RUFOUS HUMMINGBIRD

STATE OF THE SCIENCE AND CONSERVATION

Universidad de Guadalajara
Forest Service U.S. Department of Agriculture
Environment and Climate Change Canada
Environnement et Changement climatique Canada
Western Hummingbird Partnership
Klamath Bird Observatory
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Author Affiliations

Caitlyn R Gillespie, Klamath Bird Observatory
Sarahy Contreras-Martínez, Universidad de Guadalajara-CUCSUR Autlán de Navarro
Christine A Bishop, Environment and Climate Change Canada
John D Alexander, Klamath Bird Observatory

Document design by Chu-Yu Lin

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We recognize and acknowledge that the Rufous Hummingbird migrates and breeds within the traditional territories of many indigenous peoples throughout this species range.

Why a Review?

Rufous Hummingbirds are a charismatic and remarkable migratory bird, and through their role as pollinators they provide important ecological services across their range in Canada, the United States, and Mexico. There is a great opportunity for concerned communities, bird lovers, and conservation scientists to rally together to develop a full life cycle conservation strategy to protect this long-distance migrant throughout its entire range. This strategy should include the ranking of threats, the prioritization and implementation of conservation strategies and actions, and coordinated efforts to fill information gaps, monitor population trends and demographics, and measure the effectiveness of our conservation efforts.

In this Review

This report summarizes the best available information about the biology and conservation of Rufous Hummingbirds (*Selasphorus rufus*)

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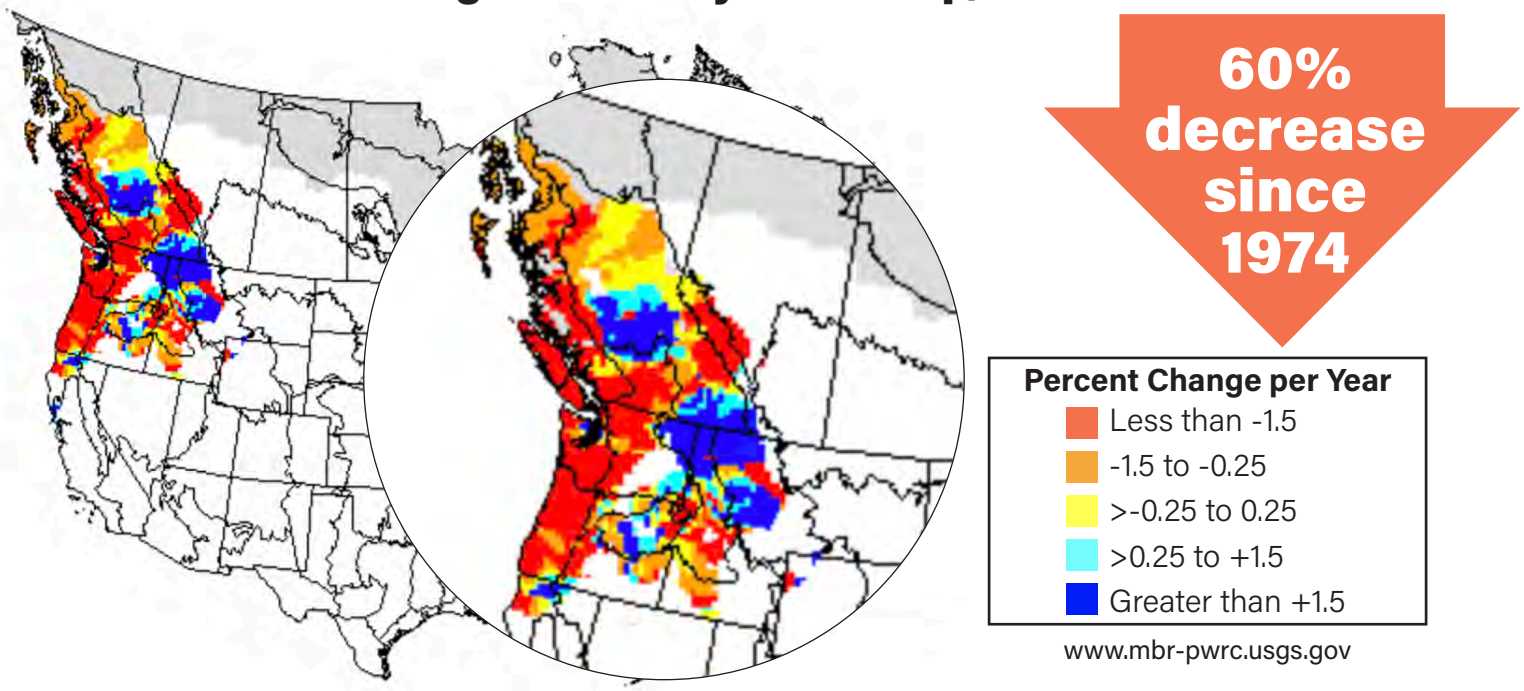
- **We review information about behavior, ecology, habitat needs, and threats throughout its geographic range, including non-breeding areas in Mexico and southeastern United States, breeding grounds in the Pacific Northwest, and the migratory stopover sites in between.**
- **We identify important information gaps along with threats and key conservation opportunities throughout the full life cycle of Rufous Hummingbirds.**
- **This document is intended to inform tri-national conservation planning and implementation for this species, through which information needs, threats, and conservation opportunities and strategies will be prioritized for action.**

While still commonly observed throughout their range, Rufous Hummingbird populations are recognized as an at-risk species.[1] Annual Breeding Bird Survey data indicate that their populations have declined by as much as 60% since 1974.[1] While the causes of past declines are unclear, recent research indicates that accelerated climate change could result in extensive range loss in the United States.[2] As a long-distance migrant, Rufous Hummingbirds require high quality habitat across a large geographic area for breeding, migratory stopovers, and wintering. Threats that may be factors in their population decline include the impacts of climate change on food and habitat resources, loss of natural and traditional fire regimes, and pesticide exposure. Because Rufous Hummingbirds likely encounter each of these threats repeatedly throughout their annual life cycle, more information is required to understand how and to what extent threats and stressors affect Rufous Hummingbirds in different geographic areas.

Breeding Bird Survey Trend Map, 1966 - 2013



The Breeding Bird Survey (BBS) is a large-scale avian monitoring program that gathers data about North American breeding bird population trends. Results from BBS data analyses show that Rufous Hummingbirds are suffering population declines throughout much of their breeding range.

