U.S. Department of the Interior
Bureau of Land Management

Strategic Plan for Pollinator Conservation

June 2022

Cover photo: Monarch butterfly *(Danaus plexippus)* by Tom Koerner, U.S. Fish and Wildlife Service

Floral Requirements photo on page 6: A monarch butterfly *(Danaus plexippus)*, honey bee *(Apis mellifera)*, and alfalfa leafcutter bee *(Megachile rotundata)* gather nectar from a showy milkweed. Photo by the Natural Resources Conservation Service

Nesting, Roosting, and Overwintering Requirements photos on page 6:
Fairy bee *(Perdita* sp.*)* by Patrick Alexander, BLM
Soft-winged flower beetle *(Listrus* sp.*)* by Patrick Alexander, BLM
Bee fly *(Exoprosopa* sp.*)* by Patrick Alexander, BLM
Dotted checkerspot butterfly *(Poladryas minuta)* by Patrick Alexander, BLM
Costa's hummingbird *(Calypte costae)* by Rick Fridell
Mexican long-tongued bat *(Choeronycteris mexicana)* by J. Scott Altenbach, Bat Conservation International

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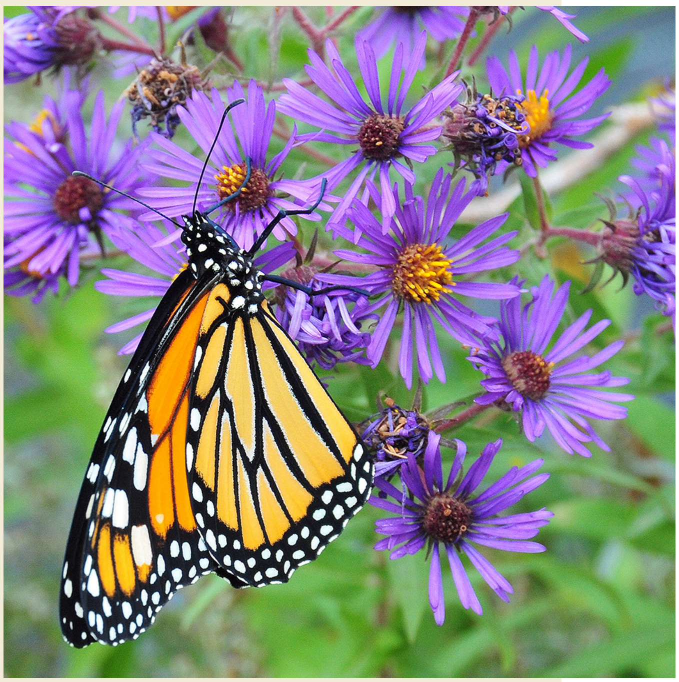

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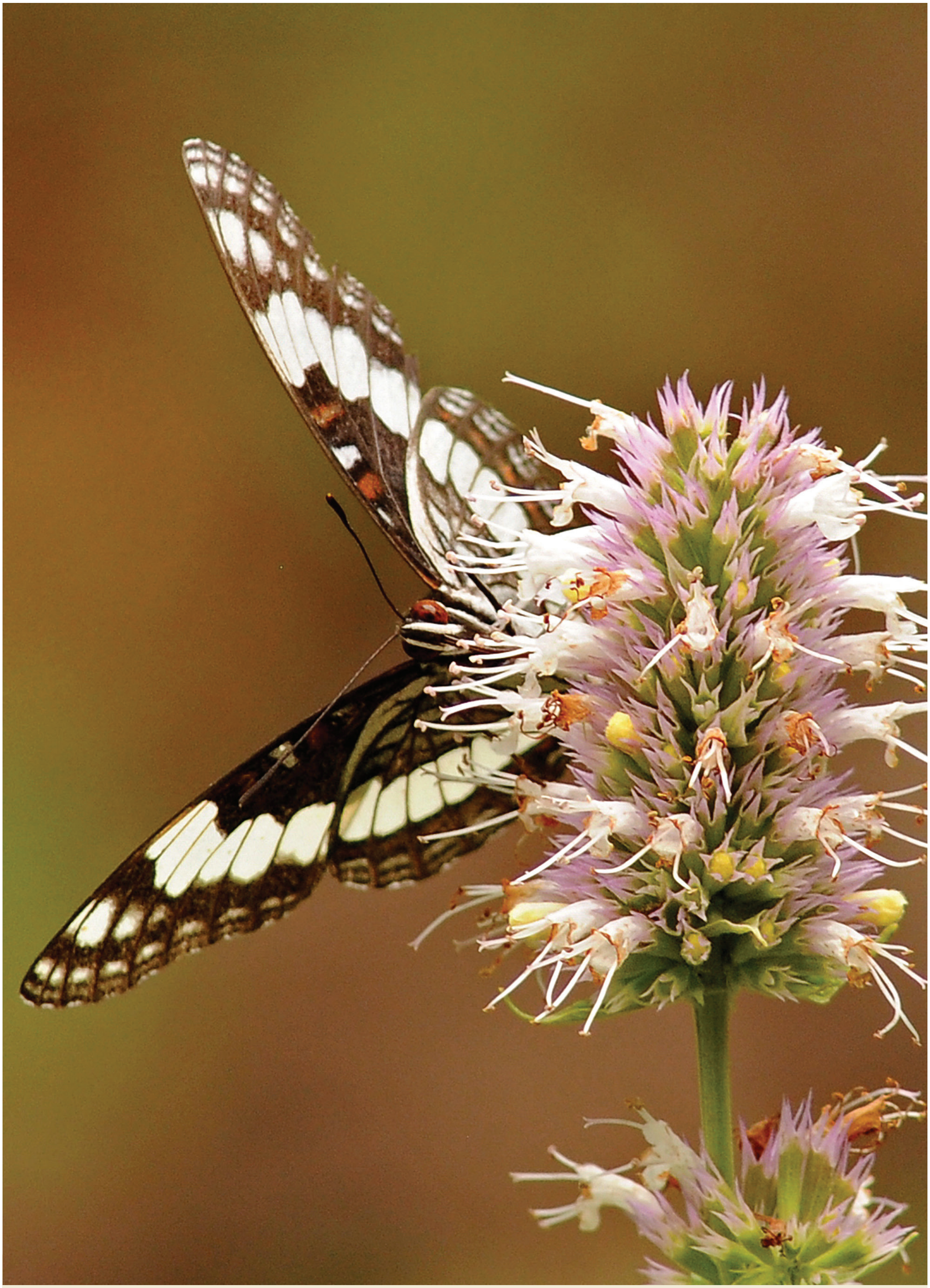


Weidemeyer's admiral butterfly *(Limenitis weidemeyerii)* by Rick Fridell

Contents

Executive Summary

The Bureau of Land Management (BLM) administers more surface land, approximately 245 million acres (one-tenth of America's land base), than any federal agency in the United States. In accordance with the Federal Land Policy and Management Act (FLPMA) of 1976, the BLM manages public lands under the principles of multiple use and sustained yield. This "Strategic Plan for Pollinator Conservation" (strategy) is intended to increase pollinator conservation efforts on BLM-managed lands by providing direction for agency commitment of resources for pollinator species and their habitats. This strategy is consistent with and supports FLPMA by directing the sustainable use and protection of ecological and environmental values for future generations (FLPMA, section 102(a)(8); BLM Handbook H-1601-1, "Land Use Planning Handbook"). This strategy also supports the America the Beautiful Initiative and "Department of the Interior Climate Action Plan 2021" to conserve lands and biodiversity.

Most of the world's flowering plants and crops depend on pollinators. Pollinators are essential for healthy, biodiverse ecosystems across public and private lands. Several threats exist that impact pollinator habitats, diversity, health, population viability, and abundance. Threats on BLM-managed lands include habitat loss and fragmentation from land development activities such as energy development, mining, fences, and rights-of-way including transmission lines and roads. Threats to pollinators also include habitat degradation from factors such as nonnative or invasive plant and animal species (e.g., honey bees, cheatgrass), ungulate grazing, artificial lighting at night, increased wildfire frequency and intensity, and climate change. Habitat loss, fragmentation, and degradation can result in the loss of flower resources, pollinator nesting and overwintering sites, as well as disruptions in migratory movements.

Successfully conserving pollinators on public lands requires understanding their habitat needs and current conditions, life-history trends, and population ecology. Developing applied science and tools that support BLM needs, adapting BLM business practices, implementing proactive conservation efforts, and effectively coordinating with federal, state, tribal, university, and nonprofit organization partners is a first step in pollinator conservation. This strategy outlines five overarching goals:

1. Inventory BLM-managed lands and identify management needs for pollinators.
2. Implement proactive efforts to conserve and restore pollinator habitats.
3. Improve BLM business practices, policies, and planning for pollinator conservation.
4. Increase science support tools and information for pollinator species and habitat management.
5. Increase communication and collaboration internally and with BLM partners.

Through the achievement of strategic goals, objectives, and actions, this strategy supports the ongoing need to identify and implement conservation actions that will improve overall pollinator habitats, diversity, health, population viability, and abundance. Strategic, proactive, and adaptive BLM efforts in support of pollinators will enhance, restore, and conserve pollinator habitats to meet BLM multiple use and sustainable yield responsibilities. These efforts will also enhance communication, collaboration, and partnerships by outlining goals, objectives, and actions for pollinator conservation on BLM-managed lands.

