) Working Groups

Participants: FWS Field Office biologists, State biologists, land managers, university scientists, Federal agencies, non-governmental organization (NGO)s, interested parties in bumble bee conservation, Canadian partners (CUs 1 and 3), and others as appropriate. Each CU would have a dedicated group lead (or co-leads).

Purpose and Roles: The purpose of each CU working group is to identify, prioritize, and implement activities needed to achieve recovery within their CU. Each CU group will develop CU-specific objectives and priorities that align with the recovery criteria and the recovery strategy.

In addition, CU working groups will:

- Establish and maintain CU working groups (participants and leadership).
- Develop and update the CU-specific RIS (using the format in the Appendix).
- Establish CU-specific targets to meet CU-specific recovery criteria as outlined in the Recovery Plan (USFWS 2021). For example, the CU will establish CU-specific arrangement of populations per downlisting criterion A2 (USFWS 2021).
- Seek sources of funding to accomplish recovery activities.
- Provide cost and time estimates for activities.
- Update and track the status of the rusty patched bumble bee populations within the CU.
- Coordinate and communicate with the coordination and science support working groups. For example, the CU groups will provide data and any revisions of their CU RIS to the coordination and science support groups and coordinate on CU-specific targets.

- Coordinate with other pollinator efforts in their CU.
- Develop adaptive strategy or decision model for activities. For example, the CU group may develop contingency plans that depend on results of prerequisite activities (if x result from activity A, then will do y).

Process

Stepped-down activities to achieve CU-specific goals

Each CU working group will provide details of unit-specific activities in the activities tracking spreadsheet according to the applicable recovery action(s). The spreadsheet includes near-term activities and activities that need to be completed to facilitate longer-term activities and will be updated regularly. The current version of the activity tracking spreadsheet is available upon request from the MN-WI Ecological Service Field Office (contact Tamara Smith at tamara_smith@fws.gov).

Appendix 1 provides a brief narrative for each conservation unit summarizing the species' current status in that unit, near-term (5 years) goals, and measurable outcomes. These narratives will be updated periodically.

Monitoring species' status

Population grid monitoring data will be compiled and provided annually to each working group. These data will include grid numbers, state, county, detection years, and other information for each conservation unit. Bee surveyors are expected to submit survey and monitoring data to the USFWS using the USFWS Bumble Bee Reporting Form 3-2526 available on the USFWS website (https://www.fws.gov/species/rusty-patched-bumble-bee-bombus-affinis).

Reporting framework

Each CU working group is responsible for tracking and reporting progress towards CU-specific recovery activities. Ensure that progress in the CU template spreadsheet and information on this form is up to date and submitted to the coordination working group by April 30th of each year. USFWS biologists will compile the information that is submitted to assess progress towards recovery.

Appendix 1: Summary of current status, near-term goals, and measurable outcomes for each conservation unit

Conservation Unit: 1 – Upper West: North Dakota, South Dakota, Minnesota, Wisconsin, Michigan- upper peninsula, western Ontario

Date: April 18, 2022

1. Current Population Status: Conservation Unit 1 currently has 255 known occupied grids[1], 0 of which are known healthy populations (as described in the recovery plan and the SSA) of rusty patched bumble bees as of April 18, 2022. Use this map of rusty patched bumble bee grids to visualize which grids are currently occupied and the year of the last rusty patched bumble bee detection.

2. Near-term (5 years) Focus and Goals: There are currently 255 known occupied grids in CU1, however, we do not know the number that are considered healthy. The focus of CU1 will be multi-faceted. Several entities in CU1 will focus on conducting surveys and habitat assessments from 2022–2027, which contributes to action 4 (Assess population and habitat status and trends through monitoring and surveys) in the recovery plan. This work will include public engagement through community science projects (e.g., Wisconsin Bumble Bee Brigade, Back Yard Bumble Bee Count, Minnesota Bee Atlas) and bumble bee identification and conservation workshops. It will also include studies to improve monitoring through occupancy modeling and by using innovative techniques (eDNA). During population surveys, some permitted researchers will collect additional data (e.g., pollen, genetic samples, fecal samples) to inform the definition of healthy populations in the recovery plan. CU1 will also conduct habitat restoration and enhancement projects, including outreach to increase public awareness and participation in habitat projects and habitat research projects which all contribute to action 5 in the recovery plan. Studies contributing to recovery plan action 3 include dispersal and habitat use studies, studies to find nesting locations, and studies to improve captive breeding of at-risk bumble bees. In addition, we will gather information to help inform future reintroductions with the aim to identify sites for potential reintroductions. CU1 will continue to work in collaboration with the science support working group to identify and implement priority research needs.