Addressing these threats to Rufous Hummingbirds, like many other migratory species, is limited by information gaps about their breeding, migration, and wintering ecology. Details about their migration and wintering areas are especially limited. Given its rapid population decline, our efforts to determine the best approaches to coordinated research and population monitoring must accelerate and involve conservation scientists, bird lovers, and concerned communities that can provide an important voice to help advance the conservation of this species.

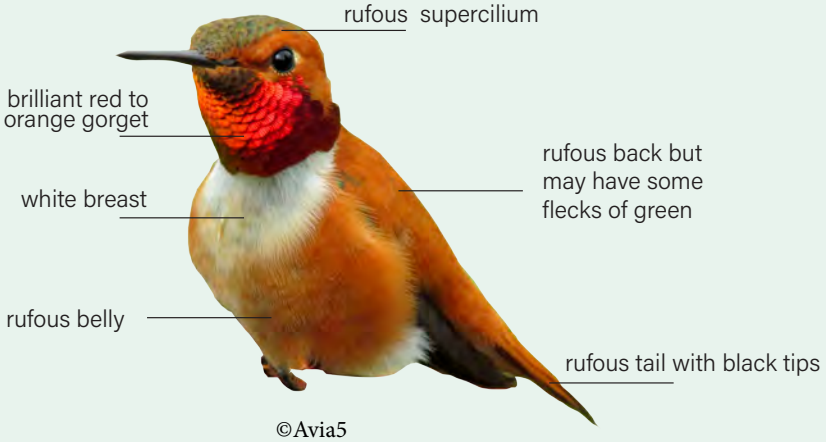
Conservation Status

The Rufous Hummingbird is identified as a species of continental concern on the North American Watch List.[3] It also appears on the International Union for Conservation of Nature (IUCN) Red List of Threatened Species as Near Threatened.[4]

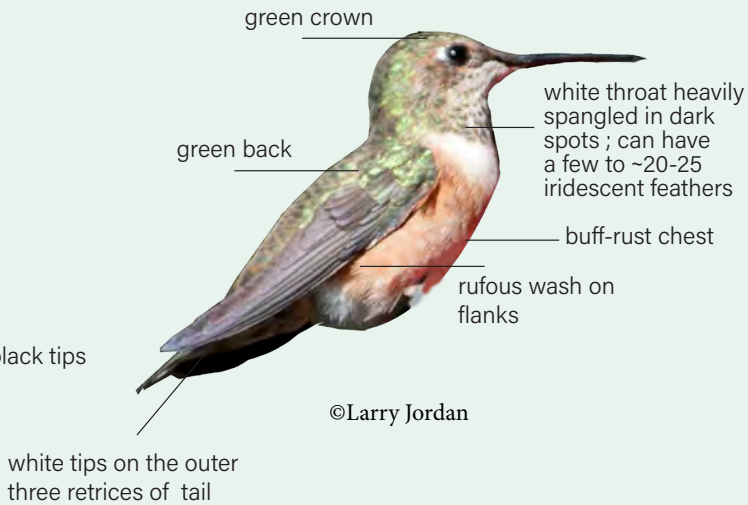
Identification

Rufous Hummingbirds are among the smallest hummingbirds in the world, only 9-10 cm in length[5] with a body mass of about 3.5 grams – that's less than a nickel![6] Named for their distinctive coloration, male Rufous often have a solid rufous back, but many individuals have green back feathers and a few (especially young ones) are more than half green. Their crown is bright green, while cheeks and eyebrows and flanks are rufous. The adult male has a striking red gorget. The adult females are bright green above and white below, however they still have strongly washed rufous on sides, flanks, and undertail coverts to the edges of the rump. The face and sides of the female's gorget are washed rufous. The female gorget is creamy white but can be heavily spangled with green to bronze to iridescent red feathers, which can vary from a few feathers to a small triangle or diamond.

Adult Male Rufous Hummingbird



Adult Female Rufous Hummingbird



Correct identification of Selasphorus hummingbirds requires knowledge of details in coloration and tail shape.

Distribution and population data for the Rufous Hummingbird can be complicated by incorrect identification of Rufous females and young, which can closely resemble similar hummingbird species. The immature Rufous males and females resemble adult females however the gorget on males is heavily striped and can have a few iridescent markings. Key morphological features that distinguish Rufous from Allen's hummingbird (*Selasphorus sasin*) include the second tail feather on Rufous males that is distinctly notched on the inner web near its tip; this feature is less noticeable but also present on female Rufous, but not present on Allen's. The male's steep oval or J-shaped courtship display and courtship sounds the Rufous males make are also distinctly different than Allen's.[7,8] There is hybridization where the breeding ranges of these two species overlap near the California-Oregon border.[9]

Adult Female

Adult Male

Immature Female

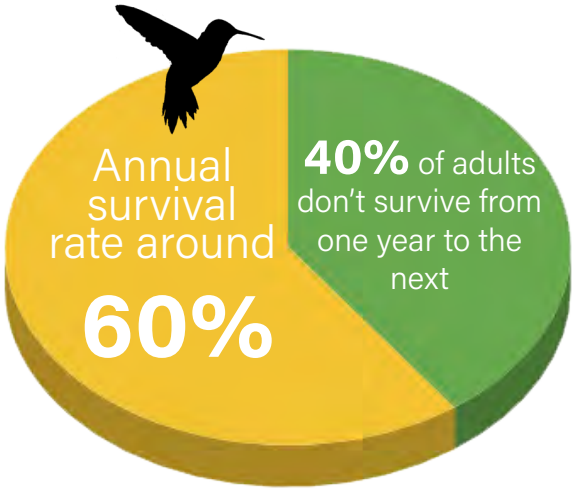
Immature Male

Allen's Hummingbird

Young or female Rufous Hummingbirds are difficult to identify and can be confused with similar species such as Allen's Hummingbird (*Selasphorus sasin*).

