Icaricia icarioides sacre (Sacred Boisduval's Blue)

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Taxonomy

- **Class**: INSECTA
- **Order**: LEPIDOPTERA
- **Family**: LYCAENIDAE
- **Genus**: Icaricia
- **Scientific Name**: *Icaricia icarioides sacre* (R. Holland, 2011)
- **Common Name**: Sacred Boisduval's Blue
- **Synonyms**: Plebejus icarioides ssp. sacre R. Holland, 2011
- **Taxonomic Name Source**:Holland, R. 2011. Lepidoptera of North America 10. Review of *Plebejus icarioides* and *Glaucopsyche lygdamus* in New Mexico with four new subspecies (Lycaenidae, Lycaeninae, Polyommatini). Contributions of the C.P. Gillette Museum of Arthropod Diversity Colorado State University, Fort Collins, Colorado. 29 pp.

Agency Status

- **NMDGF**:
- **Federal Status**:
- **BLM Sensitive**:
- **USFS**:
- **IUCN Red List**: Not Evaluated
- **Nature Serve Global**: TNR
- **NHNM State**: S2
- **NM Endemic**:YES

Description

Boisduval's is our largest blue, but still not very big. Males are iridescent sky blue above with black edging. Females are dark gray above with blue basal scaling. Beneath, the forewing has a bold postmedian band of white-ringed black spots and a similar cell-end bar. The hindwing underside is gray with small, dark submarginal chevrons and a postmedian band of white-ringed black spots. There is a gap between submarginal chevrons and postmedian band. **Comments.** Great geographic variation in this species has resulted in proliferation of named subspecies by taxonomists (25, by our last count). Most New Mexico populations are grouped with central Rocky Mountains race Icaricia icarioides lycea (W. H. Edwards 1864), which has bold ventral hindwing black cell spots. Populations in the Sierra Blanca complex (Li,Ot) colonize the endemic Lupinus sierrae-blancae and are subspecies I. i. sacre (R. Holland

2011), which is now recognized by Pelham (2024).

Description courtesy of Steven J. Cary, Butterflies of New Mexico, 2024

Habitat and Ecology

This butterfly lives in high elevation montane savannas and meadows where its sole known host plant, the endemic Sierra Blanca Lupine (*Lupinus sierrae-blancae*) grows (Holland 2011, Cary and Toliver 2024). The New Mexico Rare Plant Technical Council has listed the Sierra Blanca Lupine as a rare plant species in New Mexico and they describe its habitat as being meadows and roadsides along pine and fir forest between 1800 and 3350 meters (5,900 and 11,000 feet) (NMRPTC 1999). This butterfly is univoltine with its one flight peaking and mostly occurring in June (Holland 2011). Adults of this taxa feed on flower nectar although specific nectar sources have not been reported although the parent species frequently nectar on Leadplant (*Amorpha canescens*), and Redroot Buckwheat (*Eriogonum racemosum*) among others adults are also attracted to wet soil (Cary and Toliver 2024). In the parent species diapause is undergone as partially grown larvae which is probably the same case for this subspecies (Cary and Toliver 2024). Ultimately, more research into the specific life history of this butterfly is needed going forward.

Geographic Range:

The Sacred Boisduval's Blue Butterfly is a narrow New Mexican endemic, restricted to the upper elevations of the Sacramento, Sierra Blanca, and Capitan Mountains, in southern New Mexico (Holland 2011, Cary and Toliver 2024, Pelham 2024). These occurences are at the southern extreme of the range of the parent species (Holland 2011). Holland (2011) estimated that this subspecies has been isolated from any other Boisduval's Blues for about 10,900 years (Holland 2010, Holland 2011). Furthermore he also estimated that the Capitan and Sacramento mountains subpopulations have been isolated from one another for about 4,000 years, with one population now at the top of Sierra Blanca peak and the other atop the crest of the Capitan Mountains. As such, there is some divergence that has been noted between these two subpopulations but not enough to warrant a different name (Holland 2011). This high elevation butterfly is the only one of the many subspecies of the Boisduvals Blue that is frequently observed above 3,000 meters (9,800 feet) (Holland 2011).

