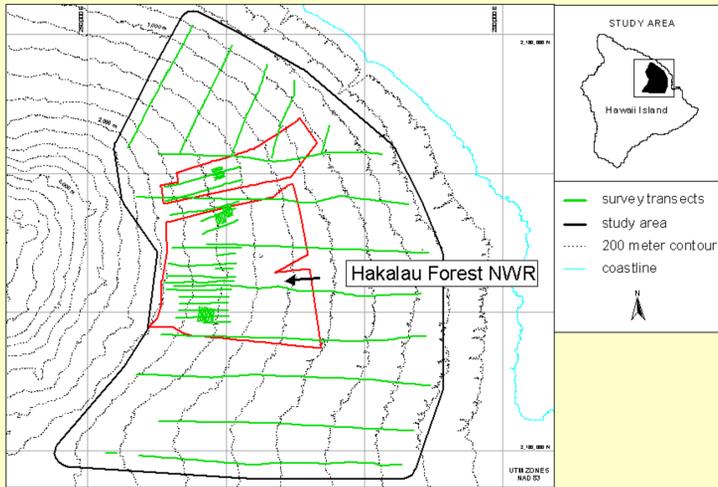


Population estimates, distribution and habitat associations of birds in a Hawaiian rainforest refuge

RICHARD J. CAMP, MARCOS GORRESEN, BETHANY L. WOODWORTH, and THANE K. PRATT
 USGS – Pacific Island Ecosystems Research Center, Hawaii Volcanoes National Park

INTRODUCTION: The Hakalau Forest National Wildlife Refuge (HFNWR) harbors populations of native forest birds critical to preservation and recovery efforts. To assist in these objectives, the Hawaii Forest Bird Interagency Database Project (HFBIDP) has modeled habitat associations, species distributions, and population estimates for native and alien forest birds within the HFNWR region. Results are presented for four native species: Hawaii Amakihi (*Hemignathus virens*), Hawaii Creeper (*Oreomystis mana*), Akepa (*Loxops coccineus*) and Akiapolaau (*Hemignathus munroi*).

METHODS: The study area, situated on the northeastern slopes of the Island of Hawaii, encompasses a 648 km² region inclusive of the HFNWR. Count data from 66 variable circular plot surveys spanning 24 years (1977 – 2000) were analyzed. See adjacent poster “Spatial modeling of Hawaiian forest bird densities” for a description of habitat variables and modeling methods.



Sign of habitat variables significantly ($P < 0.05$) associated with bird density in regression and correlation analyses.

Variable	Amakihi	Akepa	Creeper	Akiapolaau
ohia cover	-	+	+	+
koa cover	+	+	+	+
grass cover	+	-	-	-
closed canopy	-	+	+	+
open canopy	-	-	-	-
sparse canopy	-	-	-	-
high canopy	-	+	+	+
tree fern	-	-	-	-
matted fern	-	-	-	-
Passiflora	+	-	-	-
richness	+	-	-	-
slope	+	-	+	-
temperature	-	-	-	-
rain	-	-	-	+
elevation	+	+	+	+