SOCIAL BEHAVIOR, PHYSIOLOGY, AND MORPHOLOGY

Rufous Hummingbirds are highly territorial at breeding, migratory stopover, and non-breeding sites. Male Rufous Hummingbirds arrive on the breeding grounds before females where they establish territories and perform flight displays.[10] When females arrive they choose nest sites, not necessarily within male flight display territories.[10] Females exclusively build nests, incubate, and feed nestlings and fledglings. Nests may be reused from year to year. Females may cluster their nests in concentrations of up to 20 within a small area.[11,12] Males copulate with multiple females if they can and then leave breeding territories; they may remain nearby for the season or move from coastal locations to interior or higher elevation locations where they may establish new breeding territories.[13] Recapture rates of the Rufous Hummingbird reveal that they can live for at least five years, with annual survival around 60%.[14]



The oldest recorded Rufous Hummingbird was nearly nine years old when she was recaptured and rereleased during banding operations in British Columbia. [8]

Torpor

Hummingbirds seem to compensate for high elevations and low temperatures by increasing net energy intake, likely through one or more behavioral modifications.[15] For example, Rufous Hummingbirds conserve energy overnight by placing their bodies in a state of torpor (low-energy use, short-term hibernation).[16] Torpor allows them to counteract for their small body size and energy loss in colder and sometimes oxygen-poor (i.e., high-elevation) environments.[16–18]

Information Gaps

More data is needed to understand how hummingbird morphology, physiology, and social behavior will influence their ability to adapt to climate change and other stressors. For example, are drying conditions changing nectar volumes and/or shifting ranges of high-elevation nectar resources and impacting hummingbird populations? How will the unique behavioral and physiological characteristics that allow Rufous Hummingbirds to breed in northern latitudes and persist in high elevations adapt to a changing climate and multiple stressors at the same time?

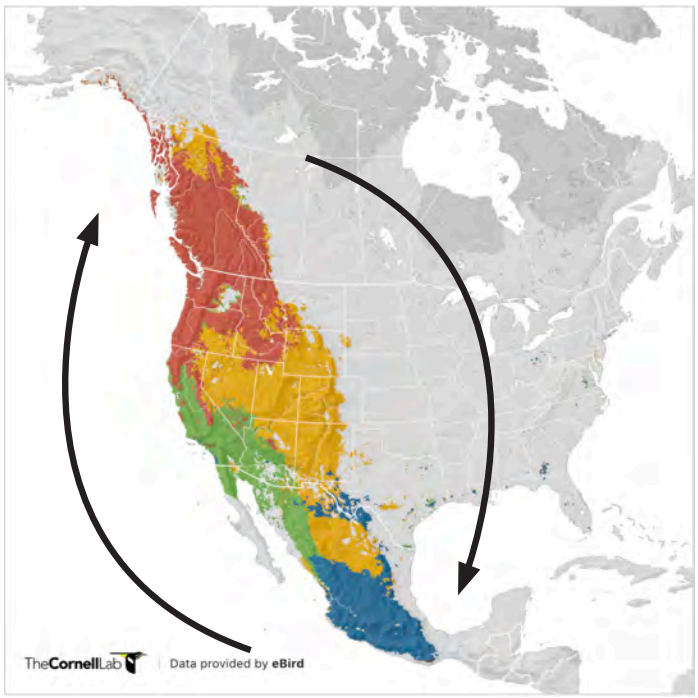
Wing morphology

Hummingbirds often hover in flight, a behavior that is energetically demanding. Smaller wing sizes allow for some of the territorial flight displays of male Rufous Hummingbirds; female Rufous have slightly larger wing sizes than males.[19]

Annual Migratory Cycle – An elliptical migration

Rufous Hummingbirds breed in coastal southeastern Alaska south through southwestern Yukon, British Columbia, southwestern Alberta, Washington, northern and central Idaho, western Montana, Oregon, and extreme northwestern California.[5] During southward migration, they stopover in both the Pacific and Rocky Mountain flyways. Males depart for southward migration initially and generally follow a narrow path through the Rocky Mountains. Within 1 to 2 weeks females then depart and follow a broader southward route that includes the Rockies and mountain ranges farther west. Thereafter, juveniles migrate along the same route as females but a greater number move south along the eastern Sierra Nevada mountain range and even further west in California.[20] They spend the non-breeding season in coastal southern California and Gulf Coast south to south central Mexico[5,21] and more recently east along the northern coast of the Gulf of Mexico. Adult males initiate spring migration earlier than females[5] and mainly follow the Pacific flyway through California northward.[21]

Rufous Hummingbirds migrate north in spring along the Pacific Coast to breeding sites in the northwestern United States, Canada, and Alaska. Their return migration in late summer and early fall follows the Rocky Mountains before reaching Mexico.[66]



Recaptures also show that some individuals may migrate from breeding sites in the northwest to wintering areas in the southeastern United States, including Florida and Alabama.[67]

HABITAT USE DURING BREEDING AND POST-BREEDING MIGRATION

Rufous Hummingbirds breed in second-growth forests and forest openings, as well as in mature forests, riparian areas, parks, fields, meadows, and other open areas. In western Oregon, nests were found in second growth forests from 16 to 120 years old.[22] Females build well-concealed nests in low branches of trees and shrubs; nests are made of spider-webs and camouflaged with lichen. Rufous Hummingbirds produce 1-2 broods per year and will return to nest sites and even re-use nests in following years.[11]

During post-breeding migration, Rufous Hummingbirds use high-elevation alpine meadows, where late-blooming nectar-producing flowers are abundant.[23] Hummingbirds will use a large diversity of flowers including many that are not tubular or red.[24] Hummingbirds can visit four to five thousand flowers a day.[24] Both males and females defend territories during southward migration; territory sizes vary widely and are adjusted daily to maximize weight gain from nectar-producing flowers. Male territories tend to be smaller and have denser flower availability, while female territories can be larger.[19]
During the winter, Rufous Hummingbirds primarily occur in Mexican pine and pine-oak forests as well as high mountain meadows. They are one of the most abundant pine-oak specialists across their wintering range, regularly occurring with other hummingbirds including Mexican Violetear (*Colibri thalassinus*), Rivoli's Hummingbird (*Eugenes fulgens*), Amethyst-throated Mountain-gem (*Lampornis amethystinus*), Bumblebee Hummingbird (*Atthis heloisa*), Broad-tailed Hummingbird (*Selasphorus platycercus*), Calliope Hummingbird (*Selasphorus calliope*), Berylline Hummingbird (*Amazilia beryllina*), and White-eared Hummingbird (*Hylocharis leucotis*).

Visit 4000 - 5000 flowers a day

Annual population modeling and full life cycle conservation

Like many migrants, stressors that impact hummingbird populations at one part of their range likely have cascading effects throughout their annual migratory cycle. For example, limited food availability during spring migration may delay spring breeding arrival or cause individuals to arrive in poor condition, making it difficult to establish high-quality territories that can support successful breeding.[12] Given their high metabolism, Rufous Hummingbirds likely need abundant, reliable and pesticide-free food resources to meet the energy demands of their long migrations. A full life cycle approach to conservation of Rufous Hummingbirds must take into account threats and opportunities throughout the annual migratory cycle and at multiple geographic locations. Full life cycle analyses are needed to reveal seasonal population limitation for the species and allow for more focused conservation actions.