1.0 Introduction

1.1 Background

The Bureau of Land Management (BLM) is responsible for managing approximately 245 million acres of public lands mostly in the Western United States and approximately 710 million acres of subsurface mineral estate nationwide. The mission of the BLM is to sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations. In accordance with the Federal Land Policy and Management Act (FLPMA) of 1976, the BLM manages public lands under the principles of multiple use and sustained yield. FLPMA requires that "the public lands be managed in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values…" (section 102(a)(8)).

Because pollinators are essential for healthy, biodiverse ecosystems, the conservation of pollinators and their habitats are a priority for the BLM. Pollinators are essential for crop production and sustaining native ecosystems. They play an integral role in the survival of other plants and animals. Pollinators are responsible for most flowering plant reproduction and the maintenance of genetic diversity, and those plants provide food and shelter for numerous wildlife species (NRC 2007; Gilbert and Vaughan 2011; Harmon et al. 2011; Ollerton et al. 2011). Pollinators are thus essential for maintaining biodiversity and ensuring sustainability of most life forms on BLM lands. Creating and maintaining pollinator habitat (e.g., flowering plants) also helps purify water, prevents soil erosion, and filters the air. Pollinators also improve aesthetics for the millions of recreationists that use public lands, by ensuring diverse, healthy vegetation communities and bird, butterfly, and bat viewing opportunities (NRC 2007).

In 2014, the Pollinator Health Task Force was created by Presidential Memorandum, involving numerous federal agencies including the Department of the Interior (DOI). The primary function of this task force was the development of a national pollinator strategy. Specific to DOI, the 2014 Presidential Memorandum committed the department to (1) develop best management practices to enhance pollinator habitat on federal lands; (2) establish a reserve of native seed mixes, including pollinator-friendly plants, for use on postfire rehabilitation projects and other restoration activities; and (3) assist state wildlife organizations in conserving pollinators through implementation of State Wildlife Action Plans.

In May of 2015, the Pollinator Health Task Force released the "National Strategy to Promote the Health of Honey Bees and Other Pollinators," hereafter referred to as the White House strategy. The goals of the White House strategy are to: (1) reduce honey bee colony losses during winter (overwintering mortality); (2) increase the Eastern population of the monarch butterfly; and (3) restore or enhance 7 million acres of land for pollinators over the next 5 years through federal actions and public-private partnerships.

Included as an appendix to the 2015 White House strategy is the DOI Pollinator Protection Plan. The DOI Pollinator Protection Plan commits that the BLM will take steps to increase the extent and quality of pollinator habitat through specific actions including the use of pollinator-friendly native plants in restoration efforts; identify pollinator-friendly native plant species by ecoregion; and establish a reserve of native seeds (e.g., including seed collection and storage).

BLM biologist Cristina Dressel examines a butterfly caught at the BioBlitz. Photo by Chaney Swiney

Also in 2015, in response to the 2014 Presidential Memorandum, the U.S. Department of Agriculture and DOI developed the "Pollinator Friendly Best Management Practices for Federal Lands." This document provides a range of best management practices that consider quality of foraging habitat; identification of important pollinator reproduction, nesting, and overwintering sites; pollination of at-risk plant species; removal of invasive species to improve pollinator habitat; using genetically appropriate (i.e., locally adapted) natives seeds; adaptive management; and public outreach.

In 2015, the Plant Conservation Alliance, chaired by the BLM, developed the "National Seed Strategy for Rehabilitation and Restoration" (national seed strategy). The national seed strategy focuses agency efforts toward improving ecological conditions through reclamation and restoration using native seed and other plant materials (e.g., seedlings and container stock). Successful implementation of the national seed strategy is essential for the conservation of pollinators due to their reliance on native plant populations. The BLM is also committed to implementing the national seed strategy by working with the Seeds of Success Program, BLM ecoregional native plant materials development programs, and National Seed Warehouse System to collect and increase the availability of species that are important for pollinators.

Direction for BLM implementation of the White House strategy was originally provided by Instructional Memorandum 2016-013, "Managing for Pollinators on Public Lands." Direction in this instruction memorandum commits the BLM to several actions to implement the DOI Pollinator Protection Plan and other conservation efforts. Commitments include the integration of pollinator-friendly native plant species into habitat restoration, postfire rehabilitation and stabilization seedings, fuel treatments, and other projects that use seeds or seedlings. The long-term goal is to provide a suite of early-blooming to late-blooming flowering plants to ensure floral resource availability for pollinators throughout the growing season. Although this instruction memorandum is expired, many of its recommendations remain relevant and are incorporated in this strategy.

Federal laws and BLM policies complement pollinator conservation efforts. FLPMA directs the protection of ecological values, preservation of certain lands in their natural condition, and management of fish and wildlife as one of six "principal or major uses" of public lands (FLPMA, section 103(l)). In addition, many pollinator species are in decline and are included in BLM special status species lists as sensitive, threatened, endangered, or under review by the U.S. Fish and Wildlife Service (USFWS) for increased protection under the Endangered Species Act (ESA) of 1973, as amended. Section 7(a)(1) of the ESA provides direction to all federal agencies to utilize their authorities and carry out programs for the conservation of threatened and endangered species. BLM Manual 6840, "Special Status Species Management," directs the BLM to manage BLM sensitive species (including pollinator species) and their habitats to minimize or eliminate threats and improve the condition of species' habitats. BLM Manual 1740, "Renewable Resource Improvements and Treatments," and BLM Handbook 1740-2, "Integrated Vegetation Management Handbook," provide policy and direction for maintaining and restoring native plant communities that protect diversity, resiliency, and productivity to assist with maintenance, enhancement, and restoration of pollinator habitats on BLM-managed lands. All other laws and policies guiding pollinator management are listed in section 6.0 of this strategy.

1.2 Purpose and Need

The purpose of this strategy is to build upon existing directives and promote necessary proactive efforts to conserve, enhance, and restore important pollinator habitats and populations across BLM-managed lands. The BLM administers more surface land than any other federal agency in the United States. This widespread land base provides substantive opportunities for the BLM to support and facilitate the long-term conservation of pollinators through proactive habitat management decisions. For example, BLM-managed lands in the Southwest are the epicenter of native bee species richness and abundance in North America (Orr et al. 2021) and provide important habitats for many other pollinator species (USFWS 2018a; USFWS 2018b; Alexander et al. 2020).

Pollinators provide ecosystem services (e.g., the contributions of pollinators to plant reproduction and ecosystem health) of significant ecological and economic importance (Gilbert and Vaughan 2011; Harmon et al. 2011). Pollinators are vital for agriculture production—pollinator-dependent crops account for up to one-third of total U.S. food consumption (NRC 2007; Hellerstein et al. 2017).

More specific to BLM-managed lands and other natural landscapes, pollinators play a critical role in maintaining ecosystem composition, structure, and function. Up to 80 percent of the world's flowering plants use pollinators to reproduce (Gilbert and Vaughan 2011; Harmon et al. 2011; Ollerton et al. 2011), and about half of these species rely on pollinators for most or all their seed production (Rodger et al. 2021). A strong diversity of pollinators is important for maintaining ecosystem sustainability (Fontaine et al. 2006; Ebeling et al. 2008; NRC 2017; Ramos-Jiliberto et al. 2020; Rodger et al. 2021). Without pollinators, plant species diversity will decline, causing reductions in food and shelter resources for numerous wildlife species (Fontaine et al. 2006). Many flowering plant species reproduce exclusively through pollination or depend on pollinators to reach maximum reproductive potential (Hooks and Espíndola 2020). Pollinators (e.g., insects) themselves provide an important food source for many wildlife species (Harmon et al. 2011). Pollinator and plant diversity helps create healthy and vibrant habitats for recreational opportunities including hiking, wildlife viewing, birdwatching, and hunting (NRC 2007; Harmon et al. 2011).

Pollinator species have declined worldwide (NRC 2007; Cameron et al. 2011; Koh et al. 2016; Hallmann et al. 2017; Cardoso et al. 2020; Forister et al. 2021; Wagner et al. 2021). The extent is not well understood due to a lack of systematic monitoring of most species (Vanbergen 2013). More than 70 pollinator species are protected as threatened or endangered under the ESA (USFWS 2021a). Listed species include 12 bat species in the conterminous U.S., Hawaii, and territories (USFWS 2021b). Nine species of honeycreepers or honeyeaters in Hawaii are listed (USFWS 2021a); hummingbird species are declining (English et al. 2021a); and several insect pollinators are being reviewed by the USFWS for protection under the ESA. For example, in 2016, the USFWS initiated a status review of the western bumble bee, potentially affecting 15 western states. The rusty patched bumble bee was listed as endangered in 2017; the western monarch butterfly was determined to be warranted for listing in 2020; and in 2021, the USFWS initiated a review for Suckley's bumble bee. In addition, the BLM has identified 62 butterflies or moths and 17 bees as BLM sensitive species, with more likely to be included as sensitive species as updates continue. As of 2015, State Wildlife Actions Plans included 143 pollinator taxa as species of greatest conservation need (Mawdsley and Humpert 2016).

