Considerations for Conserving Crotch's Bumble Bee (*Bombus crotchii*), Franklin's Bumble Bee (*Bombus franklini*), Western Bumble Bee (*Bombus occidentalis*), and Suckley's Cuckoo Bumble Bee (*Bombus suckleyi*)

Crotch's bumble bee (Bombus crotchii); Photo by Dylan Winkler, CDFW

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Preface

Crotch's bumble bee (*Bombus crotchii*), western bumble bee (*Bombus occidentalis*), Franklin's bumble bee (*Bombus franklini*), and Suckley's cuckoo bumble bee (*Bombus suckleyi*) are the first insect species to become candidates for listing under the California Endangered Species Act (CESA). CDFW recognized a need for information on the ecology and considerations for avoiding or minimizing project-related impacts to these bumble bee species to help inform projects that may have interactions with these species during CESA candidacy. Because information regarding species distribution, ecology, status, and conservation needs continues to evolve, this document is intended to serve as a flexible, science-based guidance resource that may be revised or updated as new information becomes available and as their status changes based on future Fish and Game Commission's CESA-listing determination.

This document is non-regulatory. Nothing in this document should be interpreted as an order or mandatory standard for environmental review or permitting. The information provided herein is intended to assist CDFW staff, project proponents, and consultants in conserving these species. While this document provides considerations and examples for avoiding or minimizing project-related impacts, practical applications must be based on the best available scientific information and project- and site-specific conditions, including an evaluation of the potential impacts from anticipated project activities. If project proponents believe their project may result in incidental take, CDFW recommends contacting the appropriate CDFW regional office in which the project will occur to discuss specific project-related concerns and options to comply with CESA, if necessary, based on proposed project activities. If the Fish and Game Commission determines that listing under CESA is not warranted and one or more of these species are no longer candidates for listing, this document will remain a resource but any references to compliance with CESA will no longer be applicable to species without listing or candidacy status.

Introduction

Bombus crotchii, *B. occidentalis, B. franklini*, and *B. suckleyi* (referred to as "candidate bumble bees" herein) are candidates for listing under the California Endangered Species Act (CESA). This document provides a brief overview of general bumble bee ecology and of each species' specific ecology. Understanding the ecology of these species is critical to implementing a project that minimizes impacts to the species, while achieving the desired outcome of the project in an efficient and cost-effective manner[1]. This document is non-regulatory and includes considerations for avoiding or minimizing impacts to the species, habitat management strategies, and conservation strategies to help inform projects that may interact with these species. Project proponents should reach out to the appropriate CDFW regional office to discuss any project related questions or concerns.

Status According to California Law

All four candidate bumble bee species are included on CDFW's California Terrestrial and Vernal Pool Invertebrates of Conservation Priority (CDFW 2024) List, CDFW's Special Animal's List (California Natural Diversity Database [CNDDB] 2025), and are considered Species of Greatest Conservation Need in the California State Wildlife Action Plan.

In October 2018, the Xerces Society for Invertebrate Conservation, Defenders of Wildlife, and Center for Food Safety submitted a petition to the California Fish and Game Commission (Commission) to list *B. crotchii*, *B. occidentalis, B. franklini*, and *B. suckleyi* as endangered pursuant to CESA (Fish & G. Code, § 2050 et seq.). The Commission determined listing may be warranted and these species became candidates for listing when the Commission's Notice of Findings was published, June 28, 2019. The Commission's authority to list terrestrial invertebrates such as insects was legally challenged, and the court ordered a stay on the candidacy during the ensuing litigation. The Commission's decision was ultimately unanimously upheld by the court of appeals, and after the California Supreme Court declined to hear the case; the appellate court's decision was remitted to the lower court which resulted in the bumble bees candidacy being reinstated on September 30, 2022.

During CESA candidacy, a species is afforded protection as a listed species and "take"[2] is prohibited unless authorized by CDFW. Project activities within the ranges of the candidate bumble bees may need authorization for take if take cannot be avoided. Take authorization issued pursuant to CESA requires project- and species-specific avoidance and minimization measures, and depending on the authorization, may require full mitigation for project-related

[1] It is the policy of the state of California and the intent of the California Endangered Species Act legislation that "reasonable and prudent alternatives shall be developed by CDFW, together with the project proponent and the state lead agency, consistent with conserving the species, while at the same time maintaining the project purpose to the greatest extent possible (Fish & G. Code, § 2053).

[2] Pursuant to Fish and Game Code § 86 "take" means hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill.

impacts. To discuss specific project-related concerns or the need for take authorization, contact the appropriate CDFW regional office in which the project will occur.

Bumble Bee Ecology

General overview

Bumble bees (genus *Bombus*) are members of the Apidae family in the order Hymenoptera (Thorp et al. 1983). There are more than 260 Bombus species worldwide with around 25 species occurring in California, inhabiting grasslands, mountain meadows, deserts, wetlands, and coastal habitats (Fisher et al. 2022; Williams et al. 2014). Bumble bees are typically large and sturdy in comparison to most other bees and are covered in dense hairs with aposematic (warning) coloration of contrasting yellow, black, or reddish bands (Thorp et al. 1983; Goulson 2010). They can regulate their body temperature by shivering their wing muscles in cooler temperatures and thus, are adapted to flying in cooler, low light conditions compared to most other insects gaining access to early blooming plant species (Williams et al. 2014; Thorp et al. 2002a; Hatfield et al. 2012b). Additionally, they have variable tongue lengths between and within species that allow them to forage for nectar and pollen from flowers of different corolla depths (Heinrich 2004; Williams et al. 2014; Corbet et al. 1991). Together, these traits contribute to their ability to function as generalist foragers across diverse habitats and floral resources.

Most bumble bee species are primitively eusocial, living in colonies with a reproductive caste (queen) and worker caste (Williams et al. 2014). Parasitic or 'cuckoo' bumble bees (in the subgenus *Psithyrus*) are social parasites that usurp colonies of their host species (Williams et al. 2014). The female reproductive cuckoo bumble bee kills, subdues, or evicts the host queen, then uses pheromones to trick the host workers into treating her as if she were their queen, utilizing the resources of the host colony to produce her female and male offspring (Williams et al. 2014; Kawakita et al. 2004).

Bumble Bee Life Cycle

In California, most bumble bee colonies have an annual life cycle, with distinct spring, summer, fall and winter periods defined by a set of activities. In the early spring queens emerge to forage and locate a suitable nest during the **Queen Flight Season**. The queen establishes and builds the colony through summer while workers forage during the **Colony Active Period**. In the fall reproductives are produced and mate during the **Gyne Flight Season,** after which the gynes search for a hibernacula to overwinter during the **Overwintering Period.**

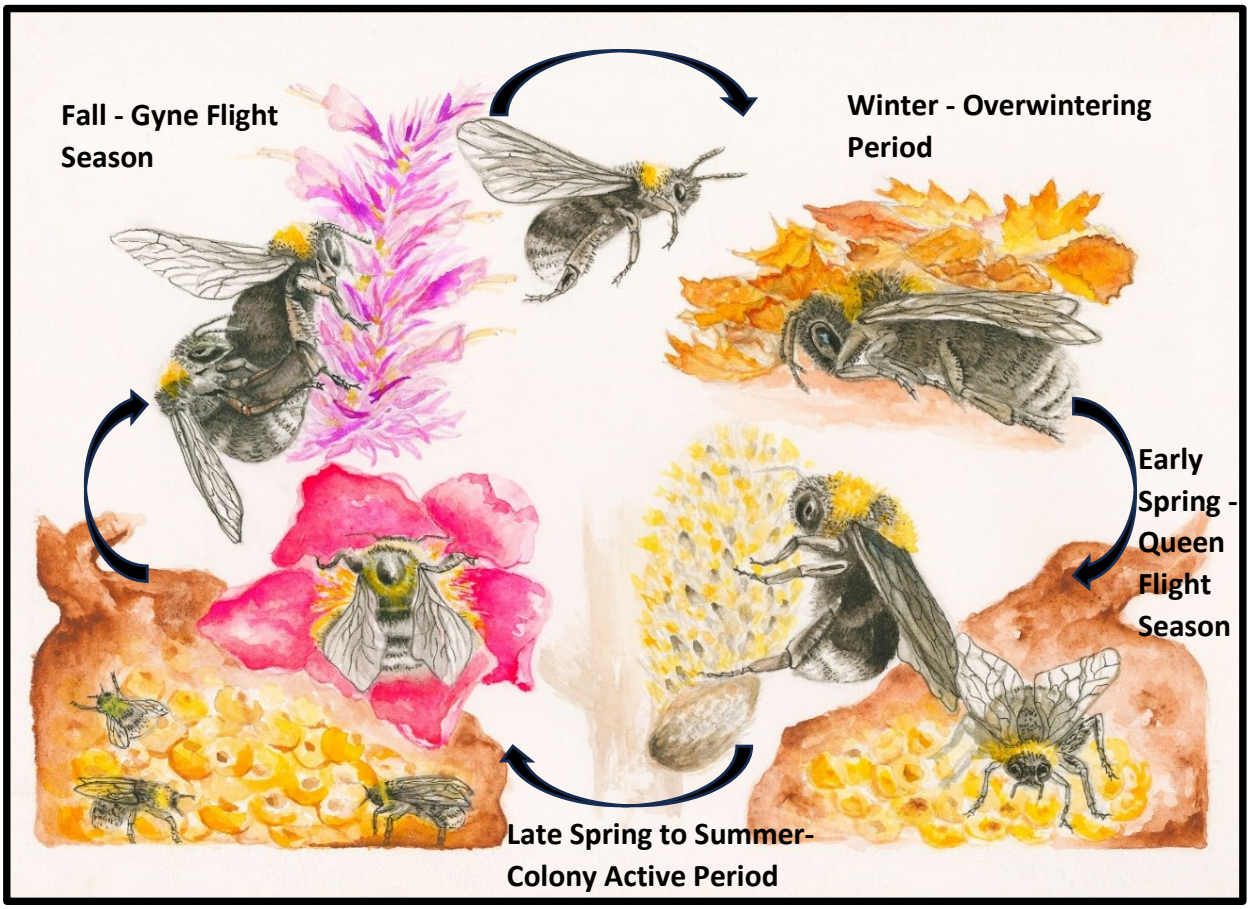

Figure 1: Illustration of the annual bumble bee life cycle by Ashley Kammet, CDFW.

Spring: Queen Establishes Nest (Queen flight Season)

Figure 2: Queen bumble bee building a nest and tending to eggs/larvae; Photos by Marion Ellis and Elaine Evans.