SPRING AND WINTER HABITAT USE

During winter, females and juveniles are more common at higher elevations, based on capture data at sites 1900-3100m in Western Mexico, while adult male Rufous Hummingbirds appear to be more common at lower elevations.[25] Human land-use often varies greatly by elevation, thus creating different survival challenges.

Hummingbirds from different breeding subpopulations, in particular coastal versus interior, select distinct sites during the non-breeding season in Mexico.[21] Evidence from isotope analysis suggests that females from coastal breeding populations winter at higher elevations than males; but similar isotope differences were not observed for interior populations.

Relative abundance changes over time during the winter. The magnitude of this change can depend on the successional stage of forests and the abundance of flowering plants.

Adults molt from December to February while juveniles begin to molt shortly after arrival on wintering grounds and can extend molting into spring migration.[5] Molt is energy-expensive, and molting season can be a difficult time for birds.

During spring migration, Rufous Hummingbirds commonly use riparian habitats and low altitudes where flowers bloom first in spring. Both male and female individuals establish and defend distinct territories around flowering plants.[26] Females can outnumber males at some spring migration stopover sites on the central coast of California.[27] Rufous Hummingbirds seem to arrive in Alaska before flowers bloom and are seen at sapsucker wells.[68]

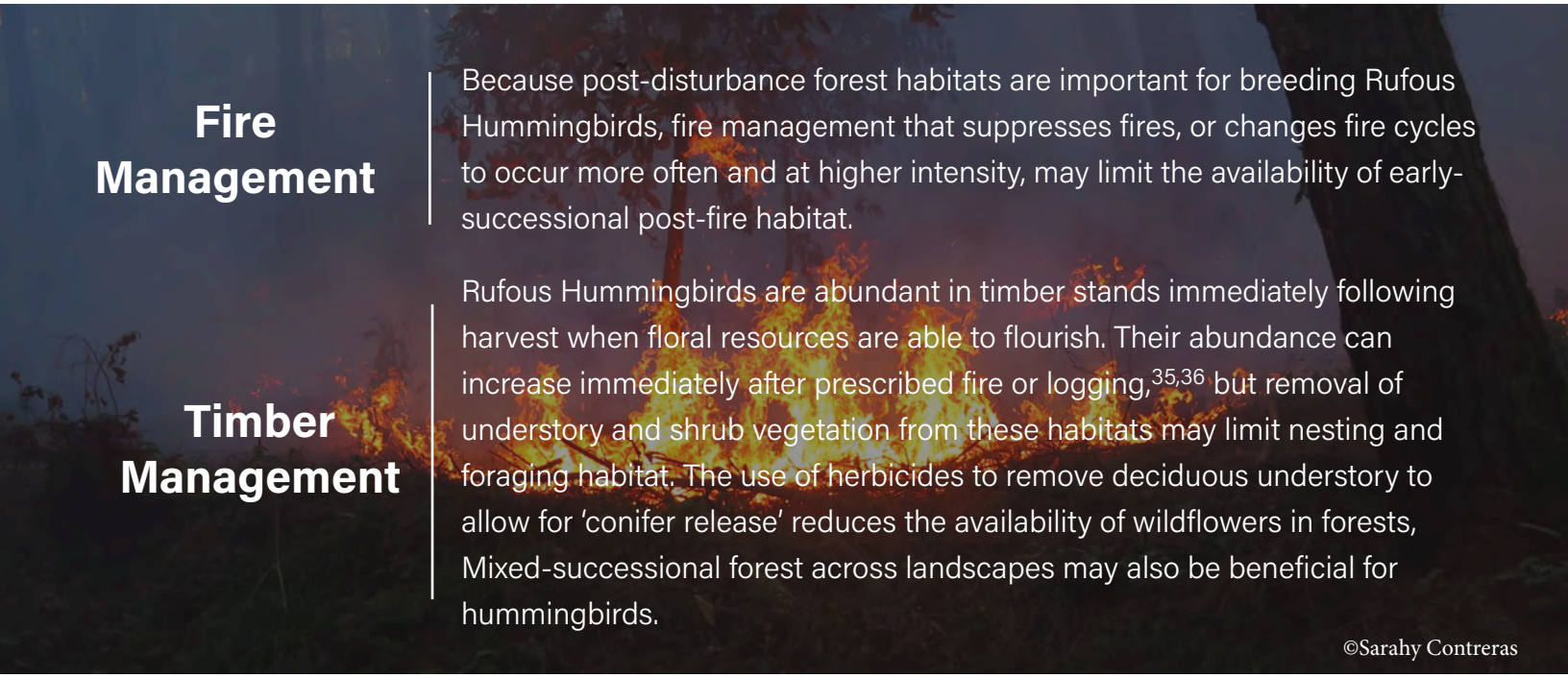
Information Gaps

Do Rufous Hummingbirds move among sites during the non-breeding season, and if so why and how far do they move? More information is needed on the sex- and age-specific movement and distribution patterns during late fall, winter, and early spring. How do these movements affect survival? Detailed information about migratory connectivity is also needed. For example, do individuals that winter in different areas of Mexico come from distinct breeding areas in Alaska and western USA? Are there differences in the relative abundance, survival, or reproductive success that vary with successional state of forested habitat?

DISTURBANCE AND FIRE

While Rufous Hummingbirds nest in both second-growth forests and older mature forest, post-disturbance mid- to early-successional habitats are important for breeding Rufous Hummingbirds. Post-fire habitats provide stopover habitat for Rufous Hummingbirds in the Sierra Nevada during their post-breeding migration; high numbers of migrating individuals have been observed when wildflowers are abundant following wildfire events.[29] In the northern Rocky Mountains, studies demonstrate the importance of post-fire habitat for a number of bird species, including hummingbirds.[30,31] It is also possible that increasing fire frequency and intensity, as well as timing of fire, have had negative effects on Rufous Hummingbird habitat and hence their populations. Reduced overall habitat availability at the landscape scale not only reduces resource availability for migratory bird species but can alter stopover habitat use.

During winter in Western Mexico, Rufous Hummingbirds utilize plants that regenerate post-fire, such as sage (including *Salvia iodantha* and *S. mexicana*).[32] Fires maintain plant species diversity in pine and pine-oak forests.[33] Recently disturbed or burned habitat is important to Rufous Hummingbirds, as is a mosaic of different successional stages that primarily result from low-severity fires that occur every 11 to 30 years.[33] Small areas (<3 hectares) affected by high severity fire that are surrounded by later successional forests are also important.[34]



Fire Management

Because post-disturbance forest habitats are important for breeding Rufous Hummingbirds, fire management that suppresses fires, or changes fire cycles to occur more often and at higher intensity, may limit the availability of early-successional post-fire habitat.

