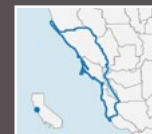


San Bruno Elfin Butterfly



Species Description

The San Bruno elfin butterfly (*Callophrys mossii bayensis*) is a small, diurnally active, univoltine (one generation per year) butterfly. The butterfly's distribution closely follows the narrow distribution of its larval host plant, broadleaf stonecrop or sedum (*Sedum spathulifolium*), which is found on thin-soiled or rocky north-facing slopes within the coastal fog belt of central California. Broadleaf stonecrop is found on varied substrates on dry rocky slopes, cliffs, marine bluffs, roadcuts, open forest, mossy riparian outcrops, and stone walls. The butterflies are highly connected to this host plant for courtship, mating, oviposition, and larval development. They also have mutualistic relationships with multiple species of ants, which tend the larvae for honeydew production and may protect the larval butterflies from parasitoids and predators. The San Bruno elfin butterfly is currently found only within discrete local populations in the coastal mountains of San Mateo County.

Species Vulnerability - High

Sensitivity & Exposure - High

Projected Changes	Trend
Air temperature	▲ Increase
Drought	▲ Increase
Precipitation	▲▼ Varies
Storms and flooding	▲ Increase
Wildfire	▲ Increase

Potential Impacts:

- Shortened flight season due to rise in spring air temperatures, limiting opportunities for mating and oviposition
- Increased threat of invasive plant spread and competition with native host plants due to reduced soil moisture
- Life cycle events disrupted by increased precipitation variability, impacting flight abilities and host plant survival
- Risk of delayed onset of adult flight and altered host plant and/or nectar source abundance following disturbance events

Non-climate stressors may interact with climate stressors and disturbance regimes:

- *Woody invasive plant species* can compete with and shade out host/nectar plants, and *invasive Argentine ants* may facilitate increased parasitism in larvae, both of which threaten the persistence of the species
- *Herbicides and insecticides* have the potential to impact San Bruno elfin habitat or the butterflies themselves, including those that drift in from proximate sites
- *Roads, highways, and trails*, as well as *off-trail recreational activity*, can degrade the butterfly's habitat and create barriers to movement
- *Residential and commercial development* has led to loss of butterfly habitat



The San Bruno elfin butterfly is sensitive to factors that affect the health and availability of the stonecrop species to which the butterfly's life cycle is closely tied, as well as factors that degrade habitats directly or create barriers to movement.

Species Vulnerability - Moderate

Adaptive Capacity - Moderate

Intrinsic factors (i.e., inherent characteristics) that enhance or undermine adaptive capacity:

Enhance:

- Seasonal drought-resistant traits present in stonecrop host plants
- Host plants able to colonize disturbed sites such as quarries and roadcuts

Undermine:

- Restricted range
- Habitat loss, fragmentation, and host plant declines
- Limited ability to navigate discontinuous habitat, leading to isolated populations

Extrinsic factors (i.e., management potential) that enhance or undermine adaptive capacity:

Enhance:

