



Hawaii Forest Bird Interagency Database Project: Collecting, Understanding, and Sharing Population Data on Hawaiian Forest Birds

An endangered native avifauna

The forest birds of the Hawaiian Islands are distinguished by the diversity of endemic forms derived from a small number of ancestral colonists. However, the avifauna has been decimated by human activities both before and after Western contact. At least 71 species or subspecies disappeared before the arrival of Capt. James Cook in 1778, and an additional 24 went extinct after 1778, of which 11 were lost since the 1960s alone. Many of the remaining Hawaiian bird populations are declining or are in danger of extinction. Vigorous efforts to survey and monitor bird populations over the past 3 decades have generated considerable information from which to assess the current status of the Hawaiian forest birds.

Management of forest birds and their habitat is driven by such questions as:

- How large is a species' population?
- How are birds distributed across the landscape, and where are the populations concentrated?
- What proportion of populations lie within and outside protected areas?
- What habitat associations are favored by native and endangered species?
- Have past restoration projects resulted in increases in native and endangered bird numbers? What conservation practices will benefit bird species in the future?
- How can bird surveys be improved to better predict distributions and track population numbers?
- How might human activities and climate change affect the distribution of bird populations?

Synthesizing over 30 years of survey data

In collaboration with a broad group of partners (see next section), scientists at the USGS Pacific Island Ecosystems Research Center have developed the Hawai'i Forest Bird Interagency Database Project (HFBIDP) to integrate the wealth of information generated from forest bird surveys conducted since the mid-1970s on the major Hawaiian Islands. The information is being used by the HFBIDP to assess species status and to develop statistical models for predicting and mapping the association of bird abundance with habitat attributes for regions across Hawai'i. The general approach involves:

- Collating into a relational database the enormous amount of count data (nearly 1 million records) gathered from almost 500 variable circular plot surveys.



The endangered 'akiapōlā'au (*Hemignathus munroi*) uses its elaborate, two-part beak to extract insect larvae from the bark of tree trunks and branches. Sadly, its abundance has declined precipitously throughout much of its fragmented range. However, conservation practices that include forest restoration and the cultivation of *Acacia koa* (a valuable native hardwood tree) in proximity to native forest can provide foraging habitat and support high densities of 'akiapōlā'au. (Photo © Jack Jeffrey)

- Integrating bird abundance with habitat information derived from digital maps of vegetation, elevation, and climate.
- Developing models of bird-habitat associations to predict abundance across the landscape and areas not surveyed.
- Determining the likelihood of detecting individuals of a species given the effects of weather, observer ability, and time of day and year.
- Applying detection probabilities to observed bird abundance to account for unobserved individuals and adjust estimates of density and population size.
- Examining regional and state-wide trends in bird abundance and occurrence.
- Assessing the effectiveness of surveys in monitoring species status.
- Sharing data and study results with the public, researchers and resource managers.



The 'akepa (*Loxops coccineus*), an endangered honeycreeper. (Photo © Jack Jeffrey)



A collaborative partnership

The HFBIDP is the result of a unique collaboration between the USGS Pacific Island Ecosystems Research Center and a number of partner universities, private landowners, state and federal agencies, and non-governmental organizations. Partners collaborate by contributing survey data, financial support, and/or helping disseminate results. Collaborators include:

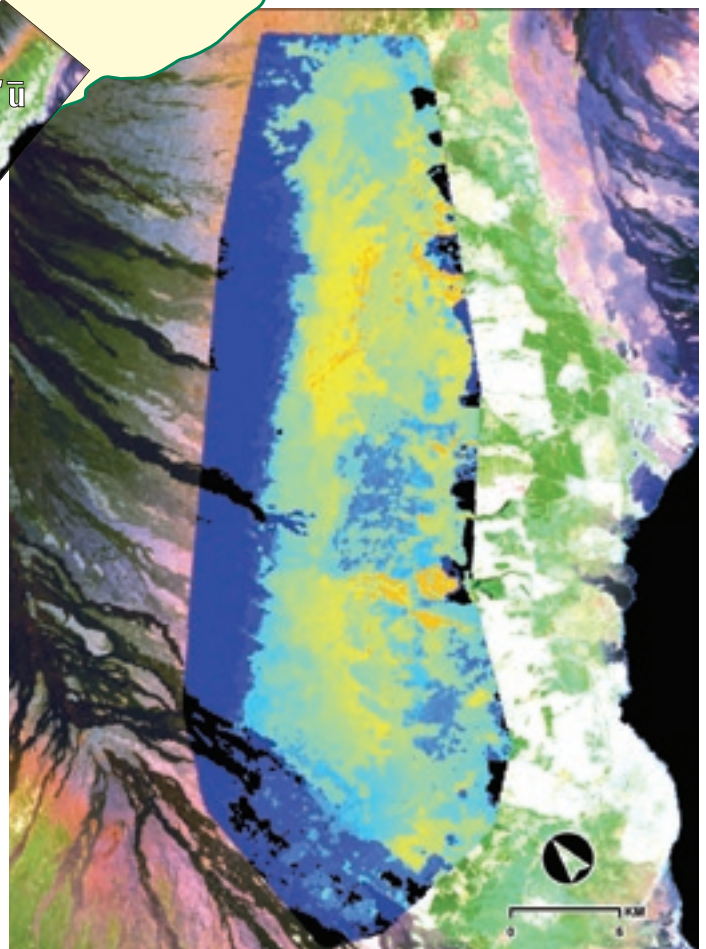
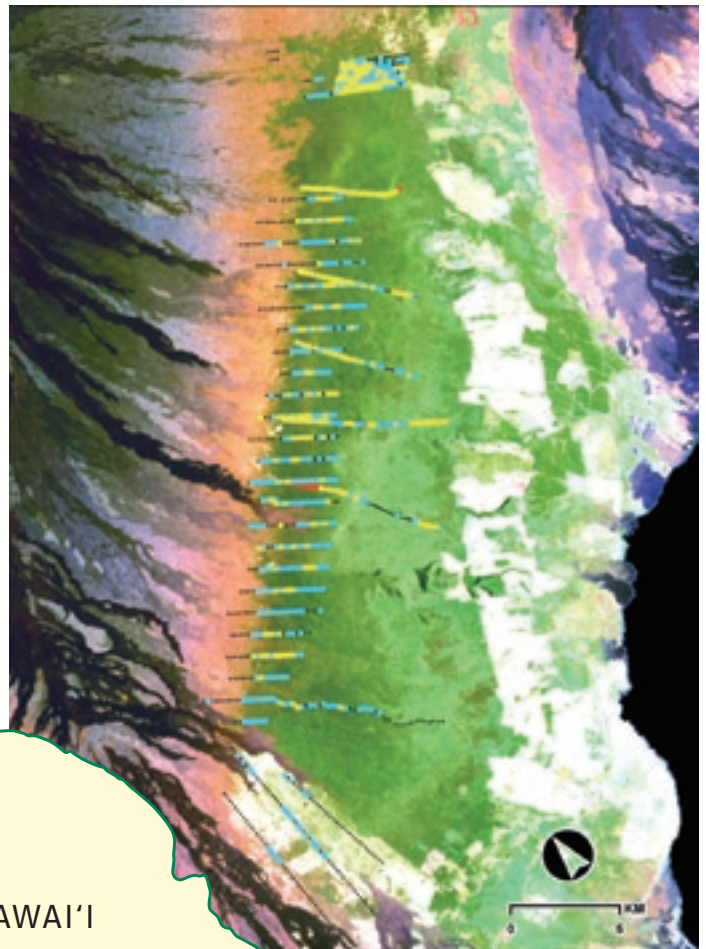
- Hawai‘i Division of Forestry and Wildlife
- Hawai‘i Cooperative Studies Unit – University of Hawai‘i at Hilo
- Kamehameha Schools
- National Science Foundation
- Natural Heritage Program – Hawai‘i
- The Nature Conservancy – Hawai‘i
- Pacific Cooperative Studies Unit – University of Hawai‘i at Mānoa
- US Fish and Wildlife Service
- US Forest Service
- US National Park Service
- USGS Hawai‘i Gap Analysis Program
- USGS Pacific Basin Information Node
- USGS Pacific Island Ecosystems Research Center

Application to Conservation Strategies

Protecting core bird populations. The identification of population concentrations can be used to prioritize habitats for conservation and monitoring. High priority areas can also serve as the basis for public and private landowners to develop conservation partnerships. For instance, research by the HFBIDP supports the monitoring and habitat protection activities of the ‘Ōla‘a-Kīlauea Partnership for areas with high bird species richness on Hawai‘i Island. Significant populations shown to reside outside of areas managed for conservation may also result in changes to management planning and improved habitat protection.

Guiding habitat management. HFBIDP research also seeks to identify habitat available for restoration or bird reintroduction. Feral ungulate (pig, cattle, goat and sheep) removal in the newly acquired Kahuku Ranch parcel of Hawai‘i Volcanoes National Park is expected to improve degraded forest bird habitat, particularly for species such as *Hawai‘i ‘elepaio* (*Chasiempis sandwichensis*) and ‘ōma‘o that are dependent on food resources from the forest understory. Continued monitoring will be needed to assess how populations respond to management actions.

Observed bird abundance (colored points in graphic at top right) is modeled with habitat information to derive predicted abundance and distribution across the landscape (blue to red corresponds with low to high; bottom right). In this example, the distribution of ‘ōma‘o (*Myadestes obscurus*) abundance is shown for the Ka‘ū District, Hawai‘i Island (inset, above). Forest is shown in green in these Landsat ETM images.





The Hawai'i Forest Bird Interagency Database Project has analyzed bird distributions and trends from almost 500 variable circular plot surveys throughout the state of Hawai'i (left). (Photo by P.M. Gorresen)

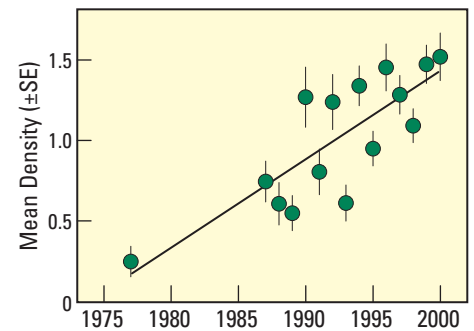
Hawai'i 'elepaio (top) and *ōma'ō* (above) are examples of native species that benefit from ungulate exclusion and the protection and restoration of the forest understory. (Photos © Jack Jeffrey)

Assessing population trends. Detecting incipient downward trends in bird populations is a critical step in formulating conservation efforts. For example, analysis by the HFBIDP of declines in endangered and once-common bird populations on Hualālai Mountain, Hawai'i Island, have lent added urgency to the state's effort to complete ungulate removal in the Pu'u Wa'awa'a Wildlife Sanctuary. Likewise, identifying upward trends can help validate past or current management actions. Native bird species have shown stable or increasing trends since the establishment of the Hakalau Forest National Wildlife Refuge on Hawai'i Island. On-going studies by the

HFBIDP will help determine how feral ungulate removal and reforestation in the refuge affect bird recovery.

Improving population monitoring.

Careful examination of survey data has made evident inefficiencies and limitations in current monitoring programs. The trends of rare species or those with highly variable abundance have been found to be poorly tracked with count surveys. Monitoring these species will require more focused efforts that examine other measures of status such as territory mapping, survival, reproduction, etc. Assessments of variability in bird numbers as a function of survey effort have also shown that there is a species-



The density of the endangered Hawai'i Creeper (*Oreomystis mana*) has increased at the Hakalau Forest National Wildlife Refuge (right) since habitat restoration activities began there in 1985. The careful monitoring of bird trends can help managers evaluate the effectiveness of conservation practices. (Photo © Jack Jeffrey)



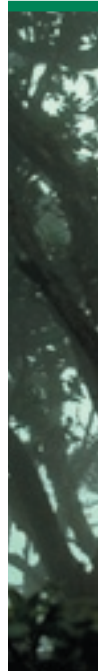
Photo © Jack Jeffrey

specific “optimal” range of samples, below which trends might not be detected and above which cost exceeds gain in information. Analyses of survey data also indicate that multi-species surveys may not coincide with peak vocalization periods for certain species and thereby underestimate bird numbers. For such species, better survey timing can result in larger population estimates. For example, recent surveys targeting the endangered ‘akiapōlā‘au have shown the population in Ka‘ū, Hawai‘i Island, to be considerably larger than previously estimated.

Collaborative efforts and sharing analytical results. HFBIDP team members have worked with the Hawai‘i GAP Analysis Program to develop bird range maps and species richness models used for identifying geographic gaps and priorities in conservation areas. HFBIDP studies are also contributing to the development of long-term survey programs such as the Inventory and Monitoring Program of the National Park Service. In addition, statewide appraisals of species status and trends have been recently completed and have contributed to extinction risk designations by the World Conservation Union and to Hawai‘i’s Comprehensive Wildlife Conservation Strategy. Detailed regional studies of bird distribution and trends are being completed for all major forest bird populations. These analyses contribute to the management planning at private, state and federal levels.

Identifying the interface of bird populations and disease zones. The mapping of predicted bird numbers can quantify the proportion of a population and the extent of bird habitat that lie within or outside areas harboring avian disease. About one-third of the ‘i‘iwi (*Vestiaria coccinea*; above) range in Ka‘ū is located

between 1,000 and 1,500 meters, a zone at which avian malaria (*Plasmodium relictum*) transmission is considered to be high and which may be contributing to declining numbers of ‘i‘iwi in the region. Bird distribution maps can help identify the areas in which the establishment of ungulate exclosures would be most effective in reducing the habitat disturbance that promotes disease transmission.



For more information:

See the HFBIDP website at the USGS Pacific Island Ecosystems Research Center: biology.usgs.gov/pierc/HFBIDPSite/HFBIDPHome.htm

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