Islands exhibit the planet’s most unique flora and fauna, but the diversity on islands is also vulnerable to impending forces of global change. Scattered across the Pacific Ocean >20,000 islands range from sandspits to large islands and support some of the most unique biotic assemblages. Shaped by island size, topography and degree of isolation from other landmasses, including continents and other islands, insular systems support the largest number of endemic flora and avifauna. Because of the mobility associated with flight, birds have colonized the most remote islands, and are one of the most important taxa in insular systems.

The unique characteristics of islands provide habitat and resources for of avian species, including resident, migrants and seabirds. For many species, islands and archipelagos extremely important, they represent full habitat ranges, and for others may provide key resources, including migration stopover sites and suitable habitat for reproduction and nesting. Insular organisms are often naïve to foreign forces, and island species are susceptible to introduced competitors and predators from continental origins and the effect of anthropogenic processes. Almost without exception, island habitats and species have been impacted by invasive species and anthropogenic processes – islands systems exhibit the highest rate of avian extinctions. Habitat alteration and introduced species often have detrimental effects in insular biota. The effects range from native habitat disturbance to the annihilation of native species, including endemics (e.g., Tern island and Guam).

Micronesia is a subregion of Oceania in the western Pacific Ocean. It encompasses >2,200 islands spread in four main archipelagos, including the Caroline Islands, Gilbert Islands, Mariana Islands and Marshall Islands. Composed of small islands, low atolls and high volcanic islands (e.g., Majuro and Pohnpei), the region has been exposed to anthropogenic processes for several thousand years. However, anthropogenic forces and introduced species had different effects on each island.

Located in the Caroline archipelago, which includes >550 islands, Pohnpei Island, Federated States of Micronesia, is considered an emerald of the Pacific. The island maintains large tracks of native forest. Its flora includes more than 110 endemic species of plants, and it support the largest mangrove forest in the region. Pohnpei is characterized by large gallery forest, and the lowest montane cloud forest in the world. Pohnpei’s forest provide habitat for more than 40 avian species, including 6 Pohnpei endemics. However, changes in culture and forest use have originated substantial landscape changes on the island landscape in the last three decades.

The Pohnpei avian community has not been studied thoroughly. Knowledge of life history traits is limited for several species, including birds common throughout Micronesia and Pohnpei. Prior to this study only two systematic surveys had been conducted. Pohnpei’s first avian survey was executed in 1983 by J. Engbring and colleagues (Engbring et al. 1990), and the second survey was conducted in 1994 by D. Buden (Buden 2000). Buden (2000) reported a large decline in the number of birds detected on Pohnpei between the 1983 and 1994 surveys. The total number of birds detected in six elevation zones (sea level [Mangrove], 0-100m, 100-200m, 200-400m, 400-600m, 600-800m) declined between 67-80%, and for 14 of 29 species studied, detections declined more than 50% in lowlands and highlands (< 200 amsl <). During the same period of time large tracks of native forest were transformed to anthropogenic habitats, mainly through new cultivation of local staple crops and “sakau” (Piper methysticum). Unlike other islands in the
region, Pohnpei does not have introduced snakes (e.g., Guam) and introduced species (e.g., rats, lizards, and birds) are present in low densities; suggesting that habitat alterations are the major drivers of Pohnpei avifauna populations.

This thesis presents two analyses. In the first, we incorporated historic and current surveys (Engbring et al. 1990, Buden 2000, and Oleiro and Kesler 2012) and vegetation information in three different ways to identify avian population responses to landscape changes that occurred across three decades. We compared detection rates for 21 species that were recorded in 2012 with those reported by Buden (2000). We assessed whether the declining trend reported between 1984 and 1994 continued in the following decade. Overall, detection rates for the endemic Rukia longirostra increased the most (359%) and declined the most for Anous spp. (-58%). However, when detection rates were analyzed by elevation zone different patterns were observed. Six species showed reduced detection rates in all elevation zones, 3 species elucidated increasing detection rates in all elevation zones, and 12 species showed a mixture of increasing and declining detection rates, depending the elevation zone. These results indicated that changes were not constant across elevation zones or among species.

To investigate whether detection rate changes across years were associated with habitat change, we created a series of generalized models that included detection rates as a response variable and the proportion of disturbed habitat at each elevation zone as an explanatory variable. Results indicated that detection rates for 2 of 16 were positively associated with anthropogenic habitat (Myzomela rubratra and Aerodramus vanikorensis) and that 8 of 16 were negatively associated (Phaethon lepturus, Anous spp., Gygis alba, Ptilinopus porphyraceus, Ducula oceanica, Trichoglossus rubiginosus, Myiagra pluto and Rhipidura kubaryi). We speculate that positive associations with agroforest and forest edge are present because they create additional foraging areas for M. rubratra and A. vanikorensis. Disturbed habitat was negatively associated with habitat specialist species, including 3 of the 6 endemics (T. rubiginosus, M. pluto, and R. kubaryi).

Pohnpei habitats change gradually among elevation zones. To investigate whether Pohnpei birds are generalists or specialists we regressed detection rates across elevation zones and tested whether each species was evenly distributed across the island, or whether there were associations with specific elevation zones. Regression analysis indicated that M. rubratra, Todiranphus reichenbachii and T. rubiginosus are associated with lower elevation habitats (respectively $r^2 = 0.87$, $r^2 = 0.57$, $r^2 = 0.65$). Contrarily, Zopteros semperi, R. longirostra and D. oceanica regression showed that detection rates increased on higher elevation zones (respectively $r^2 = 0.70$, $r^2 = 0.98$, $r^2 = 0.52$). These associations suggest that while some species are common throughout the island, others are associated with specific habitats.

In the second study we further explored the associations between Pohnpei birds and the island’s habitats. We used the 2012 survey data to identify whether each species was associated with specific habitat composition and configuration measures. We analyzed detections for 10 and 13 species, respectively, with density (?) and occupancy (?) approaches. For each species we created a series of linear models including variables for habitat composition and configuration. We followed a two-stage process. In the first stage we accounted for factors having an effect in bird detections, and in the second stage we incorporated habitat-specific factors with the potential to affect species density and occupancy. We used nine habitat variables, including percent of undisturbed habitat, percent mangrove, percent of agroforest, percent of secondary vegetation, extent of forest edge, patch number, canopy cover, canopy height, and tree stocking rate.

We used occupancy and distance-sampling protocols to analyze data collected in 247 survey stations. We used an information theoretic approach to model species density and occupancy associations with Pohnpei habitat composition and configuration. Results provided strong indications of habitat associations for most species, including Pohnpei endemics. Additionally, occupancy and density results suggested that many species on Pohnpei are habitat specialist, especially those associated with Pohnpei climax forest structure (e.g. Rukia longirostra). Model results generally indicated positive associations to Pohnpei climax forest and negative associations to anthropogenic habitats. Importantly, the results also provide indications of how Pohnpei bird populations may change if anthropogenic effects of forest composition and configuration continue on the island.