Timber Management

Rufous Hummingbirds are abundant in timber stands immediately following harvest when floral resources are able to flourish. Their abundance can increase immediately after prescribed fire or logging,[35,36] but removal of understory and shrub vegetation from these habitats may limit nesting and foraging habitat. The use of herbicides to remove deciduous understory to allow for 'conifer release' reduces the availability of wildflowers in forests, Mixed-successional forest across landscapes may also be beneficial for hummingbirds.

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Information Gaps

How do herbicide treatments specifically influence hummingbird populations? How does fire frequency, intensity, and timing influence Rufous Hummingbird habitat use and survival throughout their range? How have changes in land use and habitat loss on the breeding grounds, during stopover, and/or on the wintering grounds influenced Rufous Hummingbird declines?

Nectar

Rufous Hummingbirds feed on nectar from a variety of plant species and move in correlation with floral phenology throughout their range. In breeding and migratory stopover areas, typical flower species in their diet includes red tubular species such as red columbine (*Aquilegia formosa*), scarlet gilia (*Ipomopsis aggregate*), bearded tongues (*Penstemon spp.*), and paintbrushes (*Castilleja spp.*). They will also drink nectar from a variety of other flowers including sage (*Salvia spp.*), bouvardia (*Bouvardia ternifolia*), mint (*Stachys coccinea*), lilies (*Erythronium grandiflorum, Lilium columbianum*), purple larkspur (*Delphinium barbeyi and D. geranioides*), heath (*Vaccinium ovatum, Menziesia ferruginea*), currant (*Ribes sanguineum*), salmonberry (*Rubus spectabilis*), honeysuckle (*Lonicera spp.*), fireweed (*Epilobium angustifolium*), horsemint (*Monarda menthifolia*), toad-flax (*Linaria vulgaris*), snapdragon (*Scrophularia montana*), and bee-flower (*Cleome serrulata*).[10,28,37–41] In Mexico, presence of Rufous Hummingbird coincides with the flowering peak coincides with peak flowering of the plant genera ***Salvia, Lobelia, Calliandra, Ipomea,*** and ***Senecio.***[25,32,42,43]

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FOOD RESOURCES AND POLLINATION

While it is likely that hummingbirds act as pollinators on the wintering grounds, more research is needed to understand this important ecological role.[25] In the spring, Rufous Hummingbirds act as pollinators for early blooming nectar-producing plants.[44]

Insects

Insects such as gnats and aphids are consumed by Rufous Hummingbirds on their breeding grounds and throughout their life cycle but are particularly important as a food source for growing chicks.[45] Insects also provide protein, an essential nutrient not found in nectar and needed for feather growth during molt.

Other food resources

While nectar-producing flowers are clearly an important food source, other sources are important in the diet of Rufous Hummingbirds. Early spring migrants may supplement their nectar-based diet with alternate food sources; some will feed on sap from sapsucker wells as a source of sugar.[46] Calcium, an important nutrient for breeding females, does not occur naturally in nectar; calcium deposits from ash or soil near nest sites serve as a necessary mineral supplement[47] and insects may also be a source of minerals.

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Habitat and resource selection

How do Rufous Hummingbirds find flowers? While Rufous Hummingbirds return to known food sources, nectar from many different plant species is a less predictable yet important food resource. Rufous Hummingbirds use memory of previous foraging locations to find food sources more efficiently.[48] Rufous Hummingbirds also rely on visual cues to find food sources.[49] Large patches of blooming flowers are necessary to sustain Rufous hummingbird territories. Individuals maximize energy intake and may make daily adjustments to defend territory size.[23] When flower numbers are reduced or destroyed by natural events, such as storms, Rufous Hummingbirds appear to leave the immediate area rather than settle into smaller or lower-quality territories.[50]

CLIMATE CHANGE AND PHENOLOGY

Rufous Hummingbird migration is closely timed with floral phenology; however, it is possible that shifts in local resource phenology may now be out of sync due to shifts in timing of migration as a result of accelerated climate change. Flowering phenology across habitats and elevations may be affected differently by climate change in local temperature and precipitation regimes. Changes in the availability of resources could alter hummingbird habitat selection and migratory stopover behavior.[51] Uneven changes in resource availability across geographies may impact Rufous Hummingbird survival at multiple times throughout the full life cycle and contribute to population declines.[52]

Breeding

Spring arrival of Rufous Hummingbirds in the northern parts of their breeding range have shifted earlier in the last 10 years.[53] Breeding success will likely depend on corresponding shifts in local floral and insect phenology, although research is still needed to quantify potential mismatches in local resource phenology across the breeding ranges. Declines in insect populations,[54] in addition to climate-related shifts in phenology, have the potential to impact food sources for chicks.

Southward migration

Warming temperatures and reduced snowpack in montane meadows have resulted in earlier flowering phenology in some plant species. Montane meadows in the Rocky Mountains have seen a reduction in mid-summer (July-August) flower abundance, which may affect pollinators including hummingbirds.[55]

Non-breeding/wintering

In Mexico, Rufous Hummingbirds undergo a complete molt on their wintering grounds,[56] an important and energetically taxing life-history event. Changes in the peak flowering phenology of hummingbird-associated plant species or declines in insect populations during this time could threaten Rufous Hummingbirds.

Northward migration

During northward migration, early spring migrants may compete for limited resources that are affected by climate change and related phenology shifts in the flowering of nectar-producing plants.