Overall, this strategic plan supports pollinator conservation by identifying and directing implementation of conservation actions that will improve overall pollinator habitats, diversity, health, population viability, and abundance. As a federal land management agency and public resource steward, the BLM faces increasing responsibilities to be proactive, productive, and accountable to the public, local communities, and policy makers. Strategic, proactive, and adaptive BLM efforts in support of pollinators will enhance, restore, and conserve pollinator habitats to meet BLM multiple use and sustainable yield responsibilities. These efforts will also enhance communication, collaboration, and partnerships by outlining goals, objectives, and actions for pollinator conservation on BLM-managed lands.

Cactus bee (*Diadasia* sp.) by Rick Fridell

2.0 Pollinators and Their Habitat Requirements

2.1 The Pollinators

Pollination is the movement of pollen within or between flowers to allow fertilization and seed production. North American pollinators include species of bats, birds, butterflies, moths, flies, beetles, ants, and bees (Hopwood et al. 2015). Many of these species have specialized host plants and adaptations to take advantage of floral resources (Van der Niet et al. 2014). Diversity of pollinator species is therefore important for increasing seed set and decreasing pollen limitation in plant species (Robertson et al. 2021).

Most pollinators are insects (Hopwood et al. 2015; Hopwood et al. 2016). The number of native insect pollinator species in North America is estimated at 4,000 bees (Winfree et al. 2007; Moisset and Buchmann 2011), 750 butterflies (Smithsonian 2021a), 12,000 moths (Smithsonian 2021b), 900 flower flies (Shepherd and Hoffman Black 2021), and likely thousands of other fly, wasp, beetle, and ant species. Native bees are the most important group of pollinators in temperate climates due in part to their diversity and high pollination efficiency (Batra 1995; Moissett and Buchmann 2011; Winfree et al. 2007; Hopwood et al. 2016; Stein et al. 2020). Bee pollinator effectiveness is due to the hairs on their bodies that can carry pollen, as well as consistent and frequent flower visitation (Batra 1995; Moissett and Buchmann 2011). Nocturnal moths also represent an important insect pollinator for many plant species (MacGregor et al. 2015). Wasps appear to be an important pollinator for some species, including milkweeds, and flies are often important pollinators at high altitudes (Kephart 1983; Betz et al. 1992; Inouye 2020).

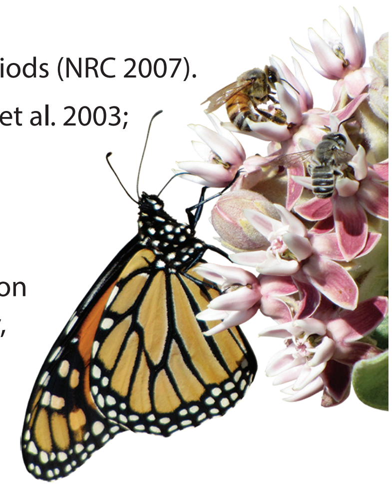
Three families of birds evolved as flower and pollinator specialists, including hummingbirds, sunbirds, and honeyeaters (Cronk and Ojeda 2008). Behaviors such as the ability to fly and forage at long distances, carry large pollen loads, and remain active in harsh climate conditions (e.g., deserts, alpine habitats) make birds important pollinators (Cronk and Ojeda 2008; Fleming et al. 2009). In North America, the primary pollinating bird species are hummingbirds (18 species in the U.S.), American orioles, and white-winged doves which are important pollinators of the saguaro cactus (NRC 2007; Cronk and Ojeda 2008).

At least 12 species of pollinating bats occur in North America and southern Mexico (Baker et al. 2003; NRC 2007). Three of these bats are well-known pollinators—the lesser long-nosed bat, Mexican long-nosed bat, and hog-nosed bat (NRC 2007). Many species of cacti, agave, and other desert plants rely heavily on bats for pollination and reproduction (NRC 2007). Bats forage and pollinate flowers that open at night, when many other pollinating insect and bird species are not active (NRC 2007).

2.2 Habitat Resource Requirements

The diversity of pollinator species and habitat types makes it difficult to provide specific conditions for all pollinator habitat needs. However, all pollinator species require higher densities and diversities of flowering plants across larger landscape scales for nectar or pollen foraging opportunities (Orford et al. 2016; Aguirre-Gutiérrez et al. 2015; Papanikolaou et al. 2017). Many species also require specific nesting, overwintering, or migratory resources. The following are general descriptions of optimal conditions within pollinator floral, nesting, roosting, and overwintering habitat that can be considered when developing conservation and restoration opportunities. Additional species-specific information may be obtained through the literature or additional research as needed.

Floral Requirements

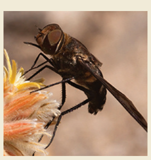


- Sites with high plant diversity, richness, and overlapping blooming periods (NRC 2007).
- Sites free of, or with low densities of, nonnative invasive plants (Levine et al. 2003; Vilà et al. 2011; Stout and Tiedeken 2017).
- Specific host plants for insect larvae (e.g., native milkweed species are important host plants for the monarch butterfly) (USDA 2015).
- Landscapes that are heterogeneous with a variety of different vegetation types and successional states[1] to support nesting, wintering, migratory, and stopover uses. Heterogeneous landscapes support higher species richness (Grime 1973; Tews et al. 2004; Fahrig et al. 2011; Odanaka and Rehan 2020) and may support higher diversity in bees (Coutinho et al. 2021) and other pollinators.

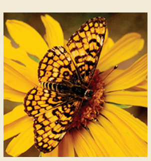
Nesting, Roosting, and Overwintering Requirements

- **Bees, wasps, and ants** (NRC 2007)
  - Substrates suitable for nesting areas, including bare ground (e.g., prairie dog towns provide open substrates), native bunchgrasses, soft woods, and pithy twigs.
  - Availability of nest sites, including underground cavities or burrows (e.g., beetle or rodent burrows), vertical cliffs, ditch banks, rodent nests, and sand dunes.
  - Availability of building materials, including mud, clay, sand, and debris.

- **Beetles** (NRC 2007)
  - Generally unknown but dependent on beetle species and plant distribution.



- **Flies** (NRC 2007)
  - Generally unknown but dependent on fly species and plant distribution.
  - Fly pollination appears dominant in small-flowered plant species that bloom under shade, in seasonally moist habitats, and often at high altitudes.



- **Butterflies and moths** (NRCS 2002; NRC 2007; Pelton et al. 2016; Malcolm 2018)
  - Larval host plants (species specific).
  - Open water and puddling areas.
  - Rock and log piles and other structures that provide cover.
  - For monarch butterflies, groves of trees with dappled sunlight, high humidity, fresh water, and an absence of freezing temperatures or high winds for overwintering.
  - Monarch butterflies in the West may use riparian corridors to move between overwintering sites, breeding, and foraging areas.

- **Hummingbirds** (NRC 2007; Alexander et al. 2020)
  - Trees and shrubs with horizontal, forked branches for nesting, perching, and foraging.
  - Building materials, including spider webs (silk), feathers, lichens, and fibers.
  - Riparian corridors for use as breeding habitat.

- **Bats** (NRC 2007; USFWS 2018a; USFWS 2018b)
  - Maternity and other communal roosting sites, including crevices, hollow trees, large caves, mines, and structures with limited human disturbance.
  - Sufficient stands of floral forage resources in proximity to day and night roosts.

[1] **Succession is the gradual replacement of one type of ecological community by another in the same area, involving a series of orderly changes, especially in the dominant vegetation.**

3.0 Threats to Pollinators and Habitats

Threats to pollinators include increasing habitat loss and fragmentation, climate change, expansion of invasive species (including nonnative honey bees), pesticides, and disease (Kearns et al. 1998; Potts et al. 2010; Cane and Tepedino 2017; Wagner et al. 2021). The combination, or synergy, between multiple threats compounds the negative effect of any single threat (Vanbergen 2013; Wagner et al. 2021).

3.1 Habitat Loss and Fragmentation

Habitat loss is the destruction of habitat to such an extent that it is no longer capable of supporting the species and ecological communities that naturally occur in that area. Habitat loss poses the greatest threat to species and biodiversity worldwide and is the leading cause of extinctions (Pimm and Raven 2000; Fahrig 2003).

Pollinators respond negatively and quickly to habitat loss, largely due to a loss of flower resources (Quesada et al. 2003; Winfree et al. 2007; Bommarco et al. 2014; Carman and Jenkins 2016; USFWS 2018a; USFWS 2018b; Alexander et al. 2020; Olynyk et al. 2021). However, the loss of other habitat components may also be important drivers. For example, the loss of monarch butterfly overwintering areas and hummingbird and bat migratory habitats due to human development, fire, and other disturbances may result in population declines (Ober et al. 2005; Pelton et al. 2016; USFWS 2018a; USFWS 2018b; Crone et al. 2019; Pelton et al. 2019; Alexander et al. 2020). Reductions in the density of flowering agave plants could increase competition for food resources and energy demands of the lesser long-nosed bat (Ober et al. 2005). Bee species that nest in above-ground cavities decrease with increasing habitat loss from land uses (Williams et al. 2010).