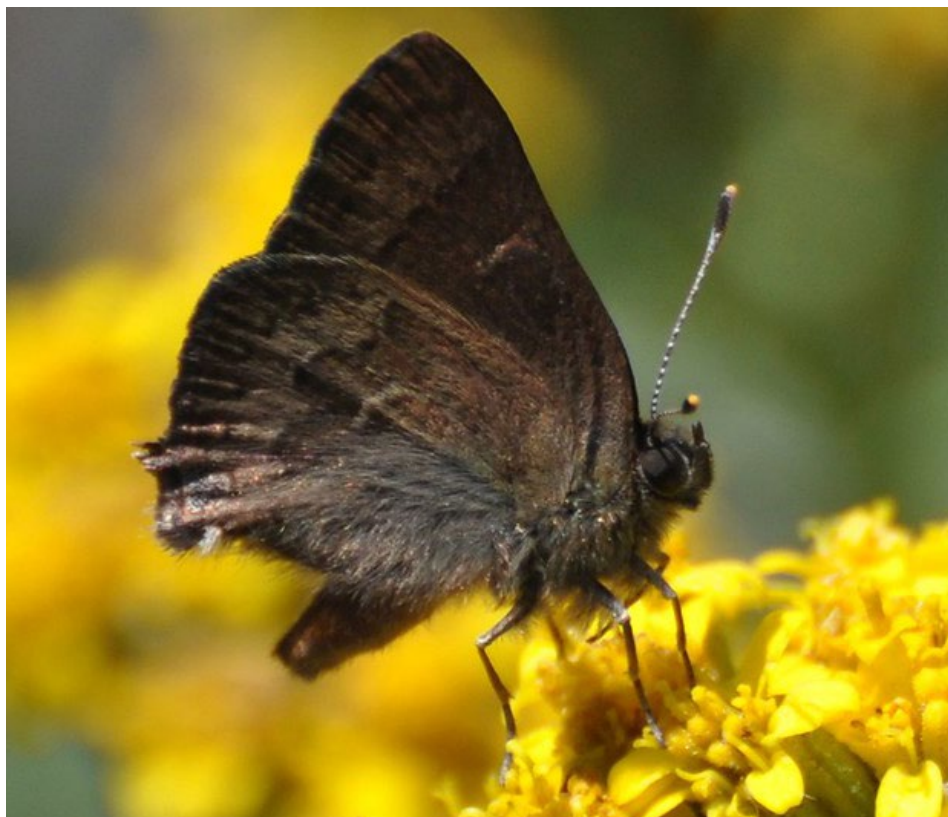
- Federally listed as an endangered species, mandating habitat protection

Undermine:

- Low public awareness of the species
- Lack of standardization in monitoring protocols and coordination between agencies that are managing populations



Although the San Bruno elfin butterfly is a federally endangered species with regulatory protections, it exists in small metapopulations, has limited capacity for dispersal, and is highly dependent on a host species whose survival is threatened by disturbance events and habitat degradation.



Don Owens, Flickr (CC BY 2.0)

Adaptation Strategies & Actions

Adaptation strategies can reduce climate change vulnerability of a given ecosystem or species by addressing any or all of the three components of vulnerability (i.e., by reducing sensitivity, reducing exposure, and/or increasing adaptive capacity). The table below presents examples of adaptation strategies and actions, which fall within five categories, or approaches: Resistance/Resilience **(R)**, Acceptance **(A)**, Direct/Response **(D)**, Knowledge **(K)**, and Collaboration **(C)**. *Please note that the strategies and actions provided here should not be considered a checklist or plan, but rather as a set of examples for land managers to consider for further study when developing site- or species-specific actions.*

Adaptation Strategies	Adaptation Actions
Improve coordination with the goal of generating shared knowledge	<ul style="list-style-type: none"> • Standardize and coordinate monitoring across the region (K/C) • Sponsor research to investigate whether recovery plan reflects the biology and management needs of the species across its range (beyond San Bruno Mtn) (K/C) • Collaborate to better understand evolutionary and population genetics (K/C) • Establish a working group/core team that includes a broad range of scientists and land managers from across the species' range (C)
Manage San Bruno elfin habitat	<ul style="list-style-type: none"> • Manage invasives, especially annual grasses (including in high nitrogen deposition areas) and arthropods (R)
Explore assisted migration possibilities	<ul style="list-style-type: none"> • Conduct a systematic study of phylogenetics that includes other subspecies (K) • Study the pros/cons and feasibility of introduction to appropriate sites (D/K) • Monitor isolated populations in order to determine if relocation is appropriate (R/K)
Conduct a high-quality inventory of San Bruno elfin butterfly occupancy and habitat	<ul style="list-style-type: none"> • Conduct presence/absence surveys to enable demonstration of viable metapopulations (K) • Conduct surveys for host plant patches (regardless of whether they currently support species occurrences) using remote sensing and/or drones (K)

Adaptation strategies and actions generated through breakout group exercises during the adaptation workshop in December 2023.