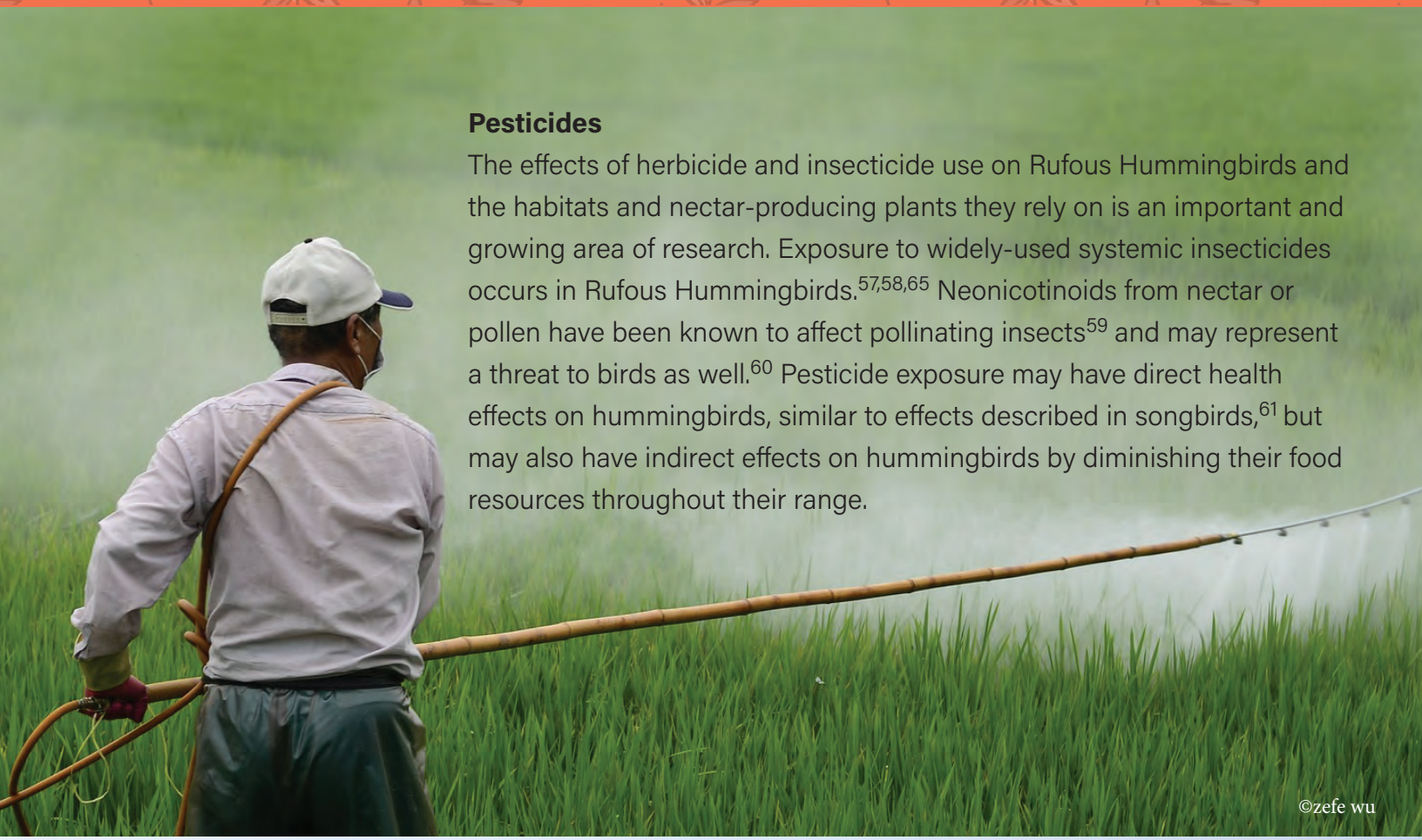
CLIMATE CHANGE AND PHENOLOGY

Information Gaps

While climate-related changes in habitat, resource, and migration phenology have the potential to impact Rufous Hummingbird populations, more research that builds on existing climate and bird conservation science is needed.[2] Future warming will require many species to shift to northern latitudes or to higher elevations, but are there physiological constraints on Rufous Hummingbirds that would prevent similar range shifts? Climate change may produce long-term drought in current areas important to Rufous Hummingbirds, which may increase fire severity. Where is drought predicted, and how might this affect Rufous Hummingbirds? Climate-smart natural resource management that takes into account projections of future climate change scenarios may help mitigate some potential impacts of climate change on hummingbird populations. For example, landscape-level conservation planning may be able to prioritize forest management for hummingbirds within their expected range under future climate change scenarios.

Phenology describes the timing of events in nature, such as the flowering of plants or the arrival of migrants. The natural cycles of events rely on cues such as day length or temperature. Because climate change may affect the cues in different ways, a "mismatch" of timing of events that were historically aligned can occur. When this happens, migrants may arrive "too late for dinner" if nectar producing plants flower earlier than normal. For example, plants are now blooming earlier than the arrival of Broad-tailed Hummingbirds (*Selasphorus platycercus*) in the northern part of their breeding range.[30]

AGRICULTURAL PRACTICES, LAND USE, AND INVASIVE SPECIES



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Pesticides

The effects of herbicide and insecticide use on Rufous Hummingbirds and the habitats and nectar-producing plants they rely on is an important and growing area of research. Exposure to widely-used systemic insecticides occurs in Rufous Hummingbirds.[57,58,65] Neonicotinoids from nectar or pollen have been known to affect pollinating insects[59] and may represent a threat to birds as well.[60] Pesticide exposure may have direct health effects on hummingbirds, similar to effects described in songbirds,[61] but may also have indirect effects on hummingbirds by diminishing their food resources throughout their range.

Grazing and Agricultural Practices

Loss of wildflower resources in forested habitats due to ungulate grazing remains unquantified. Overgrazing by ungulates removes many floral resources, but some may persist if not preferred by the grazers. Thus, the extent to which grazing reduces food for hummingbirds on a landscape scale is unknown. The conversion of native meadows and openings to non-native grasses, which reduces forbs and nectar-producing plants, may also reduce the availability of floral resources.

