Tropentag 2008
University of Hohenheim, October 7-9, 2008
Conference on International Research on Food Security, Natural Resource Management and Rural Development

Birds of Coffee Lands

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Abstract

Shade coffee plantations may have similar or higher bird diversity levels than natural forest. However, coffee and forest differed in species composition. Shade coffee may be beneficial for generalist species, but poor for forest specialists. I studied the diversity and feeding ecology of birds in the valley of the Magdalena River (Cordillera Oriental, Colombia). The landscape is dominated by shade coffee plantations, but mixed crops, pastures, gardens, guadua bamboo forests and secondary forest are also present. I captured the birds with mist nets and made observations in transects between 1998 and 2006. I registered 110 bird species of 21 families. The families with greater number of species are flycatchers and hummingbirds. Pastures and mixed crops are dominated by seedeaters, insectivorous and omnivorous. The zones with shade coffee and guadua bamboo forests have a high diversity of nectarivorous, frugivorous and migratory species. The secondary forest, guadua bamboo forests and gardens are important to nectarivorous birds of the understory. Hermit hummingbirds follow routes along these habitats to foraging in the inflorescences of Heliconiaceae, Costaceae, Musaceae and Zingiberaceae. Other hummingbirds (mainly non Hermits) defend and maintain feeding territories from other nectarivorous, including nectar robbers as the Bananaquit. Shade coffee contributes to maintain the local biodiversity in agricultural regions by providing habitat for some forest species, acting as buffer areas for forest patches and limiting the expected loss of direct species due to deforestation. Given the large area devoted to coffee cultivation in the Neotropics, more studies are needed to understand and monitoring the effects of these plantations on the ecological and evolutionary processes at different scales.

Introduction

Coffee is planted under diverse conditions and intensification levels of the productive system. From systems in which the original arboreal vegetation remains, passing by different treatments of the tree layer used as shade, until unshaded monocultures (MOGUEL AND TOLEDO, 1999). The species composition of bird communities present in coffee plantations depends on a complex arrangement of diverse factors, such as floristic structure, size and distance to the forest patches (TEJEDA-CRUZ AND SUTHERLAND, 2004; KOMAR, 2006), and composition of the original avifauna (JONES ET AL. 2002). In some regions, the richness and diversity of birds in shaded plantations tend to be lower than in natural nearby forests, but in many cases they are similar or even higher (KOMAR, 2006). In addition, many migratory birds are common in coffee plantations during the non-breeding season. These facts could favor the notion that shade coffee is a valuable agroecosystem to the birds' conservation. Nevertheless, coffee and forest differ in species composition (TEJEDA-CRUZ AND SUTHERLAND, 2004). There are more generalist species and some forest associated species are absent. My objective was to study the diversity and feeding ecology of birds in the valley of the Magdalena River.

Materials and Methods

The field study was conduced on 1200 m of elevation in the Municipality of Guaduas (5° 15′ 0″ N, 74° 40′ 0″W), Department of Cundinamarca (Colombia). The annual mean temperature is 23.5° C. At this elevation the principal economical activities are based in little to middle farms which the main incomes come from the cattle production and the coffee (*Coffea arabica*) produced under a shade of other plants used for food and timber. There are also big *Ficus* sp. trees remnants of the original vegetation and diverse wild shrubs and herbs. This type of plantation could be classified as a traditional polyculture system (MOGUEL AND TOLEDO, 1999). Another important ecosystem to the local populations are the dense patches of bamboo guadua (*Guadua angustifolia*). The remnants of natural vegetation are represented by gallery forest and secondary forest with variable extensions. Climate and soils favors the plantations of a great variety of fruits and vegetables.

I registered the birds species present in each habitat between 1998 and 2006. I made visual and auditory records along transects from 05:30-17:30 during 31 days. I captured the birds using 5 mist nets (12x5m) from 05:30-17:30 during 11 days. Occasional auditory nocturnal records of *Megascops choliba* were included. I obtained data about the consumption of different resources from direct observations in the field and a broad bibliographical search. I calculated the Number of Equivalent Species (STILES AND ROSELLI, 1998) to analyze the importance of each feeding resources to the bird community. I used a Kruskal-Wallis test in order to detect differences in the use of feeding resources into the habitats. I made a cluster analysis (with the program Statgraphics Plus 5.0 for Windows using the Nearest neighbor method), to grouping the habitats considering the presence of the species.