3. Measurable Outcomes by 2027:
    a. Increase knowledge of disease prevalence. Conduct pathogen sampling in at least 10% of occupied grids (Action 1– pathogens).

[1] Per the 2021 final recovery plan, 10km by 10km grid cells will be used to track occupancy over time.

b. Increase knowledge of pesticide exposure and impacts. Conduct pesticide sampling in at least 10% of occupied grids (Action 2 – pesticides).
c. Identify at least 3 potential sites to evaluate for potential future reintroductions (Action 3 – populations).
d. Contribute to knowledge of captive rearing techniques. Contribute to a propagation and reintroduction plan (Action 3 – populations).
e. Increase knowledge of rusty patched bumble bee grid occupancies. Survey 10 % of occupied grids annually. Survey 10% of priority unoccupied grids annually. (Action 4 – surveys & monitoring)
f. Implement 1-2 *Bombus* identification workshops annually (Action 4 – surveys & monitoring).
g. Conduct rusty patched bumble bee habitat assessments at 10% of occupied grids and 10% of priority unoccupied grids annually (Action 4 – surveys & monitoring).
h. Implement habitat improvement projects in 10% of occupied grids (Action 5 – habitat).

4. Target distribution of population clusters and rationale for the distribution: To date, no target clusters have been identified in CU1 because at this stage in the recovery process we don't yet know the optimal arrangement and location of these clusters.

Conservation Unit: 2 – Lower West: Iowa, Illinois, Missouri

Date: April 18, 2022

1. Current Population Status: Conservation Unit 2 currently has 161 known occupied grids[2], 0 of which are known healthy populations (as described in the recovery plan and the SSA) of rusty patched bumble bees as of April 18, 2022. Use this map of rusty patched bumble bee grids to visualize which grids are currently occupied and the year of the last rusty patched bumble bee detection.

2. Near Term (5 years) Focus and Goals: CU2 will focus on conducting surveys and supporting partners' rusty patched bumble bee survey efforts from 2022–2025, which contributes to action 4 (Assess population and habitat status and trends through monitoring and surveys) in the recovery plan. We will create an urban pollinator conservation model that will initially be developed in conjunction with partners in the Quad Cities. This model will focus on community outreach, creating educational plots of native plant species, and both citizen science and structured survey efforts. Elements of the partnership will be replicated in other urban areas as a way of creating connectivity on a primarily agricultural landscape. Coordination meetings will be held with interested partners throughout the CU to provide education and guidance. Near term research activities within CU2 will be comprised of graduate projects that focus on organismal and colony health as well as landscape factors affecting presence. A portion of the associated surveys will take place on USFWS Partners for Fish and Wildlife project land, allowing us to assess the success of rusty patched bumble bee-focused habitat projects.

3. Measurable Outcomes by 2027:
    a. Increase knowledge of rusty patched bumble bee grid occupancies by surveying in at least 10% of occupied grids and at least 10% of unoccupied grids annually (Action 4 – surveys & monitoring).
    b. Conduct rusty patched bumble bee habitat assessments at 10 sites (Action 4 – surveys & monitoring).
    c. Install habitat improvement projects at multiple scales throughout CU2 and in 20% of occupied grids (Action 5 – habitat).
    d. Facilitate 2 bumble bee identification workshops annually (Action 4 – surveys & monitoring).
    e. Increase knowledge of rusty patched bumble bee grid occupancies on federal land within the historical range by supporting surveys in all unoccupied grids on refuges with sufficient habitat resources (Action 4 – surveys & monitoring).
    f. Increase pollinator conservation awareness in urban areas by supporting the creation of at least 5 pollinator gardens in public spaces of each state (Action 5 – habitat).

[2] Per the 2021 final recovery plan, 10km by 10km grid cells will be used to track occupancy over time.

4. Target distribution of population clusters and rationale for the distribution: To date, no target clusters have been identified in CU2 because at this stage in the recovery process we don't yet know the optimal arrangement and location of these clusters.

Conservation Unit: 3 – Midwest: Indiana, Ohio, Michigan-lower peninsula, eastern Ontario, Quebec

Date: April 18, 2022

1. Current Population Status: Conservation Unit 3 currently has 5 known occupied grids[3], 0 of which are known healthy populations (as described in the recovery plan and the SSA) of rusty patched bumble bees as of April 18, 2022. Use this map of rusty patched bumble bee grids to visualize which grids are currently occupied and the year of the last rusty patched bumble bee detection.

