

## Forest Birds

# Palila

*Loxioides bailleui*



Photo: DOFAW

### SPECIES STATUS:

Federally listed as Endangered

State listed as Endangered

State recognized as Endemic

NatureServe Heritage Rank G1 – Critically imperiled

IUCN Red List Ranking – Endangered

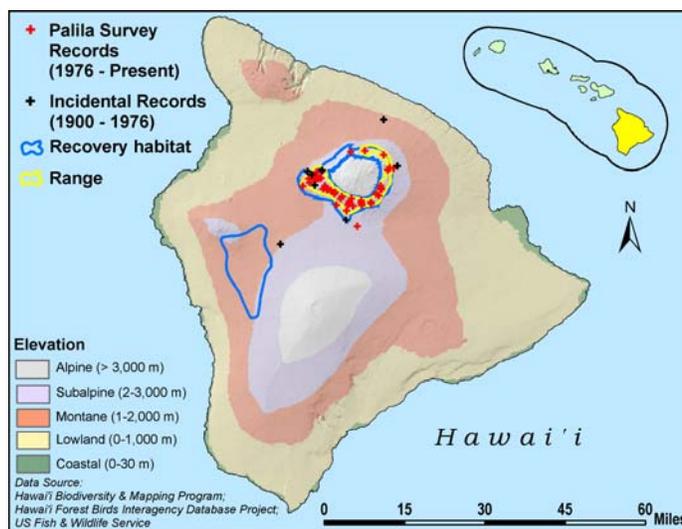
Draft Revised Recovery Plan for Hawaiian Forest Birds

– USFWS 2003

Critical Habitat Designated 1977

**SPECIES INFORMATION:** The palila is a finch-billed Hawaiian honeycreeper (Family: Fringillidae) whose life history and survival is linked to māmane (*Sophora chrysophylla*), an endemic dry-forest tree in the legume family. Males and females are similar, having a yellow head and breast, greenish wings and tail, a gray back, and white underparts. Males have a black mask, and females have less yellow on the back of their heads and a gray mask. Approximately 90 percent of the palila's diet consists of immature māmane seeds; the remainder consists of māmane flowers, buds, leaves, and naio (*Myoporum sandwicense*) berries. Caterpillars and other insects comprise the diet of nestlings, but also are eaten by adults. Māmane seeds have been found to contain high levels of toxic alkaloids, and palila use particular trees for foraging, suggesting that levels of alkaloids may vary among trees. Individuals will move limited distances in response to the availability of māmane seeds. Palila form long-term pair bonds, and males perform low advertisement flights, sing, chase females, and engage in courtship feeding prior to breeding. Females build nests, usually in māmane trees, and males defend a small territory around the nest tree. Females mostly incubate eggs, brood nestlings and feed young with food delivered by male. First-year males sometimes help a pair by defending the nest and feeding the female and nestlings. Limited genetic testing found no evidence suggesting that helpers father the nestlings they were assisting, although more data are needed. Fledglings are dependent on their parents for three to four months, during this time they learn and practice foraging skills. The availability of green māmane seeds strongly influences the number of nesting attempts in a given year. In poor years, not all pairs will attempt to nest.

**DISTRIBUTION:** Palila are mostly restricted to the western slopes of Mauna Kea between 2,000 and 2,850



meters (6,500 – 9,250 feet) elevation; small scattered populations exist on the southern, northern, and eastern slopes. Historically, palila were common in all māmane forests. Currently, the species occupies approximately 10 percent of their historic range on the island of Hawai'i. Subfossil evidence indicates palila also occurred in māmane forest on O'ahu and Kaua'i.

**ABUNDANCE:** Annual population surveys between 1998 and 2005 yield a mean population estimate of  $3,268 \pm 190$  (SE) individuals. In 2005, 2,909 birds were detected. Palila population estimates are variable among years, which may be an artifact of survey techniques or survey timing.

**LOCATION AND CONDITION OF KEY HABITAT:** Palila are restricted to māmane and māmane/naio forests, and densities are highest in areas at 2,300 meters (7,550 feet) elevation with large māmane trees and a high proportion of native shrubs. Up to 96 percent of the population and nearly all the successful breeding occurs in a 30 square kilometer (11.5 square mile) area on the western slope of Mauna Kea. In addition to having high quality habitat, this area is characterized by steep terrain. The latter is important because māmane occurring at different elevations flower and fruit at different times, ensuring that māmane seeds are always available. This is especially important during the breeding season. Most of the habitat in the species' range has been severely degraded by grazing ungulates, particularly mouflon sheep (*Ovis musimon*), and the spread of non-native plant species, especially fire-prone grasses. Most of the palila's current range occurs in the Mauna Kea Forest Reserve and is managed by the State of Hawai'i.

**THREATS:** Palila are likely susceptible to the same factors that threaten other native Hawaiian forest birds, including: loss and degradation of habitat, predation by introduced mammals, and disease. For palila populations, the following are of particular concern:

- **Feral ungulates.** Historically, large numbers of sheep (*Ovis* spp.) grazed on Mauna Kea, reducing the density and productivity of māmane trees. In addition to limiting the regeneration of other native plants, the sheep also caused soil erosion. More recently the introduction of mouflon sheep (*Ovis musimon*) has further degraded habitat.
- **Invasive plants.** Soil disturbance caused by sheep facilitated the spread of invasive plants. Fire-adapted grasses, such as fountain grass (*Pennisetum clandestinum*), are especially problematic in that they increase the risk of fire. Invasive plants also reduce the recruitment of native plants.
- **Fire.** A single large fire could severely limit food resources for the entire palila population.
- **Predation.** Predation by rats (*Rattus* spp.), feral cats (*Felis silvestris*), and the pueo (*Asio flammeus sandwichensis*) is an important factor limiting palila populations. In some areas, black rats (*R. rattus*) and feral cats may be responsible for up to 40 percent of nest failures, and feral cats have been documented preying on adults.
- **Disease.** Although palila are very susceptible to mosquito-borne diseases, mosquitoes do not occur at the elevation at which palila currently occur. However, disease almost certainly was important in the species decline and prevents palila from recolonizing low-elevation habitat.
- **Non-native insects.** Yellow jackets (*Vespula pensylvanica*) and Argentine ants (*Linepithema humile*) threaten the native caterpillars that nestlings depend on for food.

- Severe weather. The species' current range exposes them to severe weather that results in mortality in some years. Freezing temperatures, heavy rains, droughts, and high winds all can result in egg and nestling mortality.
- Population size. 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. Demographic factors include skewed sex ratios and stochastic factors include natural disasters. Habitat fragmentation exacerbates demographic and genetic problems.

**CONSERVATION ACTIONS:** To date, a number of conservation efforts have been conducted to protect the māmane woodlands specifically for the protection and recovery of the palila. In the first half of the 20<sup>th</sup> century, 46,000 sheep as well as smaller numbers of feral cattle (*Bos tarus*), goats (*Capra hircus*), and pigs (*Sus scrofa*) were removed from māmane forests. This allowed the regeneration of the māmane trees on which the palila depend. Beginning in the late 1970s, control measures to reduce mouflon sheep numbers were initiated. Considerable research has been conducted on palila including estimating population size and determining their geographic range, documenting home range size, dispersal behavior, reproductive parameters, limiting factors, and habitat characteristics. Ongoing research mostly focuses on quantifying limiting factors, especially predation, food availability, and genetics as well as refining māmane restoration techniques. Beginning in 1993, translocations were conducted on an experimental basis to determine if new breeding populations could be established. In 2004, 32 birds were translocated and in 2005, 75 birds were moved. Although most birds return to their natal territory, approximately 25 percent remained at translocation sites. In 1996, a captive propagation program was initiated and palila have successfully bred in captivity. Between 2003 and 2004, 15 captive-raised birds were released into the wild. Initial attempts at outplanting māmane have been successful in areas where competing non-native vegetation is sparse. In addition to the above efforts, palila likely have benefited from management activities designed to conserve other endangered forest birds in Mauna Kea Forest Reserve and elsewhere on the island of Hawai'i. These efforts include fencing, ungulate and small mammal control, forest restoration, habitat monitoring, and studies of disease and disease vectors. In addition to these efforts, future management specific to the palila will likely include the following:

- Stabilize and increase at least one of the small populations using translocation or establish a new self-sustaining population while continuing to intensely manage the primary population. These efforts must include the restoration and regeneration of māmane forest as well as control of mammalian predators and parasitoid wasps that threaten food sources.
- Evaluate sites throughout the species' historic range for potential māmane restoration efforts. Appropriate areas should have a range of elevation or rainfall gradients to ensure that food resources are available throughout the year. These sites would eventually serve as re-introduction sites.
- Develop a comprehensive fire-management plan.
- Increase public education and involvement in palila recovery. Volunteer opportunities exist in habitat restoration efforts, monitoring weeds and predators, and education.
- Removal of feral sheep and mouflon from palila habitat.
- Continue protection and management of wildlife sanctuaries and refuges.

**MONITORING:** Continue forest bird surveys and habitat monitoring. This information is needed to assess the efficacy of habitat management efforts.

**RESEARCH PRIORITIES:** Research priorities for most Hawaiian forest birds include developing improved methods for controlling rats and feral cats in native forests, determining the ecological requirements of *Culex* mosquitoes at mid- and high-elevation forests, and developing methods to control mosquito populations. Research priorities specific to the palila include the following:

- Refine survey methods.
- Further refine techniques to facilitate the establishment of new populations.
- Develop methods to control and eradicate the most harmful non-native plants and non-native insects that threaten native insect food sources.

**References:**

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Scott JM, Mountainspring S, Ramsey FL, Kepler CB. 1986. Forest bird communities of the Hawaiian islands: their dynamics, ecology and conservation. Lawrence, (KS): Cooper Ornithological Society.

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