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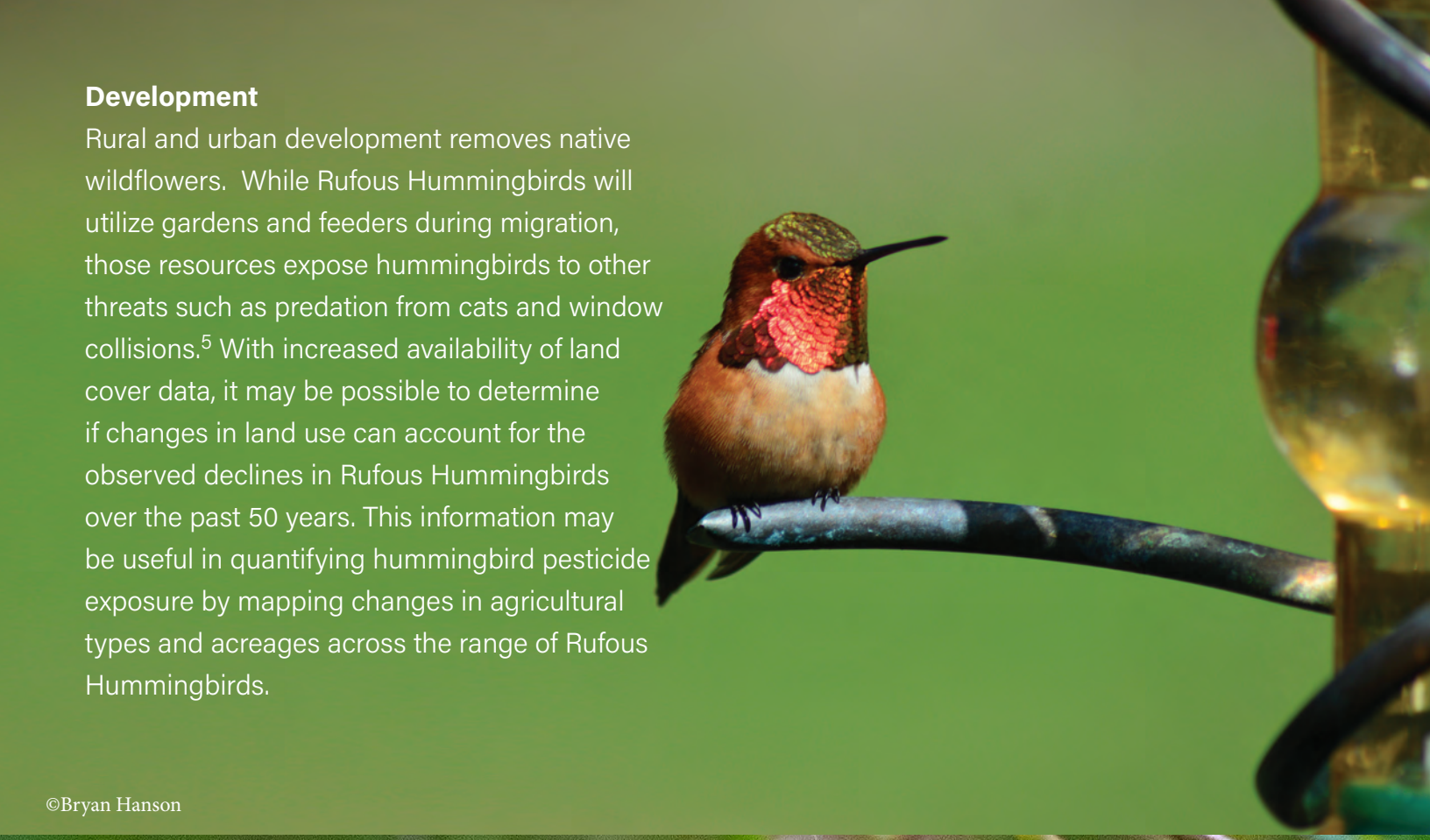
Development

Rural and urban development removes native wildflowers. While Rufous Hummingbirds will utilize gardens and feeders during migration, those resources expose hummingbirds to other threats such as predation from cats and window collisions.[5] With increased availability of land cover data, it may be possible to determine if changes in land use can account for the observed declines in Rufous Hummingbirds over the past 50 years. This information may be useful in quantifying hummingbird pesticide exposure by mapping changes in agricultural types and acreages across the range of Rufous Hummingbirds.



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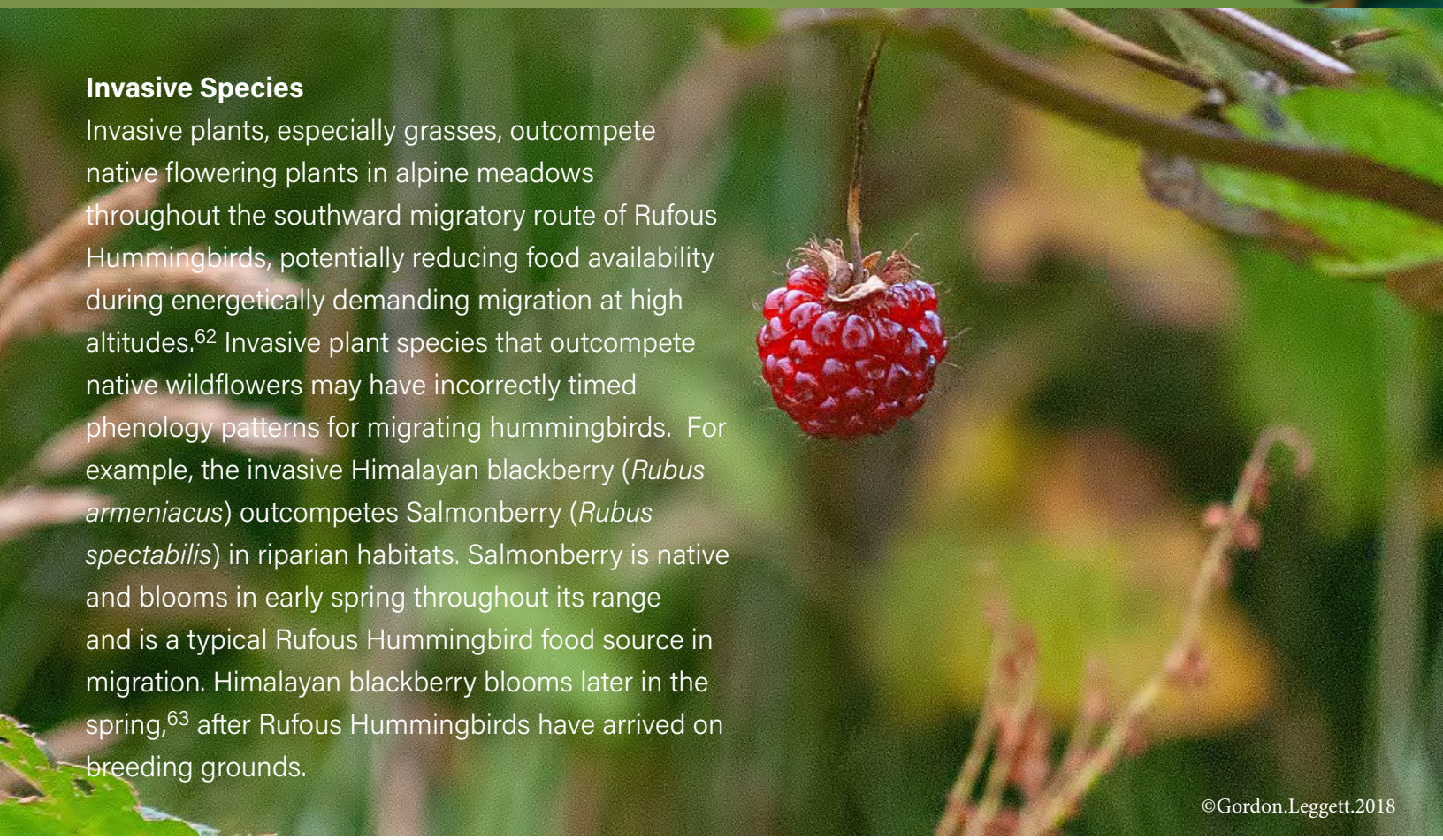
Invasive Species

