



Photo: James Bruch, KIRC

Terrestrial Invertebrates

Blackburn's Sphinx Moth

Manduca blackburni

SPECIES STATUS:

Federally listed as Endangered

State listed as Endangered

State recognized as Endemic

NatureServe Heritage Rank G1 - Critically imperiled

Recovery Plan for the Blackburn's Sphinx Moth (*Manduca blackburni*) - USFWS 2005

Designation of Critical Habitat for the Blackburn's Sphinx Moth: Final Rule - USFWS 2003

SPECIES INFORMATION: Blackburn's sphinx moth is one of Hawaii's largest native insects (Family: Sphingidae) with a wing span of up to 12 centimeters (5 inches). Adults are overall gray with black bands across the top of their wings and five orange spots on each side of their abdomen. Caterpillars are large and populations contain two distinct color morphs, bright green or purple/gray. Both morphs have scattered white speckles across their back and a horizontal white stripe on the side of each segment. Caterpillars feed on plants in the nightshade family (Solanaceae), especially native trees in the genus *Nothoecstrum*, but also on non-native solanaceous plants such as commercial tobacco (*Nicotiana tabacum*), tree tobacco (*N. glauca*), eggplant (*Pseudomonas solanacearum*), tomato (*Lycopersicon esculentum*), and Jimson weed (*Datura stramonium*). Adults have been observed feeding on the nectar of koaliawa (*Ipomea indica*). Other likely adult nectar sources include other species of *Ipomea*, maiapilo (*Capparis sandwichiana*), and 'ilie'e (*Plumbago zeylantia*); it is believed that the moth pollinates these species, but further study is necessary. Development from egg to adult may be as short as 56 days, but pupae may aestivate (i.e., period of dormancy during hot or dry conditions) in the ground for as long as a year. Moths are found year-round, but may be most active between January and April and again between September and November, especially after rains.

DISTRIBUTION: Originally distributed across all the Main Hawaiian Islands (MHI), the species was believed to be extinct in the late 1970s. In 1984, the species was rediscovered on East Maui. Additional populations recently have been found on Kaho'olawe and the island of Hawai'i. Blackburn's sphinx moth can be found across a broad elevational gradient from sea level to 1,540 meters (5,000 feet), though it does not breed in all locations where the adults might be found.

ABUNDANCE: Unknown. The species' short life span as an adult, rarity, and mobility makes estimating population sizes difficult. Despite this, it is believed that populations have declined over the past 100 years since the moth no longer occurs on several islands on which it had been recorded. Currently, the largest populations reside on Maui and Hawai'i. Historical accounts and museum specimens suggest the species was widespread and common on most of the MHI.

LOCATION AND CONDITION OF KEY HABITAT: Historical records indicate that Blackburn's sphinx moth mostly occurred in coastal, lowland, and dry forests in areas receiving

less than 127 centimeters (50 inches) of rain per year. Human modification of Hawaiian landscapes has greatly reduced these communities; for example, more than 90 percent of Hawaii's dry forests have been destroyed. Depending on the location and elevation, the composition of the plant species in moth habitat varies considerably. However, some common native plants found in areas where the species occurs include lama (*Diospyros sandwicensis*), 'ohe (*Reynoldsia sandwicensis*), hao (*Raouolfia sandwicensis*), 'āla'a (*Pouteria sandwicensis*), āulu (*Pisonia sandwicensis* and its varieties), 'a'ali'i (*Dodonaea viscosa*), naio (*Myoporum sandwicense*), and wiliwili (*Erythrina sandwicensis*). The populations on Maui and Hawai'i are primarily associated with 'aiea (*Nothocestrum* spp.) trees. Perhaps the largest stand of 'aiea trees in the State are located on Maui in the Kanaio Natural Area Reserve. Other large stands are found on Kaua'i, O'ahu, Moloka'i, Lāna'i, and the island of Hawai'i. On Moloka'i, potential moth habitat consists of mixed-species mesic and dry forests with both native and non-native plants (see below). On Kaho'olawe, caterpillars currently feed on the non-native tree tobacco, as do populations on Maui and the island of Hawai'i. Although the species will feed on non-native plants, primary constituent elements of critical habitat as designated by the USFWS include the endemic larval host plant species *N. latifolium* and *N. breviflorum*, and native nectar sources for adults including koaliawa, other species of *Ipomoea*, maiapilo, and 'ilie'e. These species are likely superior to non-natives in that they are more persistent, especially during drought conditions. In 2003, 40,420 hectares (99,433 acres) of critical habitat was designated by the USFWS on the islands of Hawai'i, Maui, Moloka'i, and Kaho'olawe.

THREATS: Historically, habitat loss and degradation due to ranching, introduced plants and animals, human development, and wildfire reduced the quantity and quality of native habitats. Current threats include non-native ants, especially the big-headed ant (*Linepithema humile*) and several species of parasitic flies and wasps. Although little documentation exists of direct predation, native insects have been eliminated in areas where big-headed ants occur, and several alien wasp species have been reported parasitizing species closely related to Blackburn's sphinx moth. All species of *Nothocestrum* are declining. Because of development, competition from non-native species, browsing by cattle and feral goats, and wildfire, the larval host plant, *N. breviflorum* on the island of Hawai'i, and the potential host plant, *N. peltatum* on Kaua'i, are federally listed as endangered. Finally, small populations are plagued by a variety of potentially irreversible problems that fall into three categories: demographic, stochastic, and genetic; the former are usually most problematic. For example, given that the species inhabits dry habitats, natural variation in rainfall can result in reduced food availability and negatively affect moth populations.

CONSERVATION ACTIONS: The Kanahā Pond Sanctuary dune restoration project on Maui is planting native host plants in response to observations of caterpillars on plants in the restoration area. In addition to common statewide and island conservation actions, specific management directed toward Blackburn's sphinx moth should include the following:

- Restoration of habitat (e.g. dry and mesic shrub land and forests) and increased protection of currently occupied habitats, especially those supporting host plants.
- Support cultivation and restoration of *Nothocestrum* species.
- Restore *Nothocestrum* on Kaho'olawe to support moth populations.
- Re-establish moth populations throughout their historic range.
- Prevent introduction of non-native invertebrates that may pose a risk to existing moth populations.

MONITORING:

- Continue surveys of populations in known and potential habitats.
- Continue monitoring of *Nothoestrum* species.
- Monitor non-native plant and animal populations in known and potential moth habitat.

RESEARCH PRIORITIES:

- Evaluate the species' habitat needs, population status, and life history.
- Evaluate limiting factors on the species, possibly through controlled release trials. This should be geared towards establishing additional populations across the former range of the species.

References:

U.S. Fish and Wildlife Service. 2003. Designation of Critical Habitat for the Blackburn's Sphinx Moth: final rule. Federal Register 68:34710-34766.

U.S. Fish and Wildlife Service. 2005. Recovery plan for the Blackburn's Sphinx Moth (*Manduca blackburni*). Portland, Oregon.

U.S. Fish and Wildlife Service. 2009. Blackburn's Sphinx Moth (*Manduca blackburni*) 5-Year Review: Summary and Evaluation. Pacific Islands Fish and Wildlife Office. Honolulu, Hawai'i.