Results and Discussion

The bird community was composed of 110 residents and 8 migratory species of 24 families. The most numerous families were hummingbirds (15 species), flycatchers (18 species), tanagers (13 species) and sparrows (13 species). Many species fed exclusively on invertebrates (mainly insects but also other arthropods) and little vertebrates, or included in their diets important quantities of them (Figure 1). Most tanagers, thrushes and orioles had a combined diet of fruits and insects. Hummingbirds consumed nectar and arthropods catched on the air or from a substrate.

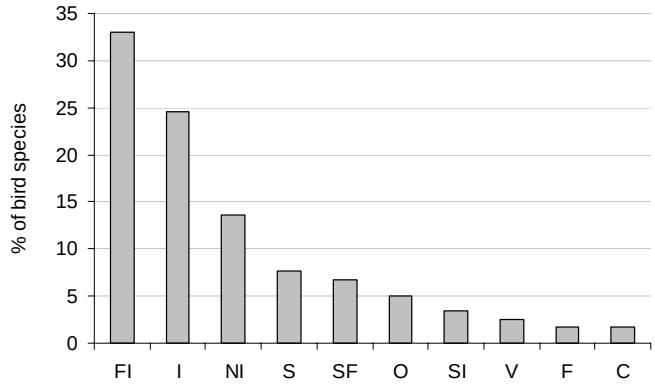

Figure 1: Percentage of bird species (n=118) that consume fruits (F), invertebrates and little vertebrates (I), nectar (N), seeds (S), vertebrates (V), or a mixture of them. I considered a bird as omnivorous (O) when consumed three or more types of feeding resources.

The habitats could be segregated in three groups considering the presence of the birds (Figure 2). One group was composed uniquely for those birds which forages from the air and occasionally perches on branches or ground (as raptors, vultures and swallows). The second group was constituted by birds tolerant to the habitats highly modified for human activities, as crops, pastures, gardens, isolated trees within them and early successional stages of native vegetation (shrubs). The third group was constituted of birds present in habitats conformed mainly for native plants or that maintain a multristrata vegetation (as bamboo forest, gallery forest and shade

coffee). Those habitats provide to the birds a major complexity of microhabitats and resources for feeding, nesting and protection against predators.

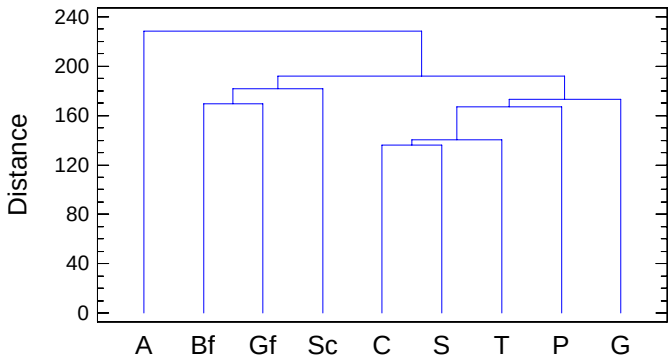

Figure 2: Cluster analysis for the habitats considering the presence of the birds. A= aerial, Bf (bamboo forest), Gf (gallery forest), Sc (shade coffee), C (other crops), S (shrubs), T (isolated trees), P (pastures) and G (gardens).

The Number of Equivalent Species was different between feeding groups ($H=17.74$, $p<0.001$). Nectarivorous and granivorous were the most sensible feeding groups to changes in the habitat (Figure 3). Pastures were the only habitat where nectarivorus birds were absent. But the offer of grass and weeds seeds made it very rich in granivorous species. Crops, shrubs and isolated trees maintained a tendency to have low richness of nectarivores. Only the gardens presented similar frequency of nectarivorous and granivorous species. The planted flowers (native or introduced) offered nectar resources to hummingbirds tolerant to disturbances. In some cases non-hermit hummingbirds (as *Amazilia tzacatl*) defended territories from other birds, especially from the Bananaquit (*Coereva flaveola*) which was a common nectar robber at this habitat. Shade coffee, bamboo guadua forest and gallery forest presented more nectarivorous. This high richness was promoted by the great diversity of nectar resources along all strata of vegetation, especially in the understory of the gallery forest. There, the flowers of Heliconiaceae, Costaceae, Musaceae, Zingiberaceae and Passifloraceae represented a very rich nectar resource to hermit hummingbirds which followed feeding routs. At difference, nectarivorous in the shade coffee foraged mainly at the canopy in the flowers of *Inga* trees, as was also noted in other localities where the majority of feeding resources were located (KOMAR, 2006). The White-tipped Sicklebill (*Eutoxeres aquila*) and other 4 species of insectivorous birds were exclusive at the gallery forest.