2. Near Term (5 year) Focus and Goals: In CU3, there are currently only 5 known occupied grids, therefore, CU3 will focus on conducting surveys (both formal including habitat assessments and using citizen science data) for the rusty patched bumble bee from 2022–2027, which contributes to action 4 (Assess population and habitat status and trends through monitoring and surveys) in the recovery plan. There is also continued research on threats to bumblebee populations in general that would be applicable to the rusty patched bumble bee. In addition, we will gather information to help inform future reintroductions with the aim to identify sites for potential reintroductions.

3. Measurable Outcomes by 2027:
    a. Increase knowledge of rusty patched bumble bee grid occupancies by surveying in at least 10% of occupied grids and at least 10% of unoccupied grids annually (Action 4 – surveys & monitoring).
    b. Identify at least 3 potential future reintroduction sites (Action 3 – populations).

4. Target distribution of population clusters and rationale for the distribution: To date, no target clusters have been identified because at this stage in the recovery process we don't yet know the optimal arrangement and location of these clusters.

[3] Per the 2021 final recovery plan, 10km by 10km grid cells will be used to track occupancy over time.

Conservation Unit: 4 – Southeast: Delaware, District of Columbia, Georgia, Kentucky, Maryland, New Jersey, North Carolina, Pennsylvania, South Carolina, Tennessee, Virginia, West Virginia

Date: June 7, 2022

1. Current Population Status: Conservation Unit 4 currently has 29 known occupied grids[4], 0 of which are known healthy populations (as described in the recovery plan and the SSA) of rusty patched bumble bees as of April 18, 2022. Use this map of rusty patched bumble bee grids to visualize which grids are currently occupied and the year of the last rusty patched bumble bee detection.

2. Near Term (5 year) Focus and Goals: In CU4, there are currently only 29 known occupied grids, therefore, CU4 will focus on conducting surveys for rusty patched bumble bee from 2022–2027, which contributes to action 4 (Assess population and habitat status and trends through monitoring and surveys) in the recovery plan. To increase our abilities in predicting rusty patched bumble bee habitat and potential presence, and to guide our survey efforts, we will conduct a GIS habitat modeling effort based on the model established by Virginia Natural Heritage. In addition, we will gather information to help inform future reintroductions with the aim to identify sites for potential reintroductions.

3. Measurable Outcomes by 2027:
    a. Complete a habitat suitability model for Southern Appalachian Region (Action 4 – surveys & monitoring).
    b. Conduct rusty patched bumble bee habitat assessments at 10 sites (Action 4 – surveys & monitoring).
    c. Identify at least 3 potential future reintroduction sites (Action 3 – populations).
    d. Increase knowledge of rusty patched bumble bee grid occupancies by surveying in at least 10% of occupied grids and at least 10% of unoccupied grids annually (Action 4 – surveys & monitoring).
    e. More focused species surveys in the suitable habitat locations of North Carolina and the Southern Appalachian region as designated by the habitat modeling efforts (Action 4 – surveys & monitoring).

4. Target distribution of population clusters and rationale for the distribution: To date, no target clusters have been identified because at this stage in the recovery process we don't yet know the optimal arrangement and location of these clusters.

[4] Per the 2021 final recovery plan, 10km by 10km grid cells will be used to track occupancy over time.

Conservation Unit: 5 – Northeast: Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island, Vermont

Date: July 1, 2022

1. Current Population Status: Conservation Unit 5 currently has 2 known occupied grids[1], 0 of which are known healthy[2] populations of rusty patched bumble bees (as described in the recovery plan and the SSA) as of July 1, 2022. Grid #8,321 in Maine's first and last records were in 2009. Grid #16,533 in Massachusetts' first record was in 1968, and its last record was in 2009. Use this map of rusty patched bumble bee grids to visualize which grids are currently occupied and the year of the last rusty patched bumble bee detection.

2. Near Term (5 year) Focus and Goals: In CU5, there are currently only 2 known occupied grids (grid 8,321 in Maine; grid 16,533 in Massachusetts), neither of which have had a rusty patched bumble bee sighting since 2009. Therefore, CU5 will focus on conducting surveys for rusty patched bumble bee from 2022–2027, which contributes to action 4 (Assess population and habitat status and trends through monitoring and surveys) in the recovery plan. In addition, we will gather information to help inform future reintroductions with the aim to identify sites for potential reintroductions.