Habitat fragmentation is the breaking up of large patches of native vegetation into smaller and increasingly isolated patches that results in the loss of landscape continuity (Pickett and White 1985; Fahrig 2003; Calvillo et al. 2010). In smaller patches, the increase in edges makes plant and pollinator communities vulnerable to increased colonization by nonnative species, predation, lower pollinator abundance and biodiversity, higher risk of local pollinator extirpations, and lower pollination services as compared with larger habitat patches (Fahrig 2003; Franzén and Nilsson 2010; Abramson et al. 2011; Olynyk et al. 2021; Cohen et al. 2021). Many native bees are absent or less abundant in small, isolated habitat areas due to a lack of adequate pollen resources (Calvillo et al. 2010; Carrié et al. 2017; Delnevo et al. 2020). Allen's and Costa's hummingbirds require large, undisturbed stands of coastal scrub and chaparral for breeding habitat (Alexander et al. 2020). Habitat fragmentation in lesser long-nosed bat habitats has resulted in spatial isolation from food resources and inadequate pollination of cacti and agave flowers, making successful migration and reproduction more challenging (Healy 2007).

Field of lupine flowers. BLM-managed land in Idaho. Photo by Justin Welty, U.S. Geological Survey

Landscapes must also interconnect habitats to support plant-pollinator interactions, foraging capability, gene flow, and species richness (Steffan-Dewenter and Tscharntke 1999; Nabhan 2001; Goverde et al. 2002; NRC 2007; Steffan-Dewenter and Westphal 2008; Bommarco et al. 2010; Cumming et al. 2015; Carman and Jenkins 2016; Dickson et al. 2017; Carrié et al. 2017). Land use activities may reduce the availability of interconnected habitats with resulting effects to pollinator species. For example, many native bees with small body sizes have small foraging ranges, meaning that they may not be able to move between habitat patches to effectively pollinate many plant species (NRC 2007; Delnevo et al. 2020). Habitat fragmentation from facilities such as wind farms may negatively affect migratory movements of bats (Ellison 2012). Hummingbirds and other pollinators may lack sufficient nectar habitat "stepping stones" to sustain long distance and local migratory movements (Nabhan 2001; Burke et al. 2019).

Federal lands are important for habitat connectivity on a landscape level, and BLM-managed lands are particularly important due to topography, fewer hydrographic barriers to ecological flow, and large expanses of undeveloped areas offering connected habitats (Dickson et al. 2017). Approximately 1.5 million acres of natural areas were lost annually, across all ownerships, in the contiguous U.S. from 2001 to 2017 (Theobald et al. 2019). From 2001 to 2011, BLM-managed lands incurred habitat loss of approximately 2.3 percent (Theobald et al. 2016). On BLM-managed lands, habitat loss and fragmentation can occur from land development activities such as energy development (renewable and nonrenewable), mines and mineral material sites (e.g., sand, stone, gravel), rights-of-way (e.g., transmission lines, roads), and fences. Ongoing habitat loss and fragmentation are expected across the West due to increased energy demands (e.g., oil and gas, geothermal, wind, and solar sources) (Northrup and Wittemyer 2013). According to data from 2015 to 2020 in "Public Land Statistics," the BLM issues approximately 110,000 lands and minerals grants and rights-of-way each year, averaging more than 1.2 million acres annually (BLM 2021b). As such, management of development projects using methods that reduce impacts to pollinators and their habitat is imperative. The BLM is actively working to ensure existing and future projects, especially renewable energy development, avoid or minimize impacts to pollinators.

The BLM has substantial opportunities to positively reduce and restore habitat loss and fragmentation by identifying priority pollinator habitats and proactively conserving large geographic areas and habitat connectivity corridors. The BLM can achieve pollinator habitat protection through internal program collaboration in land use planning processes (e.g., areas of critical environmental concern, research natural areas), habitat protection through conservation easements or Land and Water Conservation Fund acquisitions, and developing proactive project design features. The BLM can foster partnerships with other land management agencies such as the U.S. Forest Service, National Park Service, and tribes to identify and protect priority habitats,



Left to right: A large column of smoke produced by the Archie Fire in Oregon; nonnative invasive annual grass in Nevada; and herbicide application in New Mexico.

such as connectivity corridors, for pollinators. Partnerships, such as with the National Fish and Wildlife Foundation, can help the BLM leverage additional funding opportunities focusing on habitat protection.

3.2 Habitat Degradation

Habitat degradation includes changes that diminish the capacity of the environment to provide food and shelter (habitat) for wildlife and plant species at the individual and population level. On BLM-managed lands, pollinator habitat degradation results from factors such as invasive species, ungulate grazing, artificial lighting at night, increased fire frequency (see section 3.3, Climate Change), and off-highway vehicle recreation (Knop et al. 2017; McKenna et al. 2001; Stout and Tiedeken 2017). Land development (e.g., mining, energy development, roads) can also cause habitat degradation and was discussed in section 3.1, Habitat Loss and Fragmentation.

3.2.1 Nonnative Species

The introduction, establishment, and spread of nonnative plant and animal species is widely recognized as one of the most serious threats to the health, sustainability, and productivity of native ecosystems (Holmes et al. 2009; Mack et al. 2000; Pyšek et al. 2012). Nonnative invasive species reduce biodiversity (Doherty et al. 2016; Powell et al. 2011), alter hydrologic conditions (Le Maitre et al. 2015) and soil characteristics (Klironomos 2002; Belnap and Phillips 2001), change fire intensity and frequency (Pyke et al. 2016), displace rare plant and animal species (Dangremond et al. 2010), serve as reservoirs for plant pathogens (Vilcinskas 2015), and replace complex communities with simple communities (Hobbs et al. 2006; Belnap and Phillips 2001; Pyke et al. 2016). Nonnative species can also directly or indirectly (i.e., through altered wildfire cycles) destroy wildlife habitat and forage availability (Coates et al. 2015).

3.2.1.1. Nonnative Invasive Plants

In some degraded ecosystems, nonnative invasive plants increase foraging opportunities for pollinators (NRC 2007; Drossart et al. 2017). However, more typically, nonnative invasive plants outcompete native plants or reduce pollinator habitat quality due to lower plant diversity (Levine et al. 2003; Vilà et al. 2011; Stout and Tiedeken 2017; Vanbergen et al. 2017). Nonnative invasive plant species also reduce pollinator visitation, pollen deposition, seed set, reproductive success, and diversity of native forbs (Aguirre-Gutiérrez et al. 2015; Bruckman and Campbell 2016; Orford et al. 2016; Papanikolaou et al. 2017). For example, the invasion of nonnative plants and postfire conversion of southwestern desert habitats into grasslands eliminates the diversity of native plant species that are important for pollinating birds and bat foraging and roosting sites (USFWS 2018a; USFWS 2018b; Alexander et al. 2020). Pollinating bees also have specific dietary sources and nutrient requirements only found where there are diverse floral resources (Vanbergen et al. 2017); therefore, decreases in floral composition due to nonnative invasive plants adversely affects native bees.

Left to right: Geothermal energy facility, wind turbines, and solar panels.

Western honey bee *(Apis mellifera)*

On BLM-managed lands, nonnative invasive plants are a major threat to the health of native plant and pollinator communities. Of the 245 million acres managed by the BLM, approximately one-third (79 million acres) are impacted by nonnative invasive plants (BLM 2016). Moreover, invasive plants are increasing across these lands. The estimated rate of the spread of invasive grasses on public lands is 4,300 acres per day, or 10 to 15 percent annually (BLM 2016). The percent of BLM-managed lands where invasive plants are abundant (greater than 25 percent of vegetation cover) has increased, from about 17 to 25 percent from 2011 to 2018 (BLM 2021a). The suppression of native forb diversity due to nonnative invasive species such as cheatgrass is most notable in the Great Basin and Mojave and Sonoran Deserts (Brenner and Kanda 2013; Brooks et al. 2016; Marshall et al. 2012; Underwood et al. 2019; Abella 2020), which comprise more than 53 percent of BLM-managed public lands outside of Alaska.

The ability to effectively control invasive grasses and other invasive plants is limited by the expansive extent of the invasion, a lack of effective controls tools, and limited funding and staffing levels. For example, the BLM annually treated an average of 315,000 acres of invasive plants using herbicides from 2006 to 2012 (BLM 2016). Given the acreage and extent of invasive species occurrences on BLM-managed lands, invasive species management is important for successful pollinator conservation efforts.

3.2.1.2. Honey Bees

Honey bees arrived in the New World following their intentional introduction in the 16th and17th centuries for honey and wax production (Pierce and Sutherland 2017; Texas A&M University 2006; Han et al. 2012). Today, their primary value is crop pollination (e.g., almonds and fruit trees, primarily in California) and honey production, which in large commercial orchards and agricultural fields is typically accomplished by migratory beekeepers. There are approximately 2.7 million commercial honey bee operations in the United States (USDA 2019).