In the early spring, queen bumble bees emerge from their hibernacula to search for an appropriate colony nesting site (Williams et al. 2014). Emergence timing of queens is species-dependent, varies by elevation, and is in response to local environmental and climactic cues that may shift annually (Williams et al. 2014; Goulson 2010). The nesting preferences of many

bumble bee species, including some of the candidate species, remain largely undescribed. *Bombus* bumble bee queens do not dig or make their own nests. Rather, they search for suitable nest sites by flying low to the ground investigating cavities in a variety of different substrates including thatched grasses, abandoned rodent burrows or bird nests, brush piles, rock piles, and fallen logs (Sladen 1912; Free and Butler 1959; Alford 1975; Fussell and Corbet 1992; Lye et al. 2012; Williams et al. 2014). They have also been found nesting in man-made structures such as walls, rubble, or abandoned furniture (Fussell and Corbet 1992; Williams et al. 2014). Soil moisture and sun exposure may contribute to making a site suitable for nesting (Williams et al. 2019), as well as the presence of insulation (e.g., grasses) to help regulate nest temperatures.

Early spring blooming plants are critical to the queen's health and survival as well as the establishment of a successful colony (Thorp et al. 2002; Williams et al. 2014). The queen may spend two to three weeks looking for a suitable nest site (McFrederick and LeBuhn 2006). During this time, the queen is the only reproductive member of the colony and is exposed to stressors and other threats while foraging and searching for a nest (Wahengbam et al. 2019; Leza et al. 2018).

Once the nest site is established, the solitary foundress queen initiates the colony by laying fertilized eggs with stored sperm from mating the previous fall. The queen creates 'honeypots' out of wax to store nectar (Williams et al. 2014) and forms food masses out of pollen (pollen cakes) to lay her eggs (Williams et al. 2014). Larvae hatch from their eggs within about four days, feed for about two weeks on the pollen cakes, spin silk cocoons, and pupate for an additional two weeks before emerging as adult non-reproductive female workers (Goulson 2010; Williams et al. 2014).

Spring and Summer: Queen Builds the Colony (Colony Active Period)

Figure 3: Left- Bombus nest, Photo by Clare Flynn; Middle- Bombus nest site entrance, Photo by Kathy Keatley-Garvey; Right- Foraging bumble bee, Photo by Rich Hatfield, Xerces Society.

In the early stages of colony development, the queen is responsible for all food collection and care of the larvae. As the colony grows, workers take over the duties of food collection, colony defense, nest construction, regulating nest temperature, and larval care (Plowright and Pendrel 1977; Williams et al. 2014). At this point, the queen stays in the nest and continuously lays eggs all summer, building the colony and replacing workers who live on average for one to two

months (Williams et al. 2014). Colonies can contain between 50 to over 500 workers produced by a single queen (The Xerces Society 2018*b*).

Depending on the environmental conditions, location, elevation, and species, bumble bee colonies in California can be active from January through November, if floral resources are available (Williams et al. 2014), though some species that occur in coastal California have colonies that can persist year-round (Leif Richardson, pers. comm. 2023).

Fall and Winter: Mating and Hibernating (Gyne Flight Season and Overwintering Period)

Figure 4: Hibernating queen bumble bees. Left- Photo by Frances Adamson; Middle- Photo by Emily May, Xerces Society; Right- Photo by Nurturing Nature, george@nuturing-nature.co.uk.

As the bumble bee colony begins to senesce in the fall, the queen produces the next generation of reproductive gynes and drones who will leave the nest to find mates (Williams et al. 2014). The gynes forage on pollen and nectar during the day storing up fat reserves, often returning to the colony at night (Goulson 2010). Drones emerge to forage and search for mates and never return to the colony (Goulson 2010; Williams et al. 2014). Gynes continue to forage, building up reserves for their winter hibernation until they select a location to overwinter (Thorp et al. 2002; Williams et al. 2014). The remaining colony, along with the old queen and drones, die out not long after new reproductives are produced (Williams et al. 2014).

Gynes spend winters in hibernation in overwintering sites called hibernacula. Little is known about how gynes select hibernacula as they have only been identified in a few species (Williams et al. 2019). Hibernacula that have been encountered were found in shaded areas near trees, in rotten wood, in bare earth, moss, under tree litter, bare patches of soil within short grass (Sladen 1912; Plath 1927; Hobbs 1965, 1967; Alford 1969), or shallow burrows in soil on north facing slopes (Liczner and Colla 2019). Gynes have also been reported to use abandoned animal burrows (Goulson 2010; Williams et al. 2014, 2019). Overwintering queens have been found burrowed beneath 3.5-5 cm (1.35-2 inches) of forest litter duff around 1.5 meters (5 feet) from the trunks of trees and shaded from the sun (Wiliams et al. 2014; Alford 1969; U.S Fish and Wildlife Service [USFWS] 2021).

Dispersal Distance and Foraging Range

Gynes may disperse long distances from their foraging habitat to locate a suitable overwintering nest site (Williams et al. 2019). Similarly, dispersal distance of new queens from

their hibernaculum to a new nest site is unknown for most species and may vary greatly based on habitat conditions and competition between bumble bee queens. It is estimated through homing studies and genetic distance analysis that it may be around 10 kilometers (6.2 miles) (Kraus et al. 2009; Jha and Kremen 2013; Williams et al. 2014).

Bumble bees are central-place foragers, meaning they return to the same nest sites and do not move nest locations throughout the season. They have also been known to nest in areas without foraging resources and fly long distances to patches of blooms (Cresswell 1999). The distance they travel around their nest to forage is known as their foraging range. Foraging range can vary among species, the size of the colony, the size of the individual bees, and can also be attributed to the quality of habitat present, therefore it is difficult to determine the average foraging distance for bumble bees in general (Walther-Hellwig and Frankl 2000; Kreyer et al. 2004; Goulson 2010; Greenleaf and Kremen 2006). Some bumble bee species have been recorded foraging up to 11.5 kilometers (7 miles) from their nest in patchy agricultural landscapes (Rao and Strange 2012; Goulson and Stout 2001), however it is likely that the average foraging range occurs within 1 to 2 kilometers (0.62 to 1.2 miles) from the nest (Walther-Hellwig and Frankl 2000; Dramstad et al. 2003; Williams et al. 2014).

Because bumble bees can move over large distances, it is thought that bumble bees use resources at the landscape scale (Heard et al. 2007). This means that small habitat patches may be important to a colony's nutritional needs even if the nest is not proximate to said patch. Habitat quality has been shown to positively influence bumble bee species richness and abundance (Hatfield and LeBuhn 2007).

Species Specific Details

Crotch's Bumble Bee (*Bombus crotchii*)

Distribution

Crotch's bumble bee (*Bombus crotchii*) is a near California endemic, though there are a few records from Baja, Mexico, one in Nevada (Williams et al. 2014), and a 2024 single observation from Mt. Ashland, Oregon. Within California, the species historically occurred from Redding through central parts of the state including the Central Valley, Pacific coast range, and Sierra foothills, then into northern Baja (Williams et al. 2014). The highest density of observations of Crotch's bumble bee both currently and historically have occurred in the Los Angeles basin and greater San Diego area (Williams et al. 2014; NatureServe Explorer; Schweitzer and Richardson 2018; Richardson and Hatfield 2022 data). Crotch's bumble bee has recently been observed re-expanding into the northern parts of its range (NatureServe Explorer; Schweitzer and Richardson 2018; Hatfield et al. 2015; The Xerces Society 2021).

Habitat Requirements

Crotch's bumble bee is in the *Cullumanobombus* subfamily, which is predominantly associated grasslands in North America (Williams et al. 2014). Crotch's bumble bee has been documented

in open grasslands, shrublands, chaparral, desert margins including Joshua tree and creosote scrub, and semi-urban settings (Visco and Capon 1970; Pawelek et al. 2009; Williams et al. 2014). Crotch's bumble bee has a very short tongue that is best suited to open flowers with short corollas (The Xerces Society 2018*b*). The species has been observed on a wide variety of plant species in the Fabaceae, Apocynaceae, Asteraceae, Lamiaceae, Hydrophyllaceae, Plantaginaceae, Onograceae, Papaveraceae, Polygonaceae, and Boraginaceae families (Thorp et al. 1983; Koch 2012; Williams et al. 2014; The Xerces Society 2018*b*). The following plant genera appear to be preferred: *Asclepias*, *Chaenactis*, *Lupinus*, *Medicago*, *Phacelia*, and *Salvia* (Williams et al. 2014). It is important to note, however, that Crotch's bumble bees are generalists and can be found foraging on many other species of plants including non-native species.

In 2023, several confirmed nests of Crotch's bumble bee were found underground in abandoned ground squirrel and gopher burrows (CDFW staff field observations and data reported to CDFW), though the species could nest in burrows of other fossorial mammals like voles. The overwintering habitat of Crotch's bumble bee has not been documented although it is thought to be similar to that of other bumble bees.

Figure 5: Excavation of Crotch's bumble bee nest with Dr. Leif Richardson and CDFW staff. Left- Entrance to the burrow; Middle- Excavation of the complex burrow system with the entrance 25 feet from the nest; Right- The senesced nest. Photos by Krystle Hickman.

Seasonality

The Queen Flight Season for Crotch's bumble bee varies by location and seasonal weather patterns. In warm, dry years in southern California it can begin as early as late February (The Xerces Society 2021; Williams et al. 2014). In northern areas and wetter years, the Queen Flight Season more typically starts in March. The Colony Active Period ranges from March to August, with the highest detection between April 1 and June 30 (Thorp et al. 1983; Williams et al. 2014), though this varies with local climatic conditions and elevation. For example, during a drought year the Colony Active Period may begin earlier, and floral resources may diminish sooner. In contrast, during colder, wetter years the Colony Active Period may shift towards a later start and continue later into the fall depending on the floral resources available. The Gyne Flight Season can start as early as May in areas with limited floral resources but gynes are more

typically observed from July through October (Williams et al. 2014). During the breeding period males often perch on vegetation, using their large eyes to track down mates, though they also somewhat indiscriminately chase other flying insects in their search for mates (Williams et al. 2014).

Identification

Crotch's bumble bees are large bumble bees with velvety hair. They are most easily distinguished from other bumble bee species by their band coloration (The Xerces Society 2018*b*), with yellow on T2, a defining characteristic. Many individuals have a rusty color at the tip of their abdomen, however individuals in a single nest have been observed with varied color patterns (Leif Richardson, pers. comm., 2023). Males have large, bug-like eyes that appear to dominate their head and are distinct from many other bumble bee species.