3. Measurable Outcomes by 2027:
    a. Increase knowledge of rusty patched bumble bee grid occupancies (Action 4 – surveys & monitoring).
    b. Conduct rusty patched bumble bee habitat assessments at 10 sites (Action 4 – surveys & monitoring).
    c. Identify at least 3 potential future reintroduction sites (either previously occupied or new) (Action 3 – populations).

4. Target distribution of population clusters and rationale for the distribution: To date, no target clusters have been identified because at this stage in the recovery process we don't yet know the optimal arrangement and location of these clusters.

Science Support

Date: May 5, 2022

1. Near Term (5 years) Focus and Goals: The focus of the science support group will be multi-faceted to support work of the Conservation Unit (CU) groups. Key research questions to move recovery forward were prioritized during the North Central Branch of the Entomological Society of America 2022 symposium on *Bombus affinis* and through other conversations throughout the recovery planning process. CU groups 1, 3, and 4 also prioritized key research questions. Several key questions rose to the top which will help provide focus for the science support group. The following needs were identified as top priorities: 1) develop and implement metrics and methods to assess health of populations (genetically, demographically, body condition, pesticide and pathogen loads), 2) develop improvements to monitoring guidance including a minimum standard survey protocol, and 3) study overwintering, nesting, and foraging queens. Additional needs identified include: 1) conduct habitat suitability monitoring to help prioritize future survey locations, particularly in CUs 3, 4, and 5 and 2) develop a propagation and reintroduction plan. This group will continue to work in collaboration with the CU groups to identify and implement priority research needs. Many of the data collections, for example, to inform the measurable outcomes below will occur in collaboration with CU groups across the range.

    2. Measurable Outcomes by 2027:
        a. Action 1 (harmful pathogens and parasites)
            i. Refine non-lethal pathogen sampling techniques and develop sampling recommendations for researchers.
            ii. Understand the baseline harmful disease and parasite prevalence in current populations. Analyze samples collected from current populations for pathogen-parasite prevalence. *Note: Samples may be collected from members of the science group and other conservation unit participants.*
            iii. Develop healthy population targets in terms of pathogens, parasites, and disease per recovery plan Criteria A1 (*e.g.*, targets for the acceptable levels of pathogens related to their effects on reproductive success).
            iv. Develop recommendations for pathogen monitoring to inform baseline health metrics, including a survey design and methods.
                1. Determine target number of grids to monitor for pathogens to inform recovery plan Criteria A1 (*e.g.*, a minimum of 10% of extant grids will be sampled by 2027).
        b. Action 2 (pesticides)
            i. Understand the baseline pesticide prevalence in current populations. Analyze samples collected from current populations for pesticide prevalence. *Note: Samples may be collected from members of the science group and other conservation unit participants.*
            ii. Study the impacts of pesticides on health metrics (*e.g.*, using a surrogate species, measure the effects of pesticide X on number of queens produced).

iii. Develop healthy population targets in terms of pesticides per recovery plan Criteria A1(*e.g.*, targets for the acceptable levels of pesticides related to their effects on reproductive or foraging success).
iv. Develop recommendations for pesticide monitoring to inform baseline health metrics, including a survey design and methods.
    1. Develop target number of grids to sample for pesticides (*e.g.*, a minimum of 10% of extant grids will be sampled by 2027).

c. Action 3 (populations)
    i. Refine captive rearing techniques and release strategies.
    ii. Develop a propagation and reintroduction plan, including metrics to identify potential release sites.
    iii. Help CUs develop a strategy to determine population clustering targets per recovery plan Criteria A2, considering climate change projections.
d. Action 4 (surveys & monitoring)
    i. Refine monitoring guidance to include more precise levels of effort to achieve desired detectability and to help find additional populations of the species.
    ii. Determine the risks of handling spring queens and fall gynes, using surrogate species.
    iii. Optimize population and health monitoring recommendations to measure what is outlined in the recovery plan Criteria A1 (occupancy trends).
e. Action 5 (habitat) *Note that many of these can apply to multiple actions.*
    i. Provide habitat sampling and research guidance to CU team participants, for example to effectively measure efficacy of habitat management on the rusty patched bumble bee health.
    ii. Contribute to our understanding of successful overwintering requisites (including habitat and other health metrics).
    iii. Contribute to our understanding of successful nesting requisites (including habitat and other health metrics).
    iv. Contribute to our understanding of seasonal foraging and nutritional needs of the rusty patched bumble bee.
    v. Contribute to our understanding of habitat management efficacy relating to rusty patched bumble bee health.