Native plants and pollinators coexist in a symbiotic relationship that is essential to biodiversity and ecosystem function (NRC 2007). Although honey bees are effective pollinators of some plants, they can negatively impact native plants and plant communities by their inability to efficiently pollinate many species, including many rare plants. For example, approximately 15,000-20,000 species of flowering plants require "buzz pollination" which many species of bees, other than honey bees, conduct by contracting their flight muscles, producing strong vibrations that they direct onto the flower anther using their legs and mouth parts (De Luca and Vallejo-Martín 2013). In addition to affecting plant reproduction, honey bees are a potential threat to native plant populations, as they often preferentially forage on and thereby spread invasive plants (Butz Huryn and Moller 1995; Morales and Aizen 2002; Hanley and Goulson 2003).

In North America, there are about 4,000 species of native bees, the vast majority of which are solitary, not social. Alternatively, honey bee colonies act as "superorganisms" and are remarkably efficient at scouting, finding, and monitoring floral resources as far as 4-5 miles from their hive (Seeley 1995). As such, growing evidence shows that honey bees outcompete many native bees for finite pollen and nectar resources. For example, Cane and

Tepedino (2017) calculated that during a single summer, a 40-hive apiary (10,000-60,000 honey bees) residing on wildlands for 3 months collects pollen equivalent to what four million native bees would collect.

As of 2021, approximately 51 apiaries were permitted on BLM-managed lands in Idaho, according to the BLM Idaho State Office, and as of 2018, 32 apiary permits were in place in California. In accordance with DOI Departmental Manual, part 516, chapter 11, apiaries are often authorized by BLM realty staff using a categorical exclusion. The number of unauthorized apiaries on BLM-managed lands is unknown but is occurring in many states, likely at low numbers in most areas. Recent research outlines potential impacts to native pollinators, native vegetation, and ecological function, which may result in a need for an environmental assessment in some cases.

3.2.1.3 Nonnative Animals

Some nonnative animal species prey on pollinators. Monarch butterfly eggs and larvae are preyed upon by nonnative species such as European starlings, Eastern fox squirrels, European paper wasps, and fire ants (WAFWA 2019; Baker and Potter 2020). The European wasp has caused significant reductions in monarch population abundance (McGruddy et al. 2021), and the Eastern fox squirrel is a primary predator at monarch butterfly overwintering sites in California (WAFWA 2019). Nonnative praying mantises are released in gardens to control insect pests, and these large insects are known to prey on hummingbirds (Nyffeler et al. 2017). Information on the population impacts of these nonnative animal species to pollinators on BLM lands is not available.

3.2.2. Ungulate Grazing

Ungulate grazing is one of the main drivers of plant community structure and ecosystem function in arid and semiarid grassland ecosystems (Zheng et al. 2010; Wu et al. 2015; Eldridge et al. 2016). Yet, the interaction between grazing, pollinators, and plants is complex and not well understood (NRC 2007; Yoshihara et al. 2008). Although properly managed ungulate grazing can lead to increases in foraging opportunities for pollinators in some ecosystems (NRC 2007; Porensky et al. 2020), the long-term effects of improper grazing by ungulates, including wild horses and burros, is a significant cause of plant community degradation (Bai et al. 2012; Li et al. 2011). Negative consequences of improper grazing can include reductions in native plant diversity, changes in plant community composition, and overall loss of flowering plants, shrubs, and grasses (Herrero-Jáuregui and Oesterheld 2018; Souther et al. 2019).

The effects of grazing on pollinators are dependent on pollinator species and habitat types. Some bees do best in ungrazed grasslands/shrublands with higher levels of native flowering resources (Stein et al. 2020). However, the type of grazing system appears to have an influence on bee densities and abundances. For example, the bee genus *Halictus* is more associated with fall grazed pastures, and the genus *Bombus* is



Left to right: Wild horses trailing through the Swasey Herd Management Area in Utah (by Tom Flatch); domestic sheep grazing on public lands; and cattle at the Agua Fria National Monument in Arizona.

more associated with pastures that are rested or have low-intensity grazing (Blanchette 2019). Grazing can decrease milkweed and nectar plant availability, contributing to monarch butterfly declines (WAFWA 2019). Although grazing can affect nectivorous bat forage resources, such as agaves and saguaros, it does not appear to result in reduced occupancy or numbers of roosting lesser long-nosed bats (USFWS 2018a).

The BLM manages livestock grazing on 155 million acres of public lands, or 63 percent of BLM-managed lands. To achieve desired conditions on the public lands, the BLM uses rangeland health standards and guidelines. Rangeland health is defined as the degree to which the integrity of the soil, vegetation, water, and air, as well as the ecological processes of the rangeland ecosystem, are balanced and sustained (Pellant et al. 2020). The three attributes of rangeland health are soil/site stability, hydrologic function, and biotic integrity (Pellant et al. 2020). Biotic integrity is defined as the capacity of the biotic community (i.e., plants, animals, insects, and microorganisms) to support ecological processes of a site. Ecological processes functioning within a natural range of variability support specific plant and animal communities.

Recently analyzed rangeland health assessments show most BLM lands (79 to 86 percent) are functioning with none to slight or slight to moderate departure from reference conditions in terms of any of the three attributes (BLM 2021a). However, biotic integrity is declining in many ecoregions, which reduces the ability of associated plant and animal communities (including pollinators) to sustain ecological processes (Karl et al. 2016).

3.2.3. Altered Fire Regimes

On BLM-managed lands, one of the most significant causes of pollinator habitat degradation is related to changes in fire frequency and intensity that result in a profusion of nonnative invasive plant species (section 3.2.1.1, Nonnative Invasive Plants). For example, considerable evidence shows that fire frequency and intensity increased in the Great Basin because of a large expansion of invasive annual grasses (Brooks et al. 2004; Chambers et al. 2014). Areas with one to five percent cover of invasive grass in the Intermountain West are twice as likely to burn as lands with less than one percent cover of invasive grass (Bradley et al. 2017).

Fire is known to promote invasion by nonnative plant species because they are responsive to disturbance and benefit from the competition-free, nutrient-rich environments that often result from fire, particularly in wet years (Rao and Allen 2010; Steers and Allen 2011). Flammable nonnative invasive plant species can initiate a feed-back loop in which fire-promoted exotics further alter the fire regime to the detriment of native species (D'Antonio and Vitousek 1992; Brooks et al. 2004). Postfire seeding is an important management tool for increasing postfire diversity and increasing competition

Left to right: Tamarack Fire near the California and Nevada border (by Matt Smith); area with off-highway vehicle use; and nonnative invasive black henbane near the Kemmerer Field Office in Wyoming.

with nonnative species (Peppin et al. 2014). BLM postfire emergency stabilization and rehabilitation seedings are a critical tool for increasing native species diversity that supports healthy pollinator populations. The limited commercial availability of genetically appropriate (i.e., locally adapted) native seed, and in particular seed for species beneficial to pollinators, is an issue identified in the "National Seed Strategy for Rehabilitation and Restoration" and is currently being addressed through effective collaboration by the BLM Plant Conservation and Restoration Program and other interagency and nonfederal partners (PCA 2015; PCA 2021).

The effects of wildfire, in the absence of nonnative invasive plants, may have positive effects on pollinator diversity by increasing floral resources available to pollinators (Burkle et al. 2019; LaManna et al. 2021). For example, some hummingbird species in parts of the Western U.S. evolved with greater historical wildfire frequency and intensities and have adapted to take advantage of increases in early successional native forb species following fire (Alexander et al. 2020).

However, much of the western shrubland/grassland communities are now colonized by nonnative invasive annual grasses or nonnative perennial grass cultivars that alter fire regimes and interfere with postfire recovery by suppressing the persistence and recruitment of many native forbs (Beyers 2004; Fusco et al. 2019). Western shrubland and desert habitats that are invaded by nonnative plant species are often unsuitable for postfire establishment of columnar cacti and other food resources used by pollinating bats and some species of hummingbirds (USFWS 2018a; USFWS 2018b; Alexander et al. 2020).

According to BLM Public Land Statistics data, between 2011 and 2020, approximately 9.1 million acres of BLM-managed lands were burned by wildfires. Given the extent of wildfires across the West and the likely long-term effects of climate change (section 3.3, Climate Change), wildfires, along with invasive plant species expansion, are likely to continue to change habitats, by altering vegetation composition and ecosystem processes across the landscape.

3.2.4. Off-Highway Vehicle Recreation

Unauthorized cross-country off-highway vehicle (OHV) use adversely affects soils, watersheds, native plant communities, and wildlife habitat by decreasing plant species diversity, fragmenting habitat, reducing connectivity, and introducing edge effects (Ouren et al. 2007). Off-trail OHV use diminishes biodiversity by removing vegetation, suppressing plant growth, and facilitating colonization by nonnative species (Luckenbach and Bury 1983; Ouren et al. 2007). These effects may reduce pollinator forb diversity and habitat conditions in highly used areas. Arid ecosystems such as the Mojave Desert may be most susceptible to resource damage from cross-country travel because natural recovery can range from decades to centuries (Brooks and Lair 2005).