Conservation Considerations:

There are no known conservation actions being taken for this butterfly and no previous conservation assessments that we know of. The New Mexico Rare Plant Technical council considers this butterfly's host plant to be weakly conserved throughout its range (NMRPTC 1999). A NatureServe global assessment also found this endemic host plant to be globally vulnerable to extinction in 2014 (NatureServe 2024). Additionally, two other Boisduval's Blue subspecies have already made it onto the United States Endangered Species list with federal protections due to similar threats to the ones facing this butterfly including habitat loss, ecological succession, invasive species, and other threats (USFWS 2024).

Due to the large number of threats currently affecting this butterfly and its very narrow range the likelihood this butterfly survives until 2100 without conservation intervention is slim. Climate change threatens the imminent demise of this butterfly and all of the other threats aren't helping its prospects. As a result, it is recommended that conservation actions be taken to save this butterfly. This includes protecting all known habitats and starting habitat restoration to create more viable habitat for this butterfly. These restorations ideally should be focused on connecting habitat patches or enlarging them to make populations more resilient to stressors and improve their genetic health. If things are looking especially grim, captive rearing or crossing the genetics of the populations in Capitan and Sierra Blanca may be needed. Additional research on the threats to this butterfly as well as on its population size and trends and life history

will also be crucial in order to make any of these conservation measures effective.

Threats:

As a very narrow high elevation endemic to the Sacramento and Capitan mountains in southern New Mexico, the main threat to this butterfly is climate change. The Sacramento Mountains sit at the southern extreme of the parent species range and thus the warmest portion of its range. It has been documented that many butterfly species respond to climate change by moving to higher elevations or higher latitudes however, as this butterfly is isolated in the highest elevation parts of the Sacramento and Capitan mountains this is not an option and climate change threatens to push this taxa into thin air (Forister *et al.* 2010, Holland 2010, Rodder *et al.* 2021). As the western United States is expected to continue to get hotter and drier over the next century things are looking dire for this mountaintop resident (Cook *et al.* 2009, Cook *et al.* 2015, Williams *et al.* 2022). Climate change also threatens this subspecies with phenological mismatch with both host and nectar sources which could result in steady declines in population numbers or in the event of an extreme phenological mismatch the extirpation of entire populations which has been observed in other host specific lupine feeding blues (Singer and Parmesan 2010, Patterson *et al.* 2019).

The second largest threat to this subspecies is fire suppression. The lupine this butterfly relies on requires open habitats such as meadows or roadsides in order to survive; generally a healthy fire regime could maintain these meadow habitats the species relies on. However, fire suppression has been a key component of forest management in this area since the early 1900s which has resulted in dense conifer growth and increased fuel loads (Kaufmann *et al.* 1998). This has choked out meadow habitats reducing the amount of habitat for this butterfly and driving other meadow specialists in the area to the brink of extinction like the Sacramento Mountains Checkerspot Butterfly (*Euphydryas anicia cloudcrofti*). An additional problem with this fire suppression despite just removing habitat for this butterfly is the build up of fuels from fire suppression can result in catastrophic wildfires. At least nine large fires have burned over 34,000 acres of land in the Sacramento Mountains in the last 50 years (Kaufmann *et al.* 1998). These fires could easily knock out this butterfly's host plant causing mass mortality, in adults, larvae, or eggs and easily extirpating remaining colonies (Holland 2010). On top of this pesticide use has also likely adversely impacted this subspecies across its known range (Holland 2010). In 1983 and 1984 during June and July when this taxa is active and overlapping with its flight period carbaryl pesticides were sprayed using aerial application over 240,900 acres of the Sacramento Mountains at elevations between 1828 and 3353 meters (6,000 and 11,000 feet), to control an outbreak of Western Spruce Budworm (*Choristoneura freemani*)(Bennett and Linnea 1985). Most of the inhabited areas and waterways were instead sprayed with *Bacillus thuringiensis* (*Bt*). In another example, in 2007, the Village of Cloudcroft again sprayed *Bt var. kurstaki*, which targets lepidopterans, to control a Janet Fir Looper (*Nepytia janetae*) outbreak (Holland 2007).

