

The Relationship between Anthropogenic Land Use and Health/Disease of Wild Birds in Costa Rica

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Hypothesis: A direct relationship exists between the health and pathogen prevalence/diversity of avian hosts and human use of the landscape in two land use types.

Objectives: 1) to describe the relative health of birds inhabiting forest, and shade-grown coffee plantation areas, 2) to describe the pathogen prevalence/diversity of birds in those land use types, 3) to investigate the relationships between pathogens and anthropogenic activity in the area, 4) to explore the mechanisms that are responsible for the movement of these pathogens between land use types.

Research and Conservation Significance: The effect of disease on wildlife population is currently at the forefront of population ecology.^{1,2} The literature reflects numerous examples of disease emergence causing significant declines in wild animal populations.³ The relationship between disease emergence and anthropogenic activity is just beginning to be investigated. A variety of direct/indirect mechanisms have been proposed for this relationship.^{1,4-7} This project is an example of the importance of the intersection of animal, human and ecological health, and aims to elucidate the differences in pathogen prevalence/diversity with respect to land use and its effects on bird species in a tropical system.⁸ Basic Science- In this case, birds are used as representatives of any host susceptible to pathogens within its environment. Anthropogenic change to land in this case is defined as the clearing of forests for agricultural use. I hypothesize that anthropogenically affected habitats can increase either the susceptibility of a host to infection, the exposure of a host to a pathogen or changing the transmission potential of a pathogen. I will design and validate a method for measuring health and pathogen loads of birds along an anthropogenic gradient of land use that can be applied to other tropical systems. Applied Science- Despite exemplary conservation efforts, Costa Rica's major ecosystems are under some threat to be converted to human use. Due to its incredible mixture of habitats, Costa Rica boasts of more than 857 bird species^{9,10}. The Monteverde region, a popular ecotourism destination, houses over 400 species of birds.^{9,10} Although 3 highly-publicized private reserves have been established at the top of the Tilaran Mountains, private land ownership seriously threatens the avian communities just outside of reserve boundaries. It is important to underscore that small altitudinal changes translate to major shifts in avian community composition—so that although forest birds in the Santa Elena, Children's Eternal Forest and Monteverde Cloud Forest Reserve are afforded protection, rare and threatened species inhabiting a few hundred meters below these reserves are subject to ever-increasing habitat loss and fragmentation.¹⁰ As habitat loss continues, providing patches of suitable habitat within private land might be the only way to conserve certain species. Ecotourism and shade-grown coffee operations have been promoted as methods to preserve avian biodiversity, important to both Costa Rica's culture and economy.^{11,12}



However, measuring abundance and species composition might not be enough. For example, we know little about the health of the birds that live in these regions or whether these systems may serve as potential sinks for disease transmission. This project has direct application towards the conservation of avian fauna in this area of Costa Rica by both investigating diseases that may affect bird populations and elucidating the potential health risks associated with anthropogenic land use change for these birds. Other studies have effectively tied habitat disturbance with disease and other factors that affect population abundance.^{13,14} However, few examples exist where avian biodiversity declines due to disease were investigated in the context of habitat change.^{15,16} I will integrate components of population ecology and conservation medicine to determine how anthropogenic activity influences pathogen load in a tropical system.

Preliminary Data: The preliminary phase of this project was accomplished during 2 visits to Costa Rica in 2004-05. The following was accomplished: 1) the research and trapping areas were defined, 2) collaboration relationships were established at the Universidad Nacional,



Sonia teaches high school students from San Luis the value of examining and collecting blood from chickens.

Facultad de Veterinaria (College of Veterinary Medicine), 3) potential mechanisms for transmission of pathogens between human/domestic animal waste and wild birds was observed, and 4) because chickens are often used as sentinels in avian disease studies¹⁷, a health assessment of 100 domestic, free-roaming chickens living in the area was completed to best understand the viral and parasitic diseases in this environment.



Sonia holding a chicken living in a pasture embedded in cloud forest.

In 2005, 200 free-ranging birds were captured with mist nets and ground traps to identify the avian communities and to document the presence of specific pathogens in the 3 land use types. I identified 5 target species with the following characteristics: a) overlap in all 3 land use types, 2) small home ranges (<1 km), 3) representatives of different lifestyle strategies (and thus different exposure mechanisms), 4) of sufficient body size for biological sample collection.



The Long-tail manakin (*Chiroxiphia linearis*) is one of the birds often captured in mist nets for this project.

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