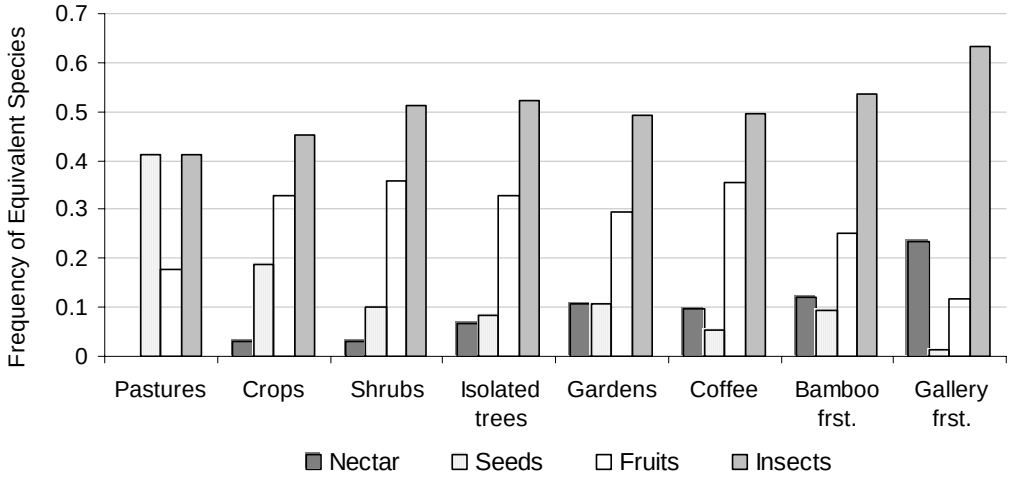

Figure 3: Frequency of the principal feeding groups within the habitats.

At the Magdalena Valley region 7 of the 8 migratory species were present at the coffee plantations. This supports the hypothesis that shade coffee plantations in the Neotropics are suitable habitat to boreal migratory birds (JONES ET AL., 2002; KOMAR, 2006).

Conclusions and Outlook

There is not a unique pattern in the composition of the diet groups in different localities evaluated in the Neotropics. Nevertheless, there are some common characteristics. Insectivorous, frugivorous and omnivorous birds are dominant in the bird communities. Whereas nectarivorous and granivorous are present in less proportions. These tendencies could be influenced by the classification system of the species within a diet group, sampling effort, detectability and season of field records, and the shade coffee system.

This and other researches (see TEJEDA-CRUZ AND SUTHERLAND, 2004), have demonstrated that shade coffee plantations have a limited importance to the birds' conservation. They have negative effects, considering that highly specialized birds which inhabit nearly forests (especially understory nectarivorous and insectivorous), are not present inside the plantations. Nevertheless, they could also have positive effects. They represent higher quality habitats than other crops (including sun coffee), are a suitable ecosystem to migratory and some forest species, and they could act as buffer habitat or corridor between forest patches.

Otherwise, birds provide important services to the coffee plantations and economical benefits for producers. They reduce the leaf damage caused by arthropods (GREENBERG ET AL., 2000) and consume the Berry-borer (*Hypothenemus hampei*), which is the world's primary coffee pest (KELLERMANN, 2007). In addition, in the Neotropics the cases of birds consuming coffee fruits are scant (KOMAR, 2006).

Many countries where coffee is cultivated are considered megadiverse. Nevertheless the studies about the impact of coffee crops on the avifauna are still scarce, especially in the main producer countries. Some research priorities are: to monitoring the populations, to understand the function of different habitats, to study the ecological requirements of specific groups of birds and to calculate costs and benefits of birds' conservation for the plantations. All this in order to generate clear conservation goals, strategies and politics for both farms and landscape based on the natural and social processes of each region.

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