FINAL REPORT

Rufford Small Grant

Project Title:	Assessment of mammal's composition (bats) at Costa Rica's rainforest landscape.
Project Location:	Costa Rica
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Objectives:

- To determine the diversity, distribution and abundance of the mammals in the different habitats/patches belonging to the landscape.
- To establish the relationships between the habitat type, forest coverage, size, perimeter, patches form and other landscape elements (agrarian matrix, distances between patches and between large forest zones, agrarian/cattle growing zones and human settlements) with the abundance and diversity of the mammals)
- To describe the different farmer's perceptions and mammals usage in the fragmented landscape.
- To formulate a list of recommendations for the sustainable management of the farms focusing on the mammals conservation in the fragmented landscape.

Particular challenges faced and solutions adopted. Changes to your project arising during the project.

During the execution of this study some problems appeared, the most important of all was the change that I had to do of the sampling initially proposed for the medium and small terrestrial mammals in the agricultural landscape of Riofrío (Costa Rica), for the sampling of bats in December, 2003. This change was communicated to you opportunely with an e-mail directed to Mr. Josh Cole on December 1st, 2003.

With the change to bat sampling, the initial objectives of the proposal were redefined to the following objectives:

1) To characterize the bat community of the tropical humid agricultural landscape of Riofrío, Costa Rica;
2) To explore the relationship between the abundance, richness and diversity of bats, and six types of habitats of the agricultural landscape;

3) To determine the degree of association and dominance in the assembly of bat community in six types of habitats;
4) To explore the role of the habitat complexity of six types of habitats on population parameters of bats; and,
5) To establish the role of the landscape structure in the abundance, richness and diversity of bats.

The change to bats was a very good decision, 1751 bats were captured on the whole, data that permitted me to test the main objectives. It is necessary to note, that I restricted my analysis to the bats of the Phyllostomidae family to avoid sampling bias. The capture with mist nets of the four other families registered in the study area (Emballonuridae, Noctilionidae, Vespertilionidae and Molossidae) might be biased. This was evident in this study, where 96% (1687 individuals representing 32 species) of the captured bats corresponded only to the Phyllostomidae family, and 4% (64 individuals representing 15 species) to the rest of families.

Another big challenge that we faced and that delayed the project was the securing of the satellite images of the zone. The study area is characterized for being a zone of high rainfall and most of the year passes cloudy, which complicated to getting good images. Finally, one year later of the field work, we can get an acceptable Quickbird satellite image. This image was used for generating the land use and vegetation map of the agricultural landscape of Riofrío, thanks to the support of Mr. Christian Brenes, geographer form the Tropical Agricultural Research and Higher Education Center – CATIE (Costa Rica). With this map I could analysis the effect of the agricultural landscape structure in the abundance, richness and diversity of phyllostomid bats.

Expenditure v Budget

Resources	**Unit Value (GBP £)**	**Quantity**	**Total (GBP £)**	**Financed by Rufford Small Grant**	
				Budgest requested	**Expenditures**
Equipment					
Laptop: Toshiba Satellite 1400-S152	732	1	732	732	US1457.94
Allowance					
Researcher lodging (**£**7/day x 30 days)	210	9	1890		
Researcher food (**£**6/day x 30 days)	180	9	1620	1386	1228.66
Assistance lodging (**£7**/day x 21 days)	147	9	1323		
Assistance food (**£**6/day x 21 days)	126	9	1134		
TOTAL (£):			**20029**	**2118**	**2118**

Where next? How will this take you forward?

As a result of this study, I wrote two scientific papers that were part of my thesis. At the moment, I am working jointly with my thesis advisors in one of these papers (titled "Habitat complexity and landscape structure effect on phyllostomid bat community in a tropical humid agricultural landscape of Costa Rica") to be submitted to Biological Conservation.