Figure 6: Crotch's bumble bee. Left-Female, Photo by © hranson; Middle-Female, Photo by© robbhamilton; Right-Male, Photo by © robbhamilton.

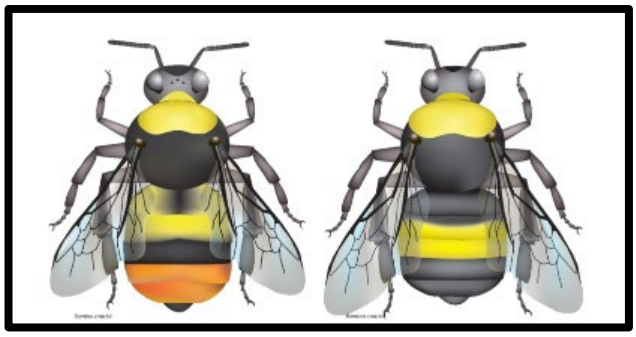

Figure 7: Two female Crotch's bumble bee color patterns, Illustrations by Elaine Evans and Paul Williams.

Franklin's Bumble Bee (*Bombus franklini*)

Distribution

Franklin's bumble bee has the smallest known range of any bumble bee in North America (The Xerces Society 2018*b*; Williams 1998); it is limited to Northern California and Southern Oregon

between the Coast and Sierra-Cascade ranges. It has been observed at elevations ranging from 160 meters (525 feet) in the northern part of its range, to 2,400 meters (8,000 feet) (Williams et al. 2014).

Franklin's bumble bee was last detected in California in 1998, when it was sighted in Siskiyou County (USFWS 2011; The Xerces Society 2018*b*). It has not been detected anywhere since 2006, when it was recorded at Mt. Ashland, Oregon (The Xerces Society 2018*b*; Williams et al. 2014).

Habitat Requirements

Franklin's bumble bee is a generalist forager that inhabits grasslands and montane meadows (The Xerces Society 2018*b*). The U.S. Fish and Wildlife Service (USFWS) has identified montane meadows as high priority zones for surveying where the highest density of observations have occurred historically (USFWS 2011). The IUCN, based on experts' assessments, also included shrublands as habitat for the species (USFWS 2019). The species has been observed collecting nectar and/or pollen from California poppy (*Eschscholzia californica*), lupine (*Lupinus spp*.), horsemint (*Agastache urticifolia*), vetch *(Vicia spp*.), and mountain coyote mint (*Monardella odoratissima*) (The Xerces Society 2018*b*), though likely uses a variety of other species as well.

The nesting habits of Franklin's bumble bee are largely unknown. It is thought to nest in underground cavities, as that is the primary nesting habitat for other species in the subgenus *Bombus sensu stricto* (Hobbs. G. A. 1968). There is no information on the overwintering habits of Franklin's bumble bee.

Seasonality

The flight season for Franklins bumble bee is from mid-May to the end of September, peaking in July (Thorp et al. 1983;).

Identification

Franklin's bumble bee has several characteristics that distinguish it from other species in its range: yellow hairs on the bee's anterior thorax that forms an inverted U-shape that extends past the wing bases and surrounds a central patch of black; an absence of yellow on the abdomen; a round face that is mostly black with yellow on top of the head; variable white hairs at the end of the abdomen; and a flat hindleg tibia forming the pollen basket (corbicula).

Figure 8: Franklin's bumble bee photos and color pattern illustration. Left- Female, Photo by Pete Schroeder; Middle- Female, Photo by James P. Strange USDA-ARS; Right- Illustration by Elaine Evans and Paul Williams.

Western Bumble Bee (*Bombus occidentalis*)

Distribution

Prior to 1998, western bumble bee (*Bombus occidentalis*) was one of the most widely distributed bumble bees in the United States and Canada, west of the Rocky Mountains (Cameron et al. 2011; Sheffield et al. 2016). In California, the species is currently restricted to high elevations in the Sierra Nevada, with some sightings along the Northern California Coast from sea level to over 2,400 meters (8,000 feet) in elevation (Williams et al. 2014; Graves et al. 2020).

Habitat Requirements

Western bumble bees are generalist foragers with short tongues and are therefore best suited to forage on open flowers with short corollas (Williams et al. 2014). However, western bumble bees are also known to engage in 'nectar robbing' behavior where they chew a hole at the base of a flowers with longer corollas to obtain nectar (Williams et al. 2014). They occur in mountain meadows, shrubland, grassland, chaparral, and coastal areas (Hatfield et al. 2015; Williams et al. 2014; The Xerces Society 2018*b*) and are "habitat generalists" (The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) 2014). Western bumble bees have been observed visiting a wide variety of plants including species in the Fabaceae, Asteraceae, Rhamnaceae, Rosaceae, and more than a dozen other plant families (Thorp et al. 1983). Examples of known foraging plant genera include *Ceanothus*, *Centaurea*, *Chrysothamnus*, *Cirsium*, *Geranium*, *Grindellia*, *Lupinus*, *Melilotus*, *Rubus*, *Solidago*, and *Trifolium* (Williams et al. 2014). Floral associations do not necessarily represent preference; these plant families may be abundant in the landscape where western bumble bees occur.

Western bumble bees nest in underground cavities such as abandoned rodent burrows, although they have also been reported in above-ground logs (Hobbs. G. A. 1968; Thorp et al. 1983; Heinrich 2004). Some of the nest tunnels have been reported to be up to 2.1 meters (7 feet) long and lined with vegetation or bird feathers (Macfarlane et al. 1994). Little is known about the habitat of the overwintering sites of western bumble bees; however, Hobbs reported that some overwintering sites were found 5 cm (2 inches) deep within a mound along a steep west facing slope (Hobbs 1968). Closely related species have reportedly been found overwintering in leaf litter beneath trees (Hobbs 1968; Liczner and Colla 2019). The western bumble bee is a frequent host species for the Suckley's cuckoo bumble bee and less frequently parasitized by three other cuckoo bumble bee species: *B. bohemicus*, *B. insularis*, and *B. flavidus* (Williams et al. 2014).

Seasonality

The Queen Flight Season for western bumble bees in California ranges from early February or March through June, depending on locality and elevation. Given the range contraction to higher

elevations, most western bumble bee queens are not likely to emerge before snow melt in the Sierras and Cascades. The Colony Active Period is typically between April and September (Thorp et al. 1983), though this can shift depending on floral resource availability and seasonal weather patterns. The Gyne Flight Period can start as early as June and run through late November depending on local conditions (Thorp et al. 1983).

Identification

Western bumble bees are stout bees with a short cheek that gives their face a rounded appearance. They have highly variable color forms with eight described in the females and seven in males (Williams et al. 2014). There are two prominent color forms in California, which vary by geographic location. In the mountains, western bumble bees generally have bright white coloration on the posterior end of the abdomen. Individuals found throughout the eastern part of the state (Sierra-Cascade Range near Yosemite to Oregon and west along the northern tier of counties into Humboldt) usually do not have yellow on the T1-T4.

Figure 9: Western bumble bee. Left- Female, Photo by © Martin Dollenkamp; Middle- Female, Photo by © lyndas; Right- Male, Photo by © funnystuff2495. Identification by John Ascher via iNaturalist.

Figure 10: Western bumble bee color patterns, Illustrations by Elaine Evans and Paul Williams.

Suckley's Cuckoo Bumble Bee (*Bombus suckleyi*)

Distribution

Historically, Suckley's cuckoo bumble bee had a broad range across North America, however within California it is restricted to the Northern portion of the state in the Klamath Mountain region (The Xerces Society 2018*b*). The species has not been observed in California since 2009, and only five observations in the state have been reported (The Xerces Society 2021). Cuckoo bees can be more challenging to detect than eusocial bumble bee species as they spend most of their lives within their host nests and are often only recorded during their Queen and Gyne Flight Seasons when queens are searching for a host nest or gynes are mating and looking for an overwintering site (Hatfield et al. 2015). Note, all cuckoo bee females are reproductives that usurp other bumble bee species' nests, therefore, "queen" is something of a misnomer, but given our definition of flight seasons, the terms Queen or Gyne Flight Season are used for continuity with other species.

Habitat Requirements

Suckley's cuckoo bumble bee is a nest parasite that kills or subdues queens of their host species to commandeer the nest's workforce for their own reproductive needs (Goulson 2010; Thorp et al. 1983). Their primary host is the western bumble bee (*Bombus occidentalis),* but they have also been observed parasitizing the following *Bombus* species that occur in California: *B. rufocinctus*, *B. fervidus*, *B. nevadensis*, and *B. appositus* (Williams et al. 2014). Suitable habitat therefore must include the active nest of one of its hosts and the requisite habitat elements the host depends on, such as small mammal burrows for nesting (Hobbs. G. A. 1968). Suckley's cuckoo bumble bee is a generalist forager that inhabits western meadows, mostly in mountainous areas (The Xerces Society 2018*b*). Floral taxa associated with Suckley's cuckoo bumble bee, and its host include Asteraceae, Fabaceae, Plantaginaceae, and Salicaceae; more specifically, it has been associated with the following genera: *Aster*, *Ceanothus*, *Centaurea*, *Chrysothamnus*, *Cirsium*, *Eriogonum*, *Penstemon* and *Solidago* (Thorp et al. 1983, Williams et al. 2014, The Xerces Society 2018*b*).

Seasonality

After awakening from overwintering, females spend the early portion of their flight season foraging for themselves until are they are able to locate and parasitize a host colony (The Xerces Society 2018*b*). Parasitic bumble bees typically have a later flight period than their hosts to ensure host colonies are established prior to invasion (Williams et al. 2014). In California, female Suckley's cuckoo bumble bees have a flight period from mid-May through October, while males' flight period has been recorded to occur between early July and late September (Thorp et al. 1983).

Identification

Suckley's cuckoo bumble bee is difficult to detect and identify, partially because it is similar in appearance to other cuckoo bumble bees that occur in California. This difficulty is only compounded by the species' lack of a worker class, meaning the chances of finding an

individual in flight is unlikely (Hatfield et al. 2015). Nevertheless, there are some characteristics which make identification possible, the most obvious being the lack of corbicula (pollen carrying baskets) on female's hind legs, which are instead densely occupied by short, even hairs (Williams et al. 2014). The S6 lateral keels project beyond the T6 and are clearly visible from above as shown by the arrows in the photo below.

Figure 11: Suckley's cuckoo bumble bee females. Photos by © kimmann. Identification by Lief Richardson and John Ascher via iNaturalist.