This butterfly is also likely quite threatened by inbreeding depression. Holland (2011) estimated that this butterfly has been separated from any other Boisduval's Blue for about 10,900 years and that the two remaining populations one on the top of Sierra Blanca and the other in the highest elevation parts of the Capitan mountains have been separated from each other for about 4000 years (Holland 2011). This isolation from one another and from any other Boisduval's Blues combined with the likely low population sizes due to the small amount of habitat available for them at the elevations needed and the habitat shrinking due to fire suppression and other factors puts this butterfly at high risk for inbreeding depression. Inbreeding depression can start to arise where slightly deleterious alleles can accumulate in these small populations, reducing the likelihood of population persistence (Hedrick 1994, Lynch *et al.* 1995). The accumulation of deleterious alleles and reduction in heterozygosity have been shown to reduce survival rates at several important life stages in butterflies, including those that have an effect on population stability and persistence, even after just one generation of mating between full-siblings (Saccheri *et al.* 1998, Nieminen *et al.* 2001). Nieminen *et al.* (2001) also suggests that inbreeding depression may pose an even greater problem in populations currently experiencing rapid habitat fragmentation but with minimal inbreeding in the past. A reduction in fitness resulting from the loss of genetic diversity significantly increases the risk of extinction when populations are subject to environmental stress. Saccheri *et al.* (1998) found that microclimatic conditions combined with inbreeding caused the extinction of a

checkerspot population in Finland, while Singer and Ehrlich (1979) found a combination of drought, fragmented habitat, and low dispersal rates contributed to the extinction of several butterfly populations in California. Morphological variations have been reported between the Capitan and Sacramento mountains which may be a sign that poor genetic health and inbreeding are resulting in a larger observable amount of recessive phenotypes observable in the population this may be a sign that inbreeding depression is already occurring in one or both populations (Holland 2011).

This butterflies host plant is also quite rare making its way to being listed on the New Mexico rare plant list curated by the New Mexico Rare Plant Technical Council. As the sole known host plant for this butterfly it is not a good sign to have your only host plant also be a rare narrow endemic as this leads to little ability for bet hedging or range expansion. Host specificity has also been shown to be a key indicator of extinction risk in butterflies and as such having just a single host plant and a rare one at that magnifies this butterflies chances of extinction (Kotiaho *et al.* 2005, Palash *et al.* 2022, Forister *et al.* 2023). On top of that this subspecies is univoltine which puts it at further risk of extinction as it reduces the subspecies dispersal range and increases its risk of phenological mismatch making the taxa less adaptable to and more threatened by climate change (Eskildsen *et al.* 2015, Patterson *et al.* 2019, Forister *et al.* 2023).

Recreational disturbances are also a potential threat to this taxa. As the Sacramento Mountains are the site of many recreational activities including camping, hunting, hiking, mountain biking, and off-highway vehicle (OHV) use many of which could harm this butterfly's host plant. Additionally, grazing by cattle historically and now by elk and feral horses may also be a threat to this butterfly as elk and feral horses are rampant in the Sacramento Mountains and have been shown to be causing declines in other meadow inhabiting Sacramento Mountain endemic butterflies however, currently more research is needed on the effect of grazing on this subspecies (USFWS 2004). Invasive species may also pose a significant threat to this butterfly as many invasive species are present in the meadow and roadside habitats which this butterflyâ€™s host plant resides in. These invasive species can outcompete the host plant directly resulting in less hosts for the butterfly or species such as Kentucky Bluegrass (*Poa pratensis*), may cause fire to burn deeper and hotter, due to the formation of mats potentially resulting in higher mortality (USFWS 2004). Lastly extreme weather events such as major droughts, hail, snow, flooding, or extreme cold or warm temperatures could results in major mortality for these small isolated populations furthering the threat of inbreeding depression and making it difficult or impossible for populations to recover or an extreme enough climatic event could extirpate populations entirely.

Population:

The population size and trend are not known for this subspecies. Determination of population size and monitoring of population trends is necessary to ensure the population is stable. Especially as several widespread, relatively common species of butterfly are in decline across the American west (Forister *et al.* 2021).

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More Information