Next the abstracts of the two manuscripts:

1. Abundance, richness and diversity of phyllostomid bats (order Chiroptera) in a neotropical agricultural landscape at Riofrío, Costa Rica. - It is little known the role of the different types of habitats on biodiversity conservation in the rural landscapes. To respond this, we evaluated the composition of phyllostomid bats in a tropical humid agricultural landscape of Costa Rica. Bats were sampled in 42 randomly chosen 1ha-plots of six habitat types: secondary forests, riparian forests, forest fallows, live fences, pastures with high tree cover and pastures with low tree cover, by eight mist nets per plot. With a sampling effort of 3389 hours/net, we captured 1687 individuals of 32 species of phyllostomid bats. According to the Clench model, we recorded almost 97% of the 33 species predicted by the model for the landscape. The bat abundance, richness and diversity differed between the six habitats ($p<0.05$); the riparian forests and live fences had the highest values, possibly due to that habitats at more than offering food and/or refuge and roosting sites, they might be used as corridors, diminishing thus the negative effect of the isolation and fragmentation. At trophic guild level, frugivorous species dominated in the landscape (85% of the individuals and 66% of the species), whereas the omnivorous, sanguivorous, insectivorous and carnivorous species were less common (<2% of the individuals and <9% of the species). This study highlighted the importance of secondary and riparian forests for the conservation of the insectivorous and carnivorous species, and for maintaining a greater diversity of guilds at landscape level. Also, it emphasizes the value of the riparian forests, forest fallows and live fences for the frugivorous, nectarivorous, omnivorous and sanguivorous species. Six species (5 frugivorous and 1 nectarivorous) were the most abundant in the landscape, nevertheless the numerical importance of them varied among the six habitat types, suggesting the differences in habitat preferences and in the level of tolerance of each one of them. We concluded that the tree cover mosaic of natural habitats and of man-made habitats increase the opportunities for the conservation of phyllostomid bats of different trophic guilds and with different habitat requirements.

2. Habitat complexity and landscape structure effect on phyllostomid bat community in a tropical humid agricultural landscape of Costa Rica (to be submitted to Biological Conservation).- With agricultural landscapes increasingly dominating many tropical regions, it is urgent to understand how animal communities are responding to landuse changes both at a local scale (individual habitat patches) and a landscape scale (configuration) and to use this information to provide appropriate

management recommendations. We evaluated the effects of habitat complexity and landscape structure on phyllostomid bats occurring within a pastoral landscape in Riofrío, Costa Rica. Bats were sampled in 41 randomly chosen plots of six habitat types: secondary forests, riparian forests, forest fallows, live fences, pastures with high tree cover and pastures with low tree cover. An index of habitat complexity was created using seven vegetation variables. The landscape structure was characterized by heterogeneity and equitability index and by the amount of each type of habitat surrounding the sampled patches. The abundance, richness and diversity of phyllostomid bats were positively related with habitat complexity and with the amount of riparian forests surrounding patches, and negatively related with the landscape equitability. Habitats with higher vegetation complexity (secondary forests and riparian forests) had higher values of abundance, richness and diversity of phyllostomid bats, contrasting with less complex habitats (e.g. pastures). Patches surrounded by a higher riparian forest area had a higher bat richness and diversity, suggesting the importance of riparian forests in maintaining connectivity in the agricultural landscape. In contrast, a low equitability due to the dominance of the pastures with low tree cover in the landscape, negatively affected bat species richness and diversity. This study illustrates the importance of conserving structurally complex vegetation within the agricultural landscapes (particularly forest habitats and forest fallows), maintaining riparian forests within the landscape, and increasing structural complexity of man-made habitats (live fences and dispersed trees in pastures) for maintaining a high phyllostomid bat diversity in rural landscapes.

On the other hand, it is important to highlight that my thesis was part of the Fragment Project titled “Developing methods and models for assessing the impacts of trees on farm productivity and regional biodiversity in fragmented landscapes”, financed by the European Union and performed by the Tropical Agricultural Research and Higher Education Center – CATIE (Costa Rica), Göttingen and Wales Universities, the Cocibolca Foundation (Nicaragua) and the Regional Wildlife Management Program of the National University (Costa Rica).

Specifically my study was framed inside the objective of the Fragment Project: to assess the abundance, diversity and distribution of organisms with different dispersal capabilities (plants, dung beetles, butterflies, small mammals, bats, amphibians and birds) within fragmented landscapes. Though my field work was focused on bat sampling, it is important to point out that I collaborated actively in the sampling of the other taxonomic groups considered in the Fragment Project, especially in the amphibian sampling. With this group, also I had been involved in the analysis and in the preparation of a manuscript titled “Amphibian distributions in a neotropical agricultural landscape: effects of tree cover and landscape composition”, of which I am a co-author. This manuscript was submitted to Biological Conservation in February, 2006. It is important to take note that the mentioned study of amphibians was co-financed also by Rufford Small