Figure 12: Illustration of a female Suckley's cuckoo bumble bee, Illustration by Elaine Evans and Paul Williams.

Impact Avoidance and Minimization Considerations

The following considerations are non-regulatory. They are not required or applicable to all projects, however, they may be useful when evaluating potential impacts from project activities to these species as well as developing take avoidance or minimization measures for candidate bumble bees. Projects may be strategically planned and implemented to avoid take of listed or candidate species. If take could occur, CDFW staff are available to discuss options to obtain authorization for incidental take for these species.

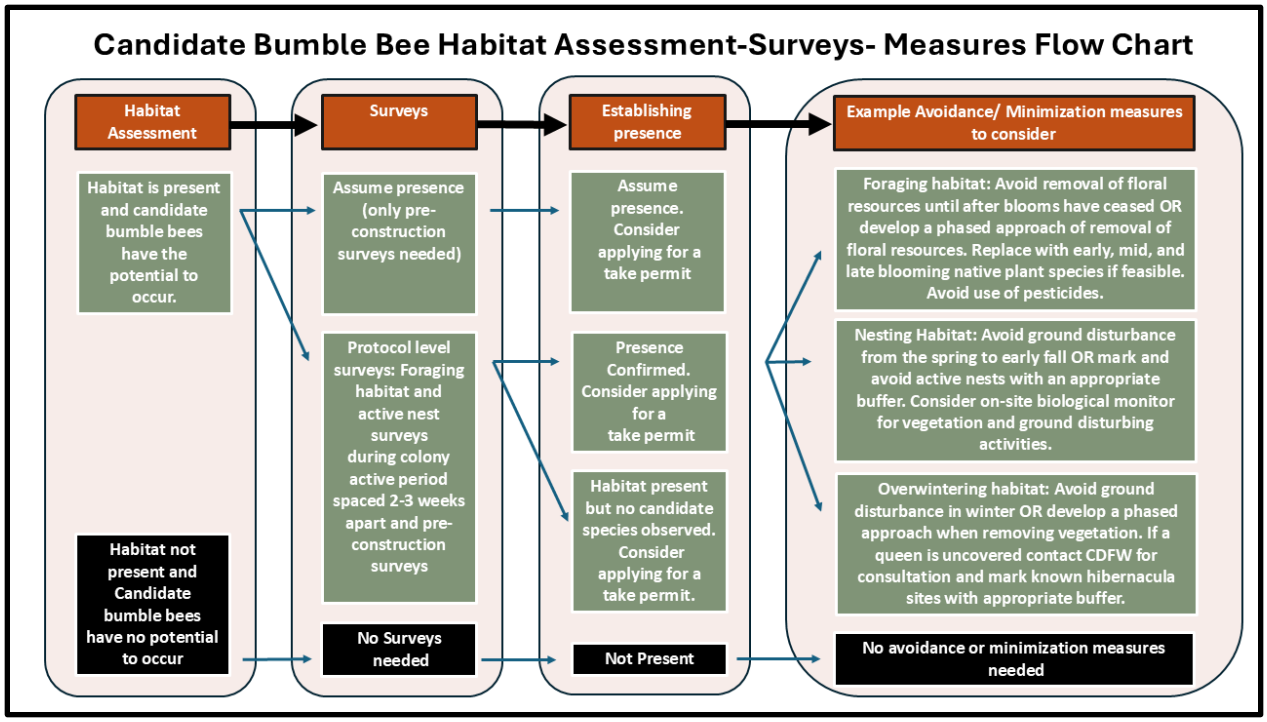

Figure 13: Example habitat assessment-survey methods-measures flow chart.

Assessing Habitat and Evaluating Presence

Habitat assessments are conducted to evaluate the likelihood that a site supports candidate bumble bees. See CDFW's Survey Considerations for California Endangered Species Act (CESA) Candidate Bumble Bee Species (Survey Considerations) for considerations and more details on conducting a habitat assessment. During a habitat assessment, a qualified biologist will evaluate the potential for foraging, nesting and overwintering habitat.

Surveys

Surveys conducted by a trained and experienced biologist are recommended if suitable habitat is identified within or adjacent to a project site. Surveys can provide information needed to determine potential effects of proposed project activities. Surveys may also help project proponents determine the best timing for various project activities during a given year to minimize or avoid take of candidate bumble bee species. The number and type of surveys conducted during a survey effort may vary on a project- and site-specific basis. For example, if candidate bumble bees are known to be present (e.g., observed during habitat assessments) or are assumed present, pre-construction surveys may be appropriate (completed no more than three weeks prior to the initiation of project activities). In other circumstances, protocol level surveys may be more appropriate to identify foraging habitat and active nests. CDFW's Survey Considerations for California Endangered Species Act (CESA) Candidate Bumble Bee Species provides an overview of survey considerations and methods that could be used by projects.

Seasonal Restrictions

A seasonal work restriction limits work during a portion of the year when the candidate species may be present in a project footprint. The ability for project proponents to use seasonal restrictions to completely avoid impacts to these species will be dependent on which species are likely to occur on the project site, the type of habitat present (e.g., nesting, foraging, or overwintering), the type of project activities that will occur, and seasonal limitations of the project activities. The implementation of seasonal restrictions to minimize or avoid take is determined on a project-by-project basis. Since it may be likely that many project sites within the species' ranges will contain multiple habitat types (e.g., nesting and overwintering), it may not always be possible to use seasonal work restrictions to completely avoid impacts to the candidate bumble bee species. Considerations for seasonal restrictions to avoid or minimize impacts to the species are discussed below.

Nesting (Colony Active Period)

Nests contain the queens and workers, thus all future reproductive capacity of the colony. Efforts should be made to avoid disturbance of occupied nests whenever possible. Unearthed nests seldom survive, and queens are unlikely to initiate new nests if their nest is destroyed.

If a site has a high proportion of nesting habitat, projects should consider if conducting activities outside of the Queen and Gyne Flight Season and the Colony Active Period, can avoid or minimize impacts to the species. The time frame for a seasonal work window should be determined on a species and project-specific basis.

Avoiding nesting habitat

If a seasonal work window is not suitable for a given project, surveys for active nest sites conducted by a qualified biologist may aid in avoidance of active nests.

If no nests are discovered, monitoring of floral resources for candidate bumble bee activity during ground disturbing activities may help minimize take and unearthing active nests.

If a nest or multiple nests are discovered the project may consider implementing:

- Visible flagging of all confirmed nest sites and instruction to project staff regarding the use of flagging and nest site location.
- A no disturbance buffer zone around the nest when activities include ground disturbance or prescribed burning. Although little is known about how deep active bumble bee nests are underground, some research has noted excavated nests at a depth from a few centimeters to more than one meter (1-4 feet) underground depending on the abandoned fossorial rodent burrow (USFWS 2021; Roberts et al. 2020; Lye et al. 2012; Osborne et al. 2007; Plath 1927; Macfarlane 1994). In 2024, CDFW staff and researcher Leif Richardson jointly excavated a senesced Crotch's bumble bee nest. They observed entrances at a distance of 7.6 meters (25 feet) from the underground nest (see Figure 5). The appropriate no disturbance buffer distances should be determined on a project-by-project basis as appropriate to local conditions and project activities.

- Limitation or exclusion of ground or vegetation disturbing activities within the buffer zone for the duration of occupancy, and appropriate restriction of travel through the buffer zone to established road passes or if barriers to movement would make continuation of project activities infeasible. Caution should be used when moving through the buffer zone to minimize potential impacts.

Determining nest senescence

CDFW has not received reports of year-round nest activity for the candidate bumble bees. To help determine when a colony or nest becomes inactive, the project may consider implementing:

- Surveys for reproductives (gynes and males) on floral resources as their presence can help signal nest senescence.
- Monitoring nests for senescence in late summer and fall, depending on the species and location. To verify senescence, CDFW recommends monitoring nests for no less than 60 minutes per day for 3 consecutive days (based on CDFW staff observation).

If there has been no nest activity after the above conditions are met, then the no disturbance work buffer likely can be removed. The timing of nest senescence should be determined on a project-by-project basis.

Foraging

Foraging bumble bees are most prevalent on the landscape during the Colony Active Period. If flowering vegetation needs to be removed during the bloom period, consider the following measures to minimize impacts to candidate bumble bee species as appropriate:

- Remove flowering vegetation before or after their bloom period.
- Avoid spraying pesticides on plants while in bloom.
- Remove flowering vegetation in a patched manner leaving areas of floral resources to maintain refugia for foraging bumble bees; for a multi-year project, the recommended ratio is 1/3 removal per year (The Xerces Society 2018*a*).
- Remove floral resources outside of the daily foraging window, for example early in the early morning or late in the day.
- Removal of non-native plants should be prioritized over removal of native plants; however, the candidate bumble bees may use non-native plants. Removal of native plants should comply with applicable laws and regulations.
- Clear vegetation by hand or by other mechanical means instead of using chemicals.

Overwintering

Very little is known about overwintering queens and how or where they choose their hibernacula. Overwintering bees are very difficult to detect, therefore it may be infeasible to avoid them if ground disturbing activities occur during this period (approximately from October 31- March 1, depending on the species and location). If disturbance to potential overwintering

habitat must occur during the overwintering period, the following precautions should be considered:

- Conduct surveys during the Colony Active Period, prior to the overwintering period, in as many adjacent patches of foraging habitat as feasible to assess if the species is present.
- Conduct work during the Overwintering Period in a patched manner or limit impacts to a portion of the site in a given year if for a multi-year project.

In the event an overwintering candidate bumble bee is uncovered and appears to be remaining in a state of hibernation (e.g., remaining immobile or remaining near the hibernacula), the project should consider:

- Placing any materials removed (e.g., grass, vegetation, bark, debris, etc.) back over the hibernating queen to re-create pre-disturbed conditions.
- Delineating a no-disturbance buffer around the overwintering site using highly visible flagging or other markings. The appropriate buffer distance should be determined on a project-by-project basis considering local conditions and project activities.
- Educating project-staff about the location of the overwintering site and avoidance measures.

