

necessary so that the moth can be reclassified to threatened and ultimately removed from the list of endangered and threatened species. Because a recovery plan for the moth has not yet been completed, in making this determination we evaluated the remaining potential habitat, the biological and life history characteristics of the moth, and the best available scientific information on conservation planning to determine what will be required to ensure viable populations of this species. However, should our understanding of what areas support essential features for the conservation of the moth change after completing the recovery planning process, we may revise the existing critical habitat designation accordingly.

Primary Constituent Elements

In accordance with section 3(5)(A)(i) of the Act and regulations at 50 CFR 424.12(b), in determining which areas to designate as critical habitat, we are required to base critical habitat determinations on the best scientific and commercial data available. We consider those physical and biological features (primary constituent elements) that are essential to the conservation of the species and that may require special management considerations or protection. These include, but are not limited to: Space for individual and population growth and for normal behavior; food, water, or other nutritional or physiological requirements; cover or shelter; sites for breeding, reproduction, or egg laying; and habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of a species.

The primary constituent elements for the Blackburn's sphinx moth include specific habitat components identified as essential for the primary biological needs of foraging, sheltering, maturation, dispersal, breeding, and egg laying, and are organized by life cycle stage. The primary constituent elements required by the Blackburn's sphinx moth larvae for foraging, sheltering, maturation, and dispersal are the two documented host plant species within the endemic genus *Nothoecstrum* (*N. latifolium* and *N. breviflorum*), and the dry and mesic habitats between the elevations of sea level and 1,525 m (5,000 ft) and receiving between 25 and 250 cm (10 and 100 in) of annual precipitation. The primary constituent elements required by Blackburn's sphinx moth adults for foraging, sheltering, dispersal, breeding, and egg production are native, nectar-supplying plants including, but not limited to,

Ipomoea indica and other species within the genus *Ipomoea*, *Capparis sandwichiana*, and *Plumbago zeylanica*, and within the dry to mesic habitats between the elevations of sea level and 1,525 m (5,000 ft) and receiving between 25 and 250 cm (10 and 100 in) of annual precipitation.

Both the larval and adult food plants are found in undeveloped areas supporting mesic and dry habitats, typically receiving less than 250 cm (100 in) of rain per year and are located between the elevations of sea level and 1,525 m (5,000 ft). Vegetative communities in these areas include native plants, and in some instances, introduced plant species (A. Medeiros, pers. comm. 1998; Roderick and Gillespie 1997; Van Gelder and Conant 1998).

Although Blackburn's sphinx moth larvae feed on the nonnative *Nicotiana glauca*, we do not consider this plant to be a primary constituent element for the designation of critical habitat. As previously discussed, the native *Nothoecstrum* species are more stable and persistent components of dry to mesic forest habitats than *Nicotiana glauca*. *Nicotiana glauca* is a short-lived species that may disappear from areas during prolonged drought (A. Medeiros, pers. comm. 1998), or during successional changes in the plant community (F. Howarth, pers. comm. 2001; Symon 1999). Many studies have shown that insects, and particularly lepidopteran larvae, consume more food when the food has a relatively high water content (Murugan and George 1992). Relative consumption rate and growth have been reported to decrease for many sphingids closely related to the Blackburn's sphinx moth when raised on host plants or diets with a relatively low water content (Murugan and George 1992). *Nicotiana glauca*'s vulnerability to drought conditions suggests that its water content frequently may not be suitable for optimal growth of Blackburn's sphinx moth larvae.

The restoration of native host species for the moth and other endangered species may also require the control or elimination of nonnative vegetation, potentially including *Nicotiana*. Additionally, unlike the *Nothoecstrum* species, *Nicotiana glauca* is more likely to occur in habitats less suitable due to their occupation by alien insect predators (D. Hopper, *in litt.* 2000, 2002; Symon 1999). Therefore, in comparison with *Nicotiana glauca*, the native *Nothoecstrum* species better fulfill the primary biological needs of the moth larvae. For all of these reasons, we are not considering *Nicotiana glauca* as a

primary constituent element for the designation of critical habitat at this time.

Criteria Used To Identify Critical Habitat

We identified critical habitat areas essential to the conservation of Blackburn's sphinx moth in the primary locations where it currently occurs or has been known to occur. We have designated sufficient critical habitat at each site to maintain self-sustaining populations of Blackburn's sphinx moth at each of these locations.

During the development of this rule, we considered the role of unoccupied habitat in the conservation of Blackburn's sphinx moth. Due to the historic loss of the habitat that supports this species, we believe that future conservation and recovery of this taxon depends not only on protecting it in the limited area that it currently occupies, but also on providing the opportunity to expand its distribution by protecting currently unoccupied habitat that contains the necessary primary constituent elements within its historic range.

To help achieve our goal of conservation of Blackburn's sphinx moth, we are including one critical habitat unit on Molokai, despite the fact that the moth has not been documented there in recent years. The area is located within dry to mesic forest on the southern uplands of Molokai and contains both larval and adult stage host plants. By allowing the moth to recover to this area, either through its own ability or with assistance, the threat of extinction due to natural catastrophe occurring within the currently, close-grouped populations will be minimized. We believe the site is essential to the conservation of the species because it is the most appropriate site for a reestablishment effort. The combination of limited range, few populations, and restricted habitat, makes the moth susceptible to extinction or extirpation due to random events, such as disease, hurricanes, or other occurrences (Shaffer 1981, 1987; Primack 1993; Meffe and Carroll 1994). Such events are a concern when the number of populations or the geographic distribution of a species is severely limited, as is the case with Blackburn's sphinx moth. Establishment of the Molokai unit for the moth is likely to prove important in reducing the risk of extinction due to such catastrophic events.

Given the large size and strong flight capabilities of the Blackburn's sphinx moth, the species is believed to use large areas of habitat. Therefore, moth