OHV recreation is an authorized use of public lands, unless specifically prohibited. In 2020, the BLM issued 725,098 recreation permits on public lands that included an estimated 159,104,000 permitted and nonpermitted (casual) recreation users (BLM 2021b). The vast majority of public land users stay on existing roads and trails; however, a small percentage (estimated to be less than five percent by BLM staff) travel cross country which is prohibited in some areas. Even though this is less than 8,000,000 users, it is important given the cumulative and lasting nature of disturbance, especially in arid environments. The BLM has completed travel management on approximately 20 percent of public lands. Completion of travel management plans on the remaining lands is a necessary step to specifically regulate cross-country travel in resource management plans that limit OHV activity to existing roads and trails.

In summary, habitat degradation occurs on BLM-managed lands due to many factors, including the introduction or persistence of nonnative species, ungulate grazing, altered fire regimes, and OHV recreation. Through this strategy, the BLM will proactively reduce impacts and restore habitats through planning processes and landscape-level conservation efforts. For example, the BLM can identify priority pollinator habitats, develop and implement vegetation treatments at a landscape level to promote resilient native plant/pollinator communities, substantially improve and use native seed sources for habitat restoration efforts, and reduce the prevalence of nonnative species.

3.3 Climate Change

Climate change can alter or disrupt plant-pollinator relationships and habitats (NRC 2007). Shifts in temperature and precipitation, concentrations of carbon dioxide (CO_2) and ozone, and ultraviolet light levels change plant and pollinator life cycles and distribution, affecting plant-pollinator interactions and community structure and resulting in extinctions (NRC 2007; Wagner 2020; Wagner et al. 2021). Climate change may be the most geographically pervasive of all threats to pollinators and the one most likely to cause cumulative interactions with other threats (Halsch et al. 2021; Wagner et al. 2021). For example, the combined stressors of habitat loss and climate change likely resulted in or contributed significantly to declines in numerous butterfly and moth species in Britain (NRC 2007; Fox et al. 2014).

Effects of climate change on pollinators are dependent on species, latitudinal and altitudinal distributions, habitat conditions, and the yet unknown ability of pollinators and plants to adapt synchronously (Inouye 2020; NRC 2007; Scaven and Rafferty 2013; Vanbergen 2013). Shifting distributions and changes in flowering and fruiting timing may affect the timing and extent of forage availability for pollinating bats and hummingbirds (Croonquist and Brooks 1991; USFWS 2018a; USFWS 2018b). Migrating pollinators (e.g., hummingbirds and bats) rely on corridors with flowers that bloom at the appropriate times to ensure metabolic replenishment during spring and fall migrations (NRC 2007). Shifts in seasonal temperature and precipitation patterns could result in reduced fruiting and seed set if pollinators and plants do not adapt to these changes synchronously (Kudo et al. 2004). In one study, significant differences in the phenology of plants and some bee species were detected in alpine regions during warmer than average years (Kudo 2014).

On BLM-managed public lands, 16 rapid ecoregional assessments (REAs) from 2010-2012 (BLM 2022), describe potential changes to public lands as a result of climate change. These assessments describe increases in monthly average minimum temperatures, decreases in snow water equivalent, and subsequent increases in invasive species and fire frequency. These changes can affect native plant communities. In some areas, native plants could remain stable, expand, and contract as the predicted climate changes. The REAs may provide BLM staff insight into how pollinator habitat may also respond to climate change.

A recent analysis of peer-reviewed literature, vegetation models, and BLM resource management plan (RMP) documents indicates a general lack of climate change management actions, directives, and science in most assessed BLM RMPs (Brice et al. 2020). To better address climate change effectively, the BLM can focus on incorporating best available climate change science into RMP and project planning documents, managing projected increases

Dagger fly *(Dolichocephala* sp.*)* by Derek Sikes, University of Alaska Fairbanks

in recreation and invasive species, restoring past disturbances, restoring habitats so they are more resilient to drought and wildfire, and increasing habitat connectivity.

3.4 Pesticides: Insecticides, Fungicides, and Herbicides

Pesticides are any substance or mixture of substances used to prevent, destroy, repel, or mitigate any pest, according to 7 U.S.C. 136. Many pesticides, including insecticides, fungicides, and herbicides are known to have adverse effects on a wide range of pollinators, including native butterflies and moths, bees, bats, and introduced honey bees (Xerces Society 2021). The toxicity of these pesticides to pollinators varies among taxa and depends on the chemical composition, mode of action, dosage, and timing of application.

Insecticide and fungicide use is linked with insect and bat pollinator declines worldwide (Cullen et al. 2019). Sublethal doses of these pesticides are linked to increased bee and monarch butterfly mortality, reduced locomotion, impaired learning and memory, impaired foraging, and reduced immunity (Malcolm 2018; Pelton et al. 2019; Belsky and Joshi 2020). Sublethal doses of pesticides can decrease energy reserves in hummingbirds and bats, which is significant for species that have high metabolic rates, resulting in reduced reproductive and foraging success and increased difficulty emerging from periods of torpor (i.e., a state of slowed body functions used to conserve energy and heat) (English et al. 2021b; Oliveira et al. 2021).

Pesticide use is common in urban and agricultural settings adjacent to public lands. Pesticides are often used on public lands to control vegetation, pathogens, and insect outbreaks (e.g., Mormon crickets, grasshoppers, bark beetles). These pathogen and insect outbreak treatments are generally implemented by the U.S. Department of Agriculture (USDA) Animal and Plant Health Inspection Service and state agencies under BLM authorization. Pollinators on public lands may be exposed to pesticides in numerous ways, including direct contact with spray residue on

Greenish blue butterfly *(Plebejus saepiolus)* by Rick Fridell

plants, ingestion of contaminated pollen or nectar, or exposure to contaminated nesting sites or materials (Winfree et al. 2011; Xerces Society 2021). Direct (lethal and sublethal) and indirect effects to nontarget species, including pollinators, varies widely based on the effected species, chemicals used, and application method. For example, several studies describe direct mortality, reductions in brood production and pollen consumption, and changes in the gut microbiota of bees after exposure to varying concentrations and applications of the insecticides diflubenzuron and carbaryl (Camp et al. 2020; Nogrado et al. 2019; Sharma and Abrol 2014; Smagghe et al. 2007). Pesticides should be used as part of an integrated pest management plan to minimize adverse impacts, but some potential impacts to pollinators can remain even after best management practices are implemented (Xerces Society 2018).

Herbicide treatments are generally intended to improve native plant communities. However, herbicide treatments can threaten pollinators due to loss of diverse floral resources (NRC 2007). Herbicides are often applied while plant species are flowering, reducing reproductive success of native plant populations. For example, herbicide use on BLM-managed lands may reduce pollinator host plants, such as milkweed, resulting in direct habitat loss for monarch butterflies (Pelton et al. 2019). More research is needed to determine if there are lethal and sublethal effects to pollinators from herbicides (Cullen et al. 2019).

Through implementation of this strategy, the BLM will work toward more targeted use of pesticides to improve pollinator habitats with minimal or no effects to pollinator species. The BLM will identify and conduct necessary science to identify and support the use of pesticides in targeted areas with effective best management practices. Coordination with other agencies such as the USDA Animal and Plant Health Inspection Service is also important for identifying pesticide avoidance areas to protect sensitive pollinator habitats.

3.5 Pathogens

In the last decade, the growth and spread of harmful pathogens and diseases resulted in pollinator population reductions, range contractions, regional population extinctions, and species extinctions (NRC 2007). White-nose syndrome is a rapidly spreading fungal disease affecting hibernating bats which causes skin lesions and disrupts natural torpor cycles, leading to high mortality during hibernation. Pollinating bats that utilize cave roost sites or undergo long periods of torpor could be susceptible to the disease (USFWS 2018a). Chalkbrood disease (caused by the fungal pathogen *Ascosphaera aggregata)* has harmed populations of alfalfa leafcutter bees (NRC 2007). There is growing evidence honey bees may also transmit diseases to native bees (e.g., deformed wing virus from honey bees to bumble bees) (Fürst et al. 2014; Burnham et al. 2021). Higher temperatures associated with climate change are expected to increase pathogen transmission and pollinator vulnerability to pathogens (Proesmans et al. 2021).

Through implementation of this strategy, the BLM will identify priority pollinator habitats that are negatively affected by pathogens. Working with federal, state, tribal, university, and nonprofit organization partners, the BLM will monitor priority habitats and identify and implement disease and pathogen monitoring and early detection and rapid response efforts.

Fairy bee *(Perdita* sp.*)* by Patrick Alexander, BLM

4.0 Strategy Goals, Objectives, and Actions

The BLM will work to implement the following goals, objectives, and actions to support the BLM mission for the benefit of pollinator species and habitats. These goals, objectives, and actions identify research needs and proactive conservation efforts that align with the target outcome of restoring or enhancing habitat for pollinators from the White House's "National Strategy to Promote the Health of Honey Bees and Other Pollinators" (Pollinator Health Task Force 2015).

4.1 Goal 1: Inventory BLM-managed lands and identify management needs for pollinators.

Objective 1.1. Develop and implement pollinator inventories, monitoring, and trend assessments on BLM-managed lands.

Actions

1.1.1. Evaluate the use of indicator species, and, if appropriate, identify species that can be used to monitor broader population and habitat condition trends based on taxonomic groups.