Invasive plants, especially grasses, outcompete native flowering plants in alpine meadows throughout the southward migratory route of Rufous Hummingbirds, potentially reducing food availability during energetically demanding migration at high altitudes.[62] Invasive plant species that outcompete native wildflowers may have incorrectly timed phenology patterns for migrating hummingbirds. For example, the invasive Himalayan blackberry (*Rubus armeniacus*) outcompetes Salmonberry (*Rubus spectabilis*) in riparian habitats. Salmonberry is native and blooms in early spring throughout its range and is a typical Rufous Hummingbird food source in migration. Himalayan blackberry blooms later in the spring,[63] after Rufous Hummingbirds have arrived on breeding grounds.



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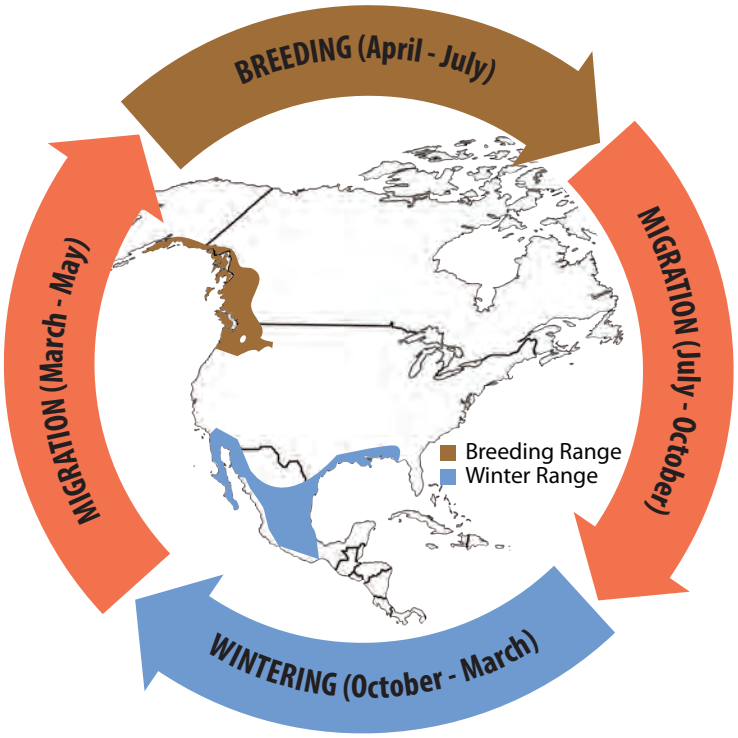
Information Gaps

How does habitat alteration from agricultural development, cattle grazing, and pesticide use affect Rufous Hummingbirds throughout their range?[25]

THREATS AND FULL LIFE CYCLE CONSERVATION



The Rufous Hummingbird is a long-distant migrant with declining populations. While still common in some parts of its range, breeding bird survey data suggest that there are 60% fewer Rufous Hummingbirds now than there were in the early 1970s. If this trend continues we may lose another 50% of the population by 2050.[1] As a result, this species is widely recognized as an at-risk species. Like many migratory birds, Rufous Hummingbirds face threats throughout their full life cycle – they face threats on their wintering grounds in Mexico, on their breeding grounds in northwestern North America, and at stopover sites that they depend on as they make their spring and fall migrations. Climate change could impact key elements of their life history and food resources as increased temperatures, drought, fire-changed habitats, and phenological mismatches occur between flowers and birds. Lack of natural and traditional fire regimes, invasive species, overgrazing, forestry practices, and pesticides all contribute to loss of floral resources and habitat. These stressors can impact all species of hummingbirds; but because Rufous Hummingbirds migrate the furthest among all species of hummingbirds, they may be especially vulnerable to changes that occur in multiple geographic locations throughout their life cycle. They may be a useful umbrella species for other western hummingbirds and for other western pollinators, and thus the Western Hummingbird Partnership (https://westernhummingbird.org/) has prioritized the study of Rufous Hummingbird.

An important next step in developing a full-life-cycle conservation strategy for western hummingbirds is to conduct an assessment of threats on the Rufous Hummingbird specifically. A broader threats assessment for migratory and resident western forest birds identified unsustainable agricultural expansion and practices, unsustainable livestock farming/ranching expansion and practices, unsustainable logging and wood harvesting, disruption of natural disturbance regimes, water management and altered hydrology, and inadequate forest restoration as the most significant threats.[64] Which of these are the most significant threats to the Rufous Hummingbird, and are there important threats not included in this list?

Despite population declines and apparent threats, we still lack critical information about Rufous Hummingbirds that will be needed to address these conservation issues. Information gaps about their breeding, migration, and wintering ecology remain broad and more information about their migration and wintering area habitat preferences is especially needed. Research on the effects of climate change and pesticide use, as detailed above, will also fill critical information gaps. Better information on survival and reproductive rates (and factors that affect these rates) will contribute important quantitative information.

" NO REGRETS" CONSERVATION ACTIONS

While we continue to improve our knowledge of these species, we need to undertake conservation now because Rufous Hummingbirds - along with other pollinators – are already declining. We know that all pollinators are completely dependent on flower availability throughout the year. We also know that many changes over the past 50 years have diminished the availability of flowers. Thus, the Western Hummingbird Partnership is focused on increasing flower abundance and diversity throughout the ranges of these hummingbird species. Native, locally adapted flowers are important for pollinators, and conservation efforts should focus on increasing the abundance and diversity of native plants whenever possible. Such conservation action must use climate-smart approaches that consider ongoing range shifts in flowering plants.

Science-driven conservation works – there are many examples that demonstrate how at-risk species can be recovered when our society chooses to invest in their conservation. With this State of the Rufous Hummingbird Science and Conservation review we sound a call to action for the full-life-cycle conservation of western hummingbirds using the Rufous Hummingbird as the lead example.

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