Habitat Management Strategies

Mowing

Mowing is a common vegetation management technique but can result in the removal of large patches of floral resources. If mowing is necessary, consider the following best management practices as appropriate:

- Implement a multi-year phased approach that retains large un-mowed patches of floral resources (Hatfield et al. 2012, The Xerces Society 2018*a*).
- Avoid mowing during the Colony Active Period. The best time for mowing is in the winter to avoid removing essential floral resources for the queens in the early spring, the Colony Active Period in the spring and summer, and the gynes in the fall gathering fat reserves to sustain them throughout the winter (Hatfield et al. 2021).
- If mowing during the early spring to the fall cannot be avoided, retain patches of habitat to create refuge sites for bumble bees (The Xerces Society 2018*a*).
- Set mow blades to the highest safe level. A minimum height of 30.5 cm (12 inches) helps to avoid disturbing nests or overwintering queens (Hatfield et al. 2012).
- Map the extent of the mowed area so that future efforts are planned accordingly and allow for native floral resources to recover (USFWS 2018).
- Conduct rapid habitat assessments if mowing for fire breaks or for other fire prevention-related activities, to minimize impacts to local floral resources or disrupt nesting sites.

Pesticide use

Bumble bees may be exposed to pesticides through direct contact from drift or from ground or foliar applications. They may also be indirectly exposed, including through pollen and nectar from systemic pesticides (Sanchez-Bayo and Goka 2014). Acute insecticide exposure can cause mortality while lower doses or continued exposure may have sublethal effects such as decreased reproductive or foraging efficiency (Stanley et al. 2015). CDFW recommends that pesticide use be avoided; however if used, targeted application should follow the best management practices described by Xerces Society's Guidance to Protect Habitat from Pesticide Contamination, California's Managed Pollinator Protection Plan-MP3, 2018 (California Department of Pesticide Regulation (CADPR) 2018), and the University of California's Division of Agriculture and Natural Resources (UCANR) Statewide Integrated Pest Management Program (IPM)'s Best management practices to protect bees from pesticides. All pesticide applications should be conducted or supervised by a Licensed or Certified Pesticide Applicator and must be used as directed by the manufacturer on the product label. Additional guidance on this topic is available by following the links above. A subset of recommendations for consideration that are adapted from the Xerces Society, CADPR, and UCANR resources include:

- Avoid applications of pesticides during the Queen and Gyne Flight Seasons.
- Avoid pesticide applications during the Colony Active Period.
- Delineate a no-pesticide buffer between 12-18 meters (40-60 feet) around active nests for any pesticides applications that occur during the Colony Active Period (The Xerces Society 2016).
- Avoid spraying herbicides on plants that are in bloom to minimize direct and/or indirect exposure to bumble bees. Instead, target other vegetive phases (typically pre-bloom) when the chemicals are most effective as recommended by the manufacturer.
- Apply pesticides in a targeted manner and use application methods that minimize drift to adjacent habitat.
- Avoid using pesticides marked with the US Environmental Protection Agency's (EPA) bee hazard icon. When possible, use pesticides that are rated green/III in UC IPM Bee Precaution Database and use the least toxic products at the least concentrated application possible.
- Avoid mixtures with fungicides, certain pesticides and/or adjuvants that have been shown to increase the risk of pesticide toxicity to bees (Straw and Brown 2021).
- Avoid using soil fumigants in areas where bumble bees are likely to nest.
- Avoid using rodenticides.

Grazing

While grazing can help increase floral resources when stocking rate and timing is suited to a given landscape, intensive grazing can negatively impact vegetative cover (Hatfield and LeBuhn 2007; Carvell 2002). Grazing management strategies should consider rotating and/or resting pastures to allow floral resources to recover (USFWS 2018). Recommendations to consider include:

- Consider limiting grazing in high quality foraging habitat during the Colony Active Period (USFWS 2018).
- Consider high-density, short durations, low animal unit months (AUM), and/or rest-rotation (Hatfield et al. 2021).
- Target grazing of flower-rich pastures to periods when most flowers are no longer in bloom, such as fall and winter. For longer grazing durations (>45 days), low intensity and low AUMs are recommended (Hatfield et al. 2021).

Prescribed Fire

Fire has been shown to maintain or open early seral habits that have high floral abundance and richness (Simanonok and Burkle 2020; Mola et al. 2020). However, poorly timed burns may reduce critical floral resources the colony or reproductives rely on. The location and timing of prescribed burn activities should minimize potential negative impacts to bumble bees. Specific considerations include:

- Burn small patches of a given area, ideally no more than one third of a site, every three to six years for each specific area (Hatfield et al. 2012; USFWS 2018).
- Do not use fire if fuel load is high; a prescribed burn may not be the appropriate tool if fuel loads are high as it could start a high intensity fire that can negatively impact bumble bee foraging or nesting habitat (USFWS 2018).
- Check any burn piles for nests prior to initiating a fire; ideally burn piles should not be left for more than a year as bumble bees can initiate nests in them (Craig Fiehler, CDFW, per. comm.).
- Mow fire breaks to create unburned patches that can serve as refuge for animals (Hatfield et al. 2012).
- If feasable, burn in cooler, humid conditions between October through January (Hatfield et al. 2021) to minimize removal of floral resources during their bloom periods and to avoid the Active Colony Period, Gyne Flight Season, and the Queen Flight Season. Local conditions and project site locations should also be considered when determing the most appropriate time to burn to minimize impacts to candidate bumble bee species and other wildlife.
- Avoid burning plant species that have been demonstrated to provide critical resources to new queens during the Queen Flight Season (e.g., manzanita).

Managed Bees

Managed bees, including European honey bees (*Apis mellifera*) and commercial bumble bees, may compete with native bumble bees for floral resources and potentially spread pathogens. Studies have shown that native bees both avoid flowers preferred by honey bees (Walther-Hellwig and Frankl 2000) and avoid foraging in close proximity to honey bee hives (Thomson 2006). Bumble bee species richness has been reported to be reduced in areas with higher honey bee density (Pyke et al. 2016). Several diseases can be spread from honey bees and managed bumble bees to native bumble bees (Singh et al. 2010), and some of these pathogens can increase morality in bumble bees (Graystock et al. 2016, Colla et al. 2006, Goulson et al.

2008, Szabo et al. 2012, Cameron and Sadd 2020). Diseases are often spread through shared flower visitation (Graystock et al. 2015). To reduce the potential for these impacts, specific considerations include:

- Honey bee apiaries should be at least 1.6 km (1 mile), though some literature recommends at least 6.4 km (4 miles), from known occurrences or nesting, foraging, or overwintering habitat of candidate bumble bee species (Hatfield et al. 2021).
- Regularly screen honey bee hives for diseases.
- If using commercial bumble bees, screen all commercial bumble bee colonies for disease prior to using as well as multiple times during use.
- Deploy commercial bumble bees in greenhouses only (no open-field settings) and ensure their sides and entrances are secured at all times so bees cannot escape into the environment. Use queen excluders to ensure reproductive individuals cannot exit the colony to potentially establish.

Additional Resources for Habitat Management:

- The Xerces Society's Best Management Practices for Pollinators on Western Rangelands (Mcknight et al. 2018).
- U.S. Forest Services' Pollinator-Friendly Best Management Practices for Federal Lands (U.S. Forest Service 2015).

Habitat Creation and Enhancement

Many of the following considerations related to the creation, enhancement, or maintenance of habitat, have been modeled after the USFWS Conservation Management Guidelines for the Rusty Patched Bumble Bee (*Bombus affinis*) (USFWS 2018) and Conserving Bumble bees Guidelines for Creating or Managing Habitat for America's Declining Pollinators from the Xerces Society (Hatfield et al. 2012).

Foraging Habitat

When creating or enhancing foraging habitat, plant a diversity of native flowering plant species (herbaceous, shrubs, and trees as appropriate for the site), ideally incorporating a minimum of three flowering species per season (spring, summer, and fall) with overlapping bloom periods. For resources on California native plant bloom periods visit Calflora. Although bumble bees are generalist foragers, they do have some preference for perennial plant species with flowers that are purple, blue, or yellow. Bumble bees are less likely to forage on red flowers because they are essentially blind to red (Hatfield et al. 2012). Including flowers with a diversity of corolla tube depths can support bumble bees with varying tongue lengths (Hatfield et al. 2012). Additionally, consider incorporating preferred host plants, as appropriate to the project location.

Floral resources may be planted in multiple patches or in a single area. Plantings should aim to achieve approximately 50 percent of vegetative cover as this is likely to provide optimal forage resources for the candidate bumble bee species (USFWS 2018). If climate extremes are a

concern, consider incorporating plants that are drought, flood, or frost hardy, depending on the predicted site conditions.

New plants should be monitored and maintained for three to five years, though plantings should be designed to persist indefinitely into the future. Management of the habitat such as weeding and watering should occur as needed. Irrigation may be necessary during plant establishment (one to three years depending on site-specific conditions and annual rainfall). For more information on pollinator conservation and establishing habitat, look at CDFAs pollinator habitat program practices and the Xerces publication Using 2014 Farm Bill Programs for Pollinator Conservation (usda.gov).

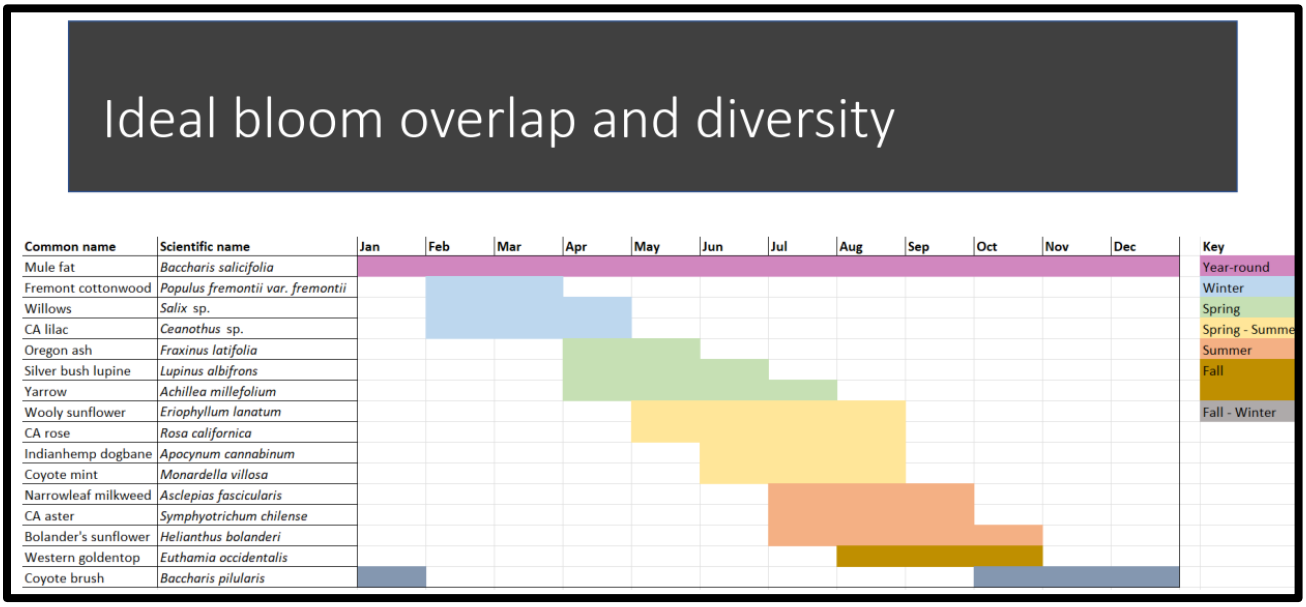

Figure 14: Example of restoration project designed to have overlapping bloom periods and at least 3 species in bloom during each season except winter and fall (after a colony likely senesces).

Nesting Habitat

To support nesting habitat, maintain areas of land that are free from disturbance (e.g., mowing and tilling) to encourage underground burrowing animals. Additionally, consider leaving leaf litter, brush piles, hedge clippings, and other woody plant material to provide shelter for wildlife and in turn future nest sites for bumble bees (Hatfield et al. 2012). If active or potential nesting habitat is encountered on a property, limit disturbance by developing appropriate no disturbance buffers around the nest site.

Overwintering Habitat

To support overwintering habitat, leave areas undisturbed. This includes locations with leaf litter, downed wood, and uncut bunch grasses USFWS 2018; (Hatfield et al. 2012).

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Appendix A: Example Avoidance and Minimization Measures That Have Been Used in Existing CESA ITPs

The following are examples of bumble bee avoidance and minimization measures taken from CDFW-issued CESA ITPs, with one additional recommended measure on unearthed active nests drawn from scientific literature. **These examples use prescriptive language (e.g., Permittee shall…) because they are examples of actual permit requirements.** This appendix includes potential measures and mitigation approaches for informational purposes only and should not be interpreted as having any determinative or binding effect on future avoidance or minimization measures or mitigation recommendations or permit requirements by CDFW. **These example measures may be used in a CESA ITP based on project activities as appropriate and will be modified as necessary on a site- and project- specific basis.**

This appendix is non-regulatory. Nothing in this appendix should be interpreted as an order or mandatory standard for environmental review or permitting. This information is intended to assist CDFW staff, project proponents, and consultants in conserving these species. While this appendix provides examples for avoiding or minimizing project-related impacts, practical applications must be based on the best available scientific information and project- and site-specific conditions. If project proponents believe their project may result in incidental take, CDFW recommends contacting the appropriate CDFW regional office in which the project will occur to discuss specific project-related concerns and options to comply with CESA, if necessary, based on proposed project activities.

Prior to Project Activities

Habitat Assessment:

Prior to initiating Covered Activities, the Designated Biologist shall conduct and submit to CDFW a habitat assessment evaluating the likelihood of bumble bees occurring within and up to 20 miles from the project area. The habitat assessment shall consider historical and current species distribution, proximity to the last known sighting, potential foraging (including native and nonnative floral resources), nesting, and overwintering habitat. The habitat assessment shall include an in-person project site observation and quantification of the amount of blooming vegetations (e.g., percent cover or a scale) and shall assess plant diversity.

Survey Plan:

The Permittee shall develop a Pre-Construction Survey Plan for the Covered Species and submit it to CDFW for approval no less than 60 days prior to the initiation of ground disturbing activities. The Survey Plan shall include the number of surveys that will be conducted, when the surveys are planned to take place (i.e., season and how much time between surveys), what type of habitat will be surveyed for (i.e., foraging, nesting, and/or overwintering), and survey method(s). The Pre-Construction Survey Plan shall consult the survey guidelines outlined in CDFW's Survey Considerations for California Endangered Species Act (CESA) Candidate Bumble Bee Species (June 6, 2023). Pre-Construction Surveys must be completed no more than 3 weeks prior to the initiation of Covered Activities. For multi-year projects, the Survey Plan shall

include multi-year surveys. The Survey Plan shall provide justification for timing and method of survey design (e.g., elevation, climatic conditions, previous year's precipitation, average ambient temperature, species Colony Active Period and Queen/Gyne Flight Season, etc.). The Survey Plan shall include the capture and identification protocol(s) for Colony Active Period surveys and the surveyor's qualifications for doing capture/release surveys. If photographs are used as vouchers, the Plan must identify the person(s) who will provide positive identification, and that person's qualifications for doing such.

Pre-Construction Survey:

The Designated Biologist shall perform a Pre-Construction Survey(s) as specified in the Pre-Construction Survey Plan. The survey(s) shall include a description of vegetation communities and floral resources. The Permittee shall provide Pre-Construction Survey notes and observations to CDFW prior to commencing Covered Activities.

The Designated Biologist shall focus attention on areas with blooming native and non-native nectar and pollen resources for the Covered Species. The survey duration shall be appropriate to the size of the area planned for Covered Activities plus 50 feet, if feasible, based on the metric of a minimum of one person for one hour of searching per three acres of suitable habitat. The Designated Biologist shall conduct surveys between 8:00 AM and 4:00 PM (Pacific Time) on sunny days between 55- and 90-degrees Fahrenheit with sustained wind speeds measuring less than 10 miles per hour. If the Covered Species is detected or suspected during surveys, the Designated Biologist shall flag the area where the observation was made and closely monitor the areas that were flagged during Covered Activities.

If during survey efforts, a queen or gyne is captured, it shall not be placed on ice and shall be released immediately. The Biologist should attempt to identify the individual by caste if possible.

Training for Project Staff

Permittee shall provide environmental awareness training for all on-site staff that identifies simple best practices for staff to follow. The training shall include general and site-specific information and include topics such as: avoiding unnecessary disturbance or damage to floral resources and potential nest sites; discussion of federal and state regulations that protect candidate bumble bees, their legal implications, and the necessity of compliance; protocols for reporting sightings of candidate bumble bees on site; protocols for if a nest site is damaged or an overwintering queen is unearthed; and photos/drawings of potential candidate species that may be present to facilitate identification.

During Project Activities

Seasonal Work Restrictions

Permittee shall avoid conducting Covered Activities involving vegetation disturbance and ground disturbance during the Colony Active Period in foraging habitat and shall ensure those activities are limited to the winter of each year. Native and non-native flowering vegetation removal shall occur prior to bloom or after blooms have senesced. If Covered Activities cannot

be avoided during this time and vegetation needs to be removed during the bloom period for those species, Permittee shall remove flowering vegetation in a patched manner leaving areas of floral resources as refugia for foraging Covered Species or wait until bloom has ceased. During the bloom period and colony active period, removal of non-native plants should be prioritized over native plants.

Permittee shall avoid conducting Covered Activities involving vegetation and ground disturbance in Covered Species habitat during the queen/gyne flight seasons, when queens emerge in the spring searching for nest sites and during the fall flight period when gynes mate and search for overwintering habitat. These time periods shift each year due to climactic conditions (drought, temperature, and precipitation). To determine these time periods each year, the Designated Biologist(s) shall be on-site and conduct Pre-Construction Surveys prior to ground disturbing activities in [July-late October] to avoid the Gyne Flight Season and again starting in [January-April] to avoid the Queen Flight Period.

Note: Brackets and grayed months indicate that the timing of these flight periods is dependent on the species, location, and climactic conditions and will be determined on a project-by project basis.

Covered Species Checks

If surveys and/or historical records indicate Covered Species presence within or adjacent to the project footprint, a qualified biologist shall be present for all ground or vegetation disturbing activities to assist in minimization impacts. The Designated Biologist or Designated Monitor will conduct visual sweeps of the Project Area where ground or vegetation disturbance is occurring for Covered Species flight activity at the start of the daily work window. Visual sweeps shall occur during optimal flight activity conditions (i.e., between 8am-4pm, low wind, low cloud cover, etc.). The Designated Biologist or Designated Monitor will intermittently repeat these visual sweeps throughout the daily work window.

If the habitat assessment identified suitable nesting, foraging, or overwintering habitat within the project site, but no Covered Species are found during the Pre-Construction Survey, the Permittee shall ensure a Designated Monitor is onsite during vegetation or ground disturbing activities that take place during any of the Queen and Gyne Flight Period and Colony Active Period.

Covered Species Observation (Suspected or Confirmed)

If suspected or confirmed Covered Species is detected in the Project Area, the Designated Biologist or Designated Monitor shall immediately contact CDFW Regional Representative by phone or email. Every effort shall be made by the Designated Biologist or Designated Monitor to locate the active nest. Covered Species nest surveys shall include the Project Area and a 50-foot buffer beyond the Project Area.

If an overwintering queen Covered Species is detected in or near a hibernaculum, the Permittee shall halt work in the immediate area, and the Designated Biologist shall immediately consult CDFW. If feasible, the Designated Biologist shall place materials removed during project activities (e.g., grass, vegetation, bark, debris, etc.) back over the hibernating queen to re-

create pre-disturbed conditions. The Designated Biologist shall delineate a [30 to 60] ft (9 to 18 m) radius around the hibernaculum as an environmentally sensitive area. The Designated Representative or Designated Biologist shall contact CDFW's Regional Representative within 24 hours for further consultation. The Designated Biologist shall record the queen's location with a GPS (including datum and horizontal accuracy in feet) and include photographs and a map of the queen's location as part of notification to CDFW's Regional Representative. Permittee shall adjust the size and/or modify the environmentally sensitive area buffer upon notice from CDFW. Permittee shall maintain buffers until further instructions from CDFW's Regional Representative.

Locating Nests

The Designated Biologist shall make every effort to locate nests if the Covered Species is suspected or confirmed within the Project Area. The Designated Biologist shall observe potential nest sites for signs of the Covered Species. To confirm a suspected Covered Species nest, the Designated Biologist may block/cover any suspected nest entrance with a jar/vial (or similar) of appropriate size for no more than 30 minutes or until a bumble bee is detected. The Designated Biologist shall continuously monitor the vial during the time it is blocking the suspected nest for confirmation. The Designated Biologist shall identify the species of bumble bee if a bumble bee is detected.

Nest Buffer

If Covered Species nest(s) are observed at any time during Covered Activities, Permittee shall halt work in the immediate area set up a 50 foot no disturbance buffer and immediately contact CDFW. Buffers shall remain until the nest(s) has senesced (becomes inactive and is no longer in use), or the Covered Activity in the Project Area is complete. The nest(s) location shall be recorded with GPS (including datum and horizontal accuracy in feet), and the Designated Biologist shall report the nest location to the CDFW Regional Representative within 24 hours of finding the nest.

Nest senescence

To determine if a nest has senesced, the Designated Biologist shall monitor the nest for senescence in late summer and fall depending on the species and location. Nest senescence can typically be denoted after the presence of reproductives (gynes and males) are observed in the fall. Nests shall be monitored for a minimum of one hour per day for three consecutive days during optimal weather conditions (i.e. from 8am -4pm, low wind, and low cloud cover conditions, etc.). If there has been no nest activity after the above conditions are met, then the no disturbance work buffer may be removed.

Unearthed Active Nest

If excavation or vegetation removal exposes a nest, the Designated Biologist shall halt work in the area and immediately contact and consult with CDFW. The Designated Biologist shall set up

a structure to shade the exposed nest and set up a 50 foot no disturbance buffer until the nest has senesced or project activities are completed, whichever one comes first.

The Designated Biologist shall consult protocols for emergency nest relocation (see resources from Xerces and NC State Extension) and shall coordinate with CDFW to plan and carry out nest relocation. Generally, emergency nest relocation should include the following steps:

- Prepare a nest box to transport the bees. The box must be covered with a small entrance hole and lined with soft material (e.g., cotton batting, dried grass clippings, etc.). Ensure the transportation box opening is plugged.
- Conduct nest excavation and transportation at night. Bees are colder so less active and less likely to be defensive; if a nest is moved during the day, worker bees out foraging will not find the nest and will be lost from the colony. Use a red light (bee's cannot see red light). Work as quickly as possible to minimize stress for the bees.
- Carefully uncover the nest and scoop the nest from underneath using a wide shovel or whatever is appropriate for the situation. The goal is to get the entire nest in one scoop to avoid crushing brood cells or spilling nectar from wax pots.
- Gently place the nest with the existing nesting material into the nest transportation box. Include as many bees as possible, most importantly the queen.
- Move the nest transportation box to a location with floral resources, protected from predators such as skunks or bears and uncap the entrance hole.
- Monitor the nest to determine whether or not it survives. Take notes on the length of time it persists and any other variables that might have contributed to its condition such as location, floral resource availability, etc.

Nesting Season - Daily Visual Sweeps

The Designated Biologist shall conduct daily visual sweeps of the Project Area for Covered Species at the start of daily work and throughout the daily workday. The Designated Biologist shall intermittently repeat visual sweeps throughout the daily work window because the Covered Species is unlikely to be active before the start of daily Covered Activities that initiate prior to 8:00 AM. After initial vegetation clearing has been completed, the frequency of daily visual sweeps may be modified after Permittee consults with and obtains written approval from CDFW.

Vegetation Management

Permittee shall remove vegetation either before plants have bloomed or after they have stopped blooming outside of the Colony Active Period, Gyne Flight Period, and the Queen Flight Period. Disturbance or removal of vegetation shall be kept to the minimum necessary to complete Covered Activities. If vegetation will be removed during the Colony Active Period, the Permittee shall alternate vegetation removal and leave areas of refugia. Vegetation marked for protection may only be trimmed with hand tools to the extent necessary to gain access to work

sites. Permittee shall set mower blade heights no lower than 12 inches, unless otherwise approved by CDFW in writing.

Pesticide Use

Permittee shall not use pesticides such as herbicides, insecticides, or rodenticides within the Project Area. If pesticides must be used, including for habitat restoration and enhancement, Permittee shall consult with CDFW and may only use pesticides upon CDFW's written approval.

Pesticide Use Plan

If pesticide use is approved by CDFW, Permittee shall submit to CDFW for its review and approval a Pesticide Use Plan to Avoid and Minimize Impacts to Covered Species (Pesticide Use Plan). The Pesticide Use Plan shall describe best management practices to avoid and minimize adverse effects of pesticide use on individuals of the Covered Species and Covered Species habitat adjacent to the Project Area. Permittee shall incorporate the following (at a minimum) into the Pesticide Use Plan: (1) follow best management practices described by Xerces Society's Guidance to Protect Habitat from Pesticide Contamination, California Department of Pesticide Regulation, and the University of California's Division of Agriculture and Natural Resources Statewide Integrated Pest Management Program's Best Management Practices to protect bees from pesticides; (2) avoid mixtures with adjuvants containing alkylphenol ethoxylates, (3) avoid use of soil fumigants, which penetrate the soil and can poison ground nesting bees; (4) avoid spraying herbicides, especially on plants that are in bloom to minimize direct or indirect contact the Covered Species; (5) use targeted methods only; (6) pesticide application shall be conducted when the Covered Species is overwintering (i.e., outside of the Colony Active Period) to the maximum extent practicable; (7) avoid the use of pesticides marked with the U.S. Environmental Protection Agency's bee hazard icon; and (8) preferentially use chemicals that are rated green/III in the University of California Integrated Pest Management Bee Precaution Database and chemicals of the least toxic products at the least concentrated application when possible.

Onsite Restoration or landscaping

Within 30 days of initiating Covered Activities, the Permittee shall submit to CDFW for approval all landscaping plans for the identified onsite restoration. The onsite restoration shall be planted with native species and incorporate the Covered Species preferred host plants as appropriate to the Project Site. Permittee shall ensure the area is planted with a diversity of flowering plant species (herbaceous, shrubs, and trees), ideally incorporating a minimum of three flowering plant species per season (spring, summer, and fall) with overlapping bloom periods. For resources on California native plant bloom periods visit Calflora.

Appendix B: Example Measures for Timberland Conservation and Fire Resiliency Projects

Timber harvesting and wildfire resiliency activities involve vegetation and ground disturbance which have the potential to impact the candidate bumble bee species through take and temporary and/or permanent impacts to the species' habitat. Timber harvesting activities (e.g., felling and harvest of trees, preparing the ground for planting of seedlings, pre-commercial thinning, fuel reduction, related road construction and maintenance, etc.) are seasonal operations intended to achieve the goals of a timber harvesting plan. Wildfire resiliency activities (e.g., fuel reduction, postfire restoration including planting of seedlings, fuel/fire breaks, prescribed fire, etc.) are conducted to increase the resistance or resilience of forests and other fire-prone landscapes to wildfire, or to recover an area after a wildfire has occurred. Project-related activities involving ground or vegetation-disturbance could result in a loss of foraging resources; changes in foraging behavior; loss of nesting habitat; nest abandonment; reduced nest success; reduced health and vigor; or direct mortality of candidate bumble bees.

Some timber harvesting and wildfire resiliency activities can also result in positive impacts to the candidate bumble bee species, particularly if protection and conservation measures are incorporated into planning and management efforts from the start. Potential project-related benefits include increasing the resistance or resilience of bumble bee habitat to large patches of high severity wildfire and increasing floral resources by reducing canopy cover or competition from trees or shrubs in the project area. Additionally, vegetation management activities can restore and prevent the degradation or loss of grassland and herbaceous plant communities that provide important foraging habitat (The Xerces Society 2018*b*). In particular, prescribed fire can prevent the encroachment of invasive species and shrubland or forested communities into these important grassland and herbaceous plant communities (The Xerces Society 2018*b*).

This appendix is non-regulatory. Nothing in this appendix should be interpreted as an order or mandatory standard for environmental review or permitting. This information is intended to assist CDFW staff, project proponents, and consultants in conserving these species. While this appendix provides examples for avoiding or minimizing project-related impacts, practical applications must be based on the best available scientific information and project- and site-specific conditions If project proponents believe their project may result in incidental take, CDFW recommends contacting the appropriate CDFW regional office in which the project will occur to discuss specific project-related concerns and options to comply with CESA, if necessary based on proposed project activities.

Though the general measures found elsewhere in this document should be considered as appropriate, this appendix includes additional considerations and example measures for timber harvesting and wildfire resiliency activities for informational purposes only. The measures in this appendix should not be interpreted as having any determinative or binding effect on future avoidance or minimization measures, mitigation recommendations, or permit requirements

from CDFW. These example measures will be modified as necessary on a site- and project-specific basis.

Example Avoidance and Minimization Measures

Vegetation Management (Timber Harvesting and Wildfire Resiliency Activities):

During the Colony Active Period:

- The qualified biologist should survey for candidate bumble bees and delineate potential foraging and/or nesting habitat by looking for available floral resources and evidence of abandoned rodent burrows. To the extent feasible, the project proponent should limit foot- and equipment-traffic within the delineated foraging and nesting habitat boundaries to avoid damaging potential nests (e.g., crushing and entombing).
- Within the delineated potential foraging and/or nesting habitat, the project proponent should limit vegetation management activities to hand thinning, mechanical thinning that will not result in ground disturbance, or prescribed burns outside of the Colony Active Season. If limiting vegetation management activities in this way is not feasible, the qualified biologist or a biological monitor should be on-site for all vegetation and ground disturbing activities to avoid and minimize impacts to any candidate bumble bees and nests within the project site.
- Vegetation and ground disturbing activities in potential foraging and/or nesting habitat should occur during the day, when it will be more likely for the biological monitor and qualified biologist to observe bumble bee activity and avoid take of a bumble bee nest. If bumble bee activity is observed that indicates a nest may be present in the active work area, all vegetation and ground disturbing activities should cease until the qualified biologist is able to determine if a nest is present. If a nest is identified that has not yet been disturbed (i.e., physical damage to the nest), the qualified biologist should establish no disturbance buffer zone around the nest. Once the buffer is established, project activities may continue outside of the buffer zone. If a nest is identified that has been disturbed, the qualified biologist should notify CDFW immediately; further coordination will be required to avoid or mitigate impacts. If no nests are identified, project activities may continue.
- For linear vegetation management projects (e.g., utility rights-of-way, safe road corridors, fire, or fuel breaks), if vegetation management activities that reduce floral resources must occur during the Colony Active Period, consider the scale of the area being treated relative to the area of available floral resources and foraging habitat outside of the treatment area. If there is little suitable foraging habitat outside of the treatment area, consider a phased approach to vegetation management that prioritizes removal of non-flowering vegetation first, to ensure that bees have adequate access to nectar and pollen throughout the Colony Active Period.

Broadcast or Relocation of Chipped Material:

- The qualified biologist should delineate potential foraging and/or nesting habitat prior to the project proponent disposing of chipped vegetation to avoid covering up potential nests and floral resources. If chipped material cannot be disposed offsite, the project

proponent should broadcast chipped material outside of the delineated habitat boundaries, to the extent feasible.

Slash and Woody Debris:

- The qualified biologist should delineate potential foraging and/or nesting habitat (other than brush piles). The project proponent should create slash piles outside of the foraging and/or nesting habitat boundaries if feasible, to avoid impacts to potential nests during burning (if burning of slash piles may occur during the Colony Active Period). Slash piles should be surveyed for active nests before burning if conducted outside the overwintering period.

Prescribed Burning (Including Pile and Broadcast Burn):

- To the extent feasible, perform prescribed burning outside of the Colony Active Period during the late fall and winter. The timing of the project activities should be determined on a project-by-project basis.
- If prescribed burning cannot occur outside of the Colony Active Period, carefully inspect slash piles prior to application of accelerant or burning, to ensure there are no bumble bee nests present as they have been known to nest under slash piles. If a bumble bee nest is identified during this inspection, the qualified biologist should establish a no disturbance buffer zone around the nest. Once the buffer is established, project activities (including burning of slash piles that have been inspected and have no bumble bee nests present) may continue outside of the buffer zone. The no-disturbance buffer should remain in place until the nest has senesced.
- Consider seeding with locally native floral resources with early, mid, and late blooming species if feasible, and in the cleared post-burn area.

Chemical Use:

Herbicides:

- For site preparation and herbicide use to reduce competing vegetation, limit herbicide application to the minimum cleared radii needed to effectively treat around saplings. Studies presented in “Reforestation Practices for Conifers in California” (Stewart 2020) have shown the minimum effective radius to be 5 feet. Avoid application of herbicides to flowering plants during their bloom period.

Fire retardants:

- Within potential and confirmed habitat for the candidate bumble bee species, long-term application of fire retardants should be limited to what is necessary to achieve fire safety standards and other approaches to achieving fire safety standards should be prioritized over long-term application of fire retardants.

Considerations for Implementing Timber Harvesting and Wildfire Resiliency Projects to Benefit Candidate Bumble Bee Species

- Focus vegetation management on invasive and non-native plants that do not provide floral resources. If flowering invasive plants need to be managed, remove them before they bloom or treat them in phases to avoid removal of all floral resources at the same time. If additional vegetation management needs to occur to meet fuel reduction or other goals, consider retaining native plant species that provide floral resources and are more fire resistant or result in less competition for growing saplings.
- In areas that require frequent vegetation management to meet fire safety standards (e.g., utility rights-of-way, safe road corridors, fire or fuel breaks, defensible space), if feasible, consider planting or seeding with locally native plant species that can achieve fire safety standards with minimal or no vegetation management, while also providing early, mid, and late blooming floral resources for the candidate bumble bee species.

Installation of a firebreak

- To the extent feasible, limit installation of firebreaks to areas that are already disturbed (e.g., existing temporary or permanent roads).
- Consider installing planted firebreaks with low maintenance and fire-resistant vegetation instead of installing disked, bare ground, or non-flammable material firebreaks.

Vegetated firebreaks and fuel breaks

- Consider planting grasses and herbaceous plants that can easily be maintained with hand thinning, mechanical thinning that does not require ground disturbance, or prescribed burning. Prioritize planting of native plants that will provide floral resources for the candidate bumble bee species throughout the Colony Active Period.

Salvage logging after disturbance event (e.g., fire, windthrow, flood)

- When conducting salvage logging activities, consider promoting heterogeneity of habitat by leaving some areas untreated. To the extent feasible, consider conducting salvage logging in the winter or choose methods for salvage logging that limit ground disturbance to reduce impacts to ground nesting bumble bees, and to reduce impacts to floral resources.

Appendix C: Permitting for Candidate Bumble Bee Surveys

The take or possession of state listed threatened, endangered, or candidate species is prohibited by CESA (Fish & G. Code, § 2080). CDFW may issue permits authorizing the take or possession of these species under certain circumstances, such as for scientific, educational, or management purposes .If take authorization is needed for activities other than surveys and that take would be incidental to an otherwise lawful activity, see CDFW's CESA internet page for permitting options.

Individuals or agencies conducting candidate bumble bee surveys where take could occur through net and capture techniques are required to obtain a Memorandum of Understanding (MOU) to handle the bees, and depending on the project type and geographic location and/or habitat, a Scientific Collecting Permit (SCP) for California's terrestrial and vernal pool invertebrates of conservation priority list may also be required (see Figure 15 below for the Permitting Flowchart). Early consultation with CDFW is recommended and the types of permits required will be determined on a project-by-project basis. Contact the relevant CDFW Regional Office for early consultation.

Relevant CDFW Issued Authorizations

Memorandum of Understanding (MOU)

Authorization through an MOU is required to import, export, take, or possess Western, Crotch's, Franklin's, and Suckely's cuckoo bumble bee for scientific, educational, or management purposes. MOUs may be issued to individuals, public agencies, universities, zoological gardens, and scientific or educational institutions. The following should be submitted when applying for an MOU to facilitate permit issuance: a cover letter from the Principal Investigator with the request, resume or curriculum vitae and a statement of qualifications, letters of recommendations, scientific research proposal, title of research proposal, title of the research and the Principal Investigator's contact information, introduction (background and justification), study area, methods and procedures, schedule of work, literature citations, list of authorized individuals, and copies of all other permits (or permit applications) related to the project. MOU authorizations do not require an application fee. In certain cases, an SCP may be required in conjunction with the issuance of an MOU.

Website: Wildlife Branch Research Permitting
Application Procedure: Contact the Wildlife Branch, WildlifeResearchPermits@wildlife.ca.gov
Code Reference: Fish & G. Code § 2081 subd. (a)

Scientific Collecting Permit (SCP)

Authorization through an SCP is required for scientific, educational, and/or propagation activities for any invertebrate listed on the California Terrestrial and Vernal Pool Invertebrates of Conservation Priority List (TVPICP) which can be found on CDFW's Scientific Collecting Permits web page . Although they are on the current version of the TVPICP list (only periodically updated), because of their CESA status, a 2081(a) MOU is required for activities involving take

of *B. crotchii*, *B. franklini*, *B. occidentalis*, and *B. suckleyi.* In some cases, both an SCP and MOU may be required if scientific, educational, or propagation activities could also impact TVPICP bumble bees (*B. morrisoni* and *B. caliginosus*). SCPs can be issued to entities or individuals; there are general and specific use permits that are applicable to different circumstances (see the Terrestrial Invertebrate Flow Chart for more information about which permits are required given the species that could be affected and the proposed methods). SCP authorizations require submittal of an application and fee.

Website: Scientific Collecting Permits
Application Procedure: Apply through the CDFW Scientific Collecting Permit Portal
Code Reference: Cal. Code Regs., tit. 14, §§ 650 and 703, Fish & G. Code § 1002, 1002.5, and 1003

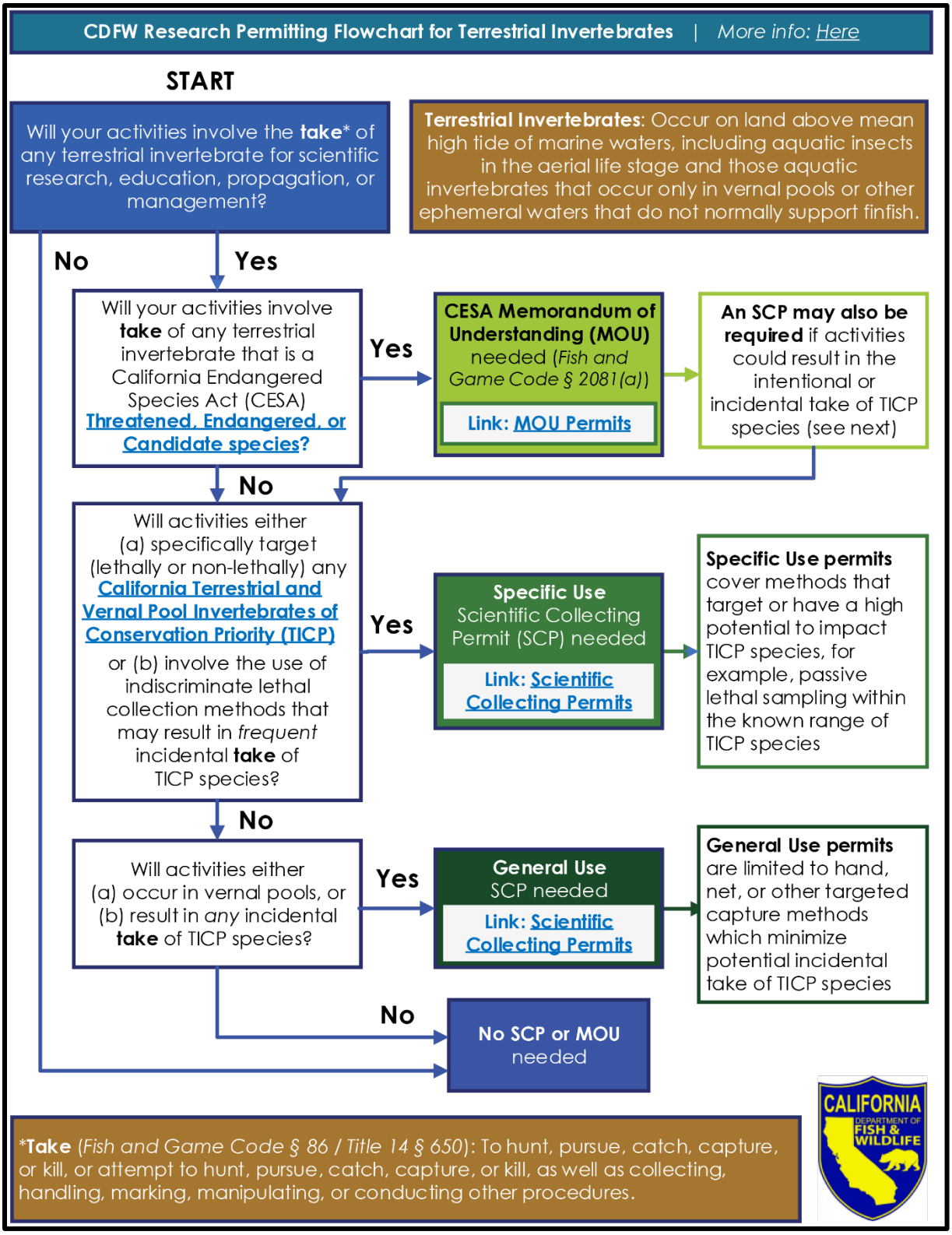

Figure 15: Permitting flowchart for terrestrial invertebrates