1.1.2. Identify, develop, and implement inventory and monitoring protocols, including standard operating procedures, for priority pollinators.

1.1.3. Develop a centralized inventory and monitoring database and document/photograph/video depositories for shared use across BLM programs (incorporated into existing BLM data systems, as feasible).

1.1.4. Identify opportunities to collaborate with other federal, state, tribal, university, and nonprofit organization partners on pollinator inventory and monitoring efforts.

Objective 1.2. Inventory, monitor, and assess pollinator habitat condition.

Actions

1.2.1. Analyze existing Assessment, Inventory, and Monitoring (AIM) Pollinator Supplemental Indicator (APSI) data to refine AIM protocols as needed to better meet BLM pollinator management needs.

1.2.2. Adopt APSI as a formal AIM supplemental indicator and incorporate into the Landscape Toolbox for pollinators.

1.2.3. Identify and develop standard operating procedures for collecting, managing, and storing APSI data.

1.2.4. Develop priority pollinator species distribution maps, habitat connectivity, and migratory maps for BLM-managed lands using existing data sources, to assist with identifying inventory and monitoring sites for priority pollinator species.

1.2.5. Support, implement, and promote vegetation mapping using the National Vegetation Classification (NVC) Standard and select/support the use of other vegetative mapping efforts (such as LANDFIRE, AIM, etc.) that would be best to develop base vegetation layers for pollinator habitat condition assessment and mapping.

4.2 Goal 2: Implement proactive efforts to conserve and restore pollinator habitats.

Objective 2.1. Proactively address habitat loss, fragmentation, and degradation resulting from land use authorizations by restoring, enhancing, and connecting pollinator habitat.

Actions

2.1.1. Conserve large geographic areas by protecting, maintaining, or restoring habitats and ecosystems that support the conservation and recovery of pollinators (e.g., land use allocation decisions that avoid impacts through no surface occupancy or exclusions; identifying and implementing conservation measures that minimize impacts of land use activities; identifying and managing areas of critical environmental concern and research natural areas for pollinator habitat conservation; removing barriers to species movements, thereby improving habitat connectivity).

2.1.2. Establish and maintain desirable measurable outcomes for pollinators and their habitats (e.g., population persistence; restoring a certain percentage of degraded habitat within a species' historic range; restoring, conserving, or managing a certain percentage of a species' habitat to ensure attainment of recovery plan goals and objectives).

2.1.3. Develop proactive project design features early in the planning process with a focus on avoiding impacts or restoring habitats for pollinators. If mitigation is needed to offset unavoidable impacts to sensitive pollinator species, ensure that a net conservation benefit is achieved for special status species where feasible.

2.1.4. Use Land and Water Conservation Funds to acquire important lands and/or easements to further special status pollinator habitat management and conservation.

2.1.5. Develop and implement vegetation treatments that promote resilient native plant communities using genetically appropriate (i.e., locally adapted) seed sources. Ensure BLM seed mixes and restoration efforts support pollinators by including locally or regionally appropriate native plant species that support foraging, nesting, and migratory habitat.

2.1.6. Develop and implement projects that reduce threats to priority pollinator species from fire, drought, disease, and invasive species.

2.1.7. Use propagation and translocation management techniques, as needed, to develop, reestablish, or enhance pollinator populations and habitat.

2.1.8. Develop reliable adaptive management triggers where useful to ensure continued viability and improvement of special status species populations.

2.1.9. Develop native seed sources and rehabilitation mixes to restore pollinator habitat. Coordinate with the Plant Conservation and Restoration Program to identify and prioritize plant species and seed sources based on seed transfer guidance for seed collection, seed increase, and inventory management through the National Seed Warehouse System.

2.1.10. Analyze vegetation project/treatment placement and design to help reduce habitat loss and fragmentation when pollinators are affected.

Objective 2.2. Understand, manage, and minimize the threats posed by nonnative invasive species, pesticides, and pathogens on public lands.

Actions

2.2.1. Annually coordinate field office pollinator project needs across HQ-230 (Division of Wildlife Conservation, Aquatics, and Environmental Protection), HQ-220 (Division of Forest, Range, and Vegetation Resources), Invasive Species Program, Fire and Aviation, Fire and Fuels, and Emergency Stabilization and Burned Area Rehabilitation to maximize treatment benefits for pollinators.

Kern's flower scarab *(Euphoria kernii)* by Patrick Alexander, BLM

2.2.2. Prioritize invasive species treatments where priority pollinator habitat is threatened by nonnative annual grasses and fire (including the Great Basin and Mojave and Sonoran Deserts).

2.2.3. Prioritize and implement invasive plant species treatments in priority pollinator wetlands and riparian habitats.

2.2.4. Coordinate with the Animal and Plant Health Inspection Service (APHIS) to minimize the broadscale use of pesticides on BLM-managed lands and develop effective best management practices. Coordinate with APHIS, line officers, and staff to ensure appropriate science is available for National Environmental Policy Act (NEPA) decision making regarding widescale pesticide applications.

2.2.5. Identify and implement disease and pathogen monitoring of insect pollinators to improve early detection and rapid response preparedness efforts, in coordination with BLM partners. Consider the potential to spread honey bee pathogens to wild bee populations in apiary permits.

2.2.6. Coordinate with agency partners to monitor and control the presence of nonnative species and pathogens where they impact pollinators on BLM-managed lands.

Objective 2.3. Identify and minimize the effects of habitat fragmentation and loss and the effects of climate change.

Actions

2.3.1. Use geospatial modeling to identify potential shifts in the distribution of individual priority pollinator species and habitats and associated avoidance areas, in response to climate change.

2.3.2. Address the effects of climate change on priority pollinator species/habitats at the resource management plan level by identifying potential ecosystem/habitat changes resulting from shifts in the climate envelope and proposing management alternatives to address these impacts. For example, where modeling indicates priority pollinator habitat is at risk, a potential management alternative could be to minimize nonclimate-related stressors, such as reducing livestock grazing animal unit months or implementing travel management.

Bee fly *(Pantarbes* sp.) by Patrick Alexander, BLM

4.3 Goal 3: Improve BLM business practices, policies, and planning for pollinator conservation.

Objective 3.1. Ensure that the BLM proactively incorporates pollinator conservation and management practices into its core business practices.

Actions

3.1.1. Establish standard best management practices (BMPs) for all vegetation and fuel management projects to minimize impacts to pollinators and ensure appropriate BMPs are included in future manual revisions and as stipulations in land use authorizations and automated in the Mineral and Land Records System. Ensure BLM field offices have the capacity to monitor project proponent compliance with biological right-of-way stipulations.

3.1.2. Coordinate with all relevant BLM programs to specifically prioritize conservation efforts for pollinators; incorporate pollinator-friendly practices, project planning, and implementation; use native seeds in restoration efforts; and facilitate monitoring and adaptive management.

3.1.3. Collaborate with pollinator experts, state wildlife agencies, and the USFWS to identify best strategies and adaptive management practices for managing pollinators.

3.1.4. Identify priority pollinator habitats at the field office level (using guidance and tools developed at Headquarters and state office levels) and develop guidance on evaluating the scope and intensity of project effects on pollinators to assist with NEPA analyses (e.g., determination of environmental assessment or categorical exclusion-level review).

3.1.5. Conduct field/state office data calls for pollinator project needs and compile a summary of state and field office projects and habitat restoration needs. Work internally and with partners to prioritize and implement landscape-level habitat restoration efforts. Integrate and coordinate pollinator projects with other vegetation management activities.

3.1.6. Prioritize the use of ESA section 7(a)(1) proactive conservation directives to support pollinator habitat management (see Objective 2.1).

3.1.7. Use habitat connectivity guidance to support pollinator habitat management.

3.1.8. Describe cumulative and landscape-level effects of land use activities on pollinators in NEPA and ESA section 7 analyses. Address habitat loss and fragmentation effects on pollinators by developing a process to (1) proactively avoid impacts resulting from land use authorizations and (2) restore and enhance habitats and connectivity at landscape levels. Where impacts to pollinators cannot be avoided and minimized during NEPA or ESA section 7 consultations, fully mitigate residual impacts as appropriate.

3.1.9. Ensure that BLM authorized permits, leases, and applications to drill support pollinator habitat management during all project phases such as permitting, operations, maintenance, termination, and reclamation.

3.1.10. Ensure travel management planning considers pollinators and pollinator habitats.

Objective 3.2. Develop and ensure BLM policy and guidance are updated and effective at integrating pollinator species and habitat conservation and management into program operations.

Actions

3.2.1. Develop policy, information tools, and geospatial tools to identify, track, and manage priority pollinator habitats, connectivity, migration corridors, and impacts, including cumulative effects resulting from BLM land use authorization and use to improve NEPA and ESA section 7 analyses at local and rangewide scales.

3.2.2. Develop pollinator policy and guidance for landscape and ecosystem-level conservation and restoration of pollinator habitat and connectivity.

3.2.3. Identify appropriate pollinator species for BLM special status species lists. Review the status of special status priority pollinator taxa and their habitats every 5 years or sooner, as necessary.

3.2.4. Update or renew BLM policy and guidance regarding the conservation and management of pollinator species and habitats, such as BLM Manual 6500, "Wildlife and Fisheries Management"; BLM Manual 6840, "Special Status Species Management"; and Instruction Memorandum 2016-023, "Reducing Preventable Wildlife Mortalities."

3.2.5. Work with BLM Lands and Realty to develop national guidance for permitting apiaries on public lands.

3.2.6. Update rangeland health assessment guidance to consider floral resources and pollinator habitats or create a separate assessment that can better identify pollinator needs.

Monarch butterfly larva *(Danaus plexippus)* by S. Damon, BLM

4.4 Goal 4: Increase science support tools and information for pollinator species and habitat management.

Objective 4.1. Increase the availability of technical resources for BLM personnel regarding pollinators.

Actions

4.1.1. Model population/habitat distributions of priority/indicator taxa (e.g., monarch butterfly, western bumble bee) where needed to identify priority pollinator habitat and implement proactive conservation efforts.

4.1.2. Utilize existing and develop new geospatial tools (e.g., Vegetation Management Action Portal) to inform and track management decisions and restoration treatments where nonnative species threaten terrestrial and aquatic pollinator habitat.

4.1.3. Develop science products that describe impacts to ecosystems, pollinator populations, or habitat from broadscale pesticide applications, grazing, oil and gas, and other land use authorizations on BLM-managed lands.

4.1.4. Work with the USFWS, NatureServe, nongovernmental organizations, and state heritage programs as needed to inform species status assessments.

4.1.5. Promote the development of emerging technologies, such as unmanned aircraft systems, artificial intelligence, radiotelemetry, and remote sensing with specific application to pollinator habitat.

4.1.6. Map and prioritize pollinator habitats and migratory pathways for conservation and protection from their threats at regional and larger scales.

4.5 Goal 5: Increase communication and collaboration internally and with BLM partners.

Objective 5.1. Increase internal awareness, information exchange, and coordination of pollinator resources and activities on BLM-managed lands.

Actions

5.1.1. Identify and facilitate opportunities for coordination across BLM programs to implement pollinator conservation efforts.

5.1.2. Increase staff awareness and consideration for pollinators as they implement BLM management actions by communicating policy and creating internal education, outreach, and interpretation materials.

5.1.3. Develop and submit an annual summary of pollinator research and conservation activity reports to Headquarters for distribution though the Executive Leadership Team.

5.1.4. Develop/implement pollinator-related training for BLM staff tailored to individual program needs, such as pollinator identification for field staff, pollinator awareness training as part of pesticide use training, and pollinator conservation during the NEPA process.

5.1.5. Centralize species status information, occurrence records, range, and distribution information so it is readily accessible to BLM staff. For example, use the Science in Practice Portal to centralize, compile, and serve information about pollinators to field staff.

5.1.6. Continue to convene regular meetings of the BLM Pollinator Coordinators group to allow for ongoing communication and collaboration.

5.1.7. Provide internal and identify external funding opportunities for pollinator conservation efforts that will benefit BLM management.

Objective 5.2. Engage external partners to increase external awareness of pollinators and to advance mutual priorities and promote efficiency.

Actions

5.2.1. Increase public awareness of BLM pollinator resources by creating public education, outreach, and interpretation materials that share information on BLM pollinator populations and habitat management activities, including invasive species.

5.2.2. Engage the public and youth in BLM pollinator activities or Public Lands Day events.

5.2.3. Identify opportunities to collaborate with federal, state, tribal, university, and nonprofit organization partners on pollinator conservation, inventories/monitoring, data management, education, and outreach.

5.2.4. Identify opportunities to collaborate and work across administrative boundaries to implement and promote landscape conservation activities.

5.2.5. Participate in local, regional, and national workgroups and partnerships to promote pollinator conservation, including, but not limited to: DOI Pollinator Conservation Coordination Group, Federal Native Bee Monitoring Task Force, Monarch Joint Venture, North American Pollinator Protection Campaign, Plant Conservation Alliance, Xerces Society for Invertebrate Conservation, National Wildlife Federation, Bat Conservation International, Western Association of Fish and Wildlife Agencies, and Association of Fish and Wildlife Agencies working groups.

5.2.6. Participate in the US National Native Bee Monitoring Research Coordination Network to develop and implement the national native bee monitoring plan.

5.2.7. Coordinate with state agencies to include pollinators in State Wildlife Action Plans.

5.0 Conclusion

Pollinators face ever-increasing challenges to their survival. From habitat loss and expanding development to rises in disease and impacts from climate change, the Nation's pollinators are undergoing unprecedented declines. This strategy provides a framework for bureauwide conservation of pollinators and their habitats.

These goals, objectives, and actions are part of a comprehensive effort to manage resources internally and with BLM partners by reducing land resource conflicts, increasing ecological resiliency, and protecting pollinators for their ecological and economic value and the enjoyment of future generations.

Lesser long-nosed bat *(Leptonycteris yerbabuenae)* by Tom Vezo/Minden Pictures

6.0 Laws and Policies Guiding Pollinator Management

Federal Laws

Endangered Species Act
Federal Land Policy and Management Act
Federal Noxious Weed Act
Fish and Wildlife Coordination Act
John D. Dingell, Jr. Conservation, Management, and Recreation Act
National Environmental Policy Act
National Invasive Species Act
Nonindigenous Aquatic Nuisance Prevention and Control Act
Plant Protection Act
Public Rangelands Improvement Act
Surface Mining Control and Reclamation Act
Migratory Bird Treaty Act

Administrative Policies

Executive Order 11990 – Protection of Wetlands
Executive Order 13112, as amended by Executive Order 13751 – Safeguarding the Nation from the Impacts of Invasive Species
Executive Order 13175 – Consultation and Coordination with Indian Tribal Governments
Executive Order 14008 – Tackling the Climate Crisis at Home and Abroad
Department of the Interior Manual

- Chapter 517: Pesticides
- Chapter 524: Invasive Species Management

Cactus bee *(Diadasia* sp.) by Patrick Alexander, BLM

BLM Policies

Manual 1601 – Land Use Planning
Manual 1626 – Travel and Transportation Management
Manual 1737 – Riparian-Wetland Area Management
Manual 1740 – Renewable Resource Improvements and Treatments
Handbook H-1740-2 – Integrated Vegetation Management Handbook
Manual 1745 – Introduction, Transplant, Augmentation, and Reestablishment of Fish, Wildlife and Plants
Manual 6100 – National Landscape Conservation System Management
Manual 6340 – Management of Designated Wilderness Areas
Manual 6400 – Wild and Scenic Rivers
Manual 6500 – Wildlife and Fisheries Management
Manual 6521 – State Agencies (cooperative relations)
Manual 6522 – Federal Agencies (cooperative relations)
Manual 6523 – Nongovernmental Organizations (cooperative relations)
Manual 6524 – Research
Manual 6525 – Sikes Act Wildlife Programs
Manual 6600 – Fish, Wildlife, and Special Status Plant Resources Inventory and Monitoring
Manual 6602 – Integrated Habitat Inventory and Classification System
Manual 6720 – Aquatic Resource Management
Manual 6721 – Reservoirs
Manual 6780 – Habitat Management Plans
Manual 6840 – Special Status Species Management
Manual 7200 – Water Resources
Manual 7240 – Water Quality
Manual 9011 – Chemical Pest Control
Handbook H-9011-1 – Chemical Pest Control
Manual 9015 – Integrated Weed Management

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Yellow vane insect trap used during Soda Fire restoration monitoring. Photo by Justin Welty, U.S. Geological Survey

Anna's hummingbird *(Calypte anna)* by Rick Fridell

1. Common blue butterfly *(Polyommatus icarus)* by Jessa Davis, BLM
2. White-lined sphinx moth larva *(Hyles lineata)* by Meredith McClure, BLM
3. Carpenter bee *(Xylocopa* sp.*)* by Rick Fridell
4. Atlantis fritillary butterfly *(Speyeria atlantis)* by Rick Fridell
5. Bee fly *(Apolysis* sp.*)* by Patrick Alexander, BLM
6. Soft-winged flower beetle *(Listrus* sp.*)* by Patrick Alexander, BLM
7. Rufous hummingbird *(Selasphorus rufus)* by Rick Fridell
8. Western honey bee *(Apis mellifera)* by Rick Fridell
9. Monarch butterfly *(Danaus plexippus)* by Rick Fridell
10. Woodborer bee *(Lithurgopsis* sp.*)* by Rick Fridell
11. Police car moth *(Gnophaela vermiculata)* by Rick Fridell
12. Juba skipper butterfly *(Hesperia juba)* by David Pilliod, USGS
13. Lesser long-nosed bat *(Leptonycteris yerbabuenae)* by Tom Vezo/Minden Pictures
14. Thread-waisted wasp *(Palmodes* sp.*)* by Rick Fridell
15 Broad-billed hummingbird *(Cynanthus latirostris)* by Rick Fridell
16. Bee fly *(Pantarbes* sp.*)* by Derek Sikes, University of Alaska Fairbanks
17. Yuma skipper butterfly *(Ochlodes yuma)* by Jessa Davis, BLM
18. Bumble bee *(Bombus* sp.*)* by Andrew Davies, BLM