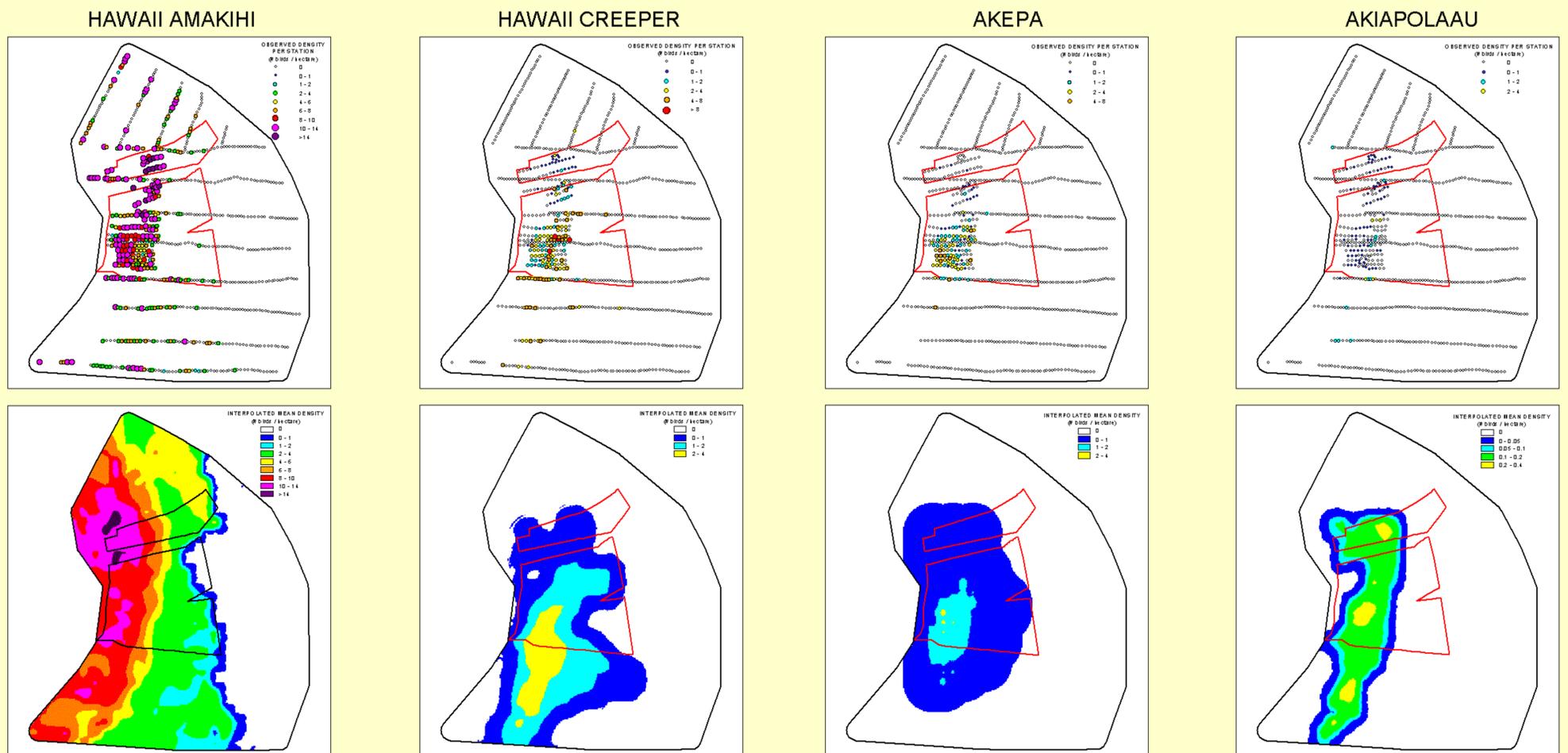
Species	Population Estimates
Amakihi	245,509
Creeper	22,234
Akepa	7,447
Akiapolaau	1,445

RESULTS: Amakihi shows a positive association with drier koa-dominated woodland and forests, particularly in areas without tree- and matted-ferns. Its generalist habits are apparent in the positive relationship with heterogeneous vegetation types (i.e., high richness), inclusive of areas with some grass cover. The positive association with elevation and negative association with temperature may be caused by the inter-correlation of these variables with rain.

Akepa and Creeper are positively associated with high stature and closed canopied ohia and koa forests. They avoid areas with much grass cover, open forest canopy, *Passiflora* infestations, and landscapes rich in vegetation types. The positive relationship to elevation is probably caused by the effects of disease, particularly avian malaria, prevalent at lower elevations. The negative relationship of density with temperature may be linked to the negative correlation between temperature and elevation.

Akiapolaau are positively associated to closed canopy ohia and koa forests within the study area. Its rarity precluded the identification of other significant habitat variables.

The density surfaces and population estimates indicate that the Amakihi population is widespread and sizable, the Creeper and Akepa populations are small and locally distributed, and the Akiapolaau population is very small and restricted to a narrow belt of habitat.



DISCUSSION: The population estimates and species distribution maps produced by the HFBIDP are a much needed update of the Scott et al. (1986) estimates from 1977 survey data. Creeper, Akepa and Akiapoolau populations are small and regionally restricted, and are therefore vulnerable to extinction from demographically and environmentally stochastic events. Considerable portions of the regional population of each species lie outside of the protection afforded by the HFNWR. The resident populations in these areas are vulnerable to habitat degradation as a result of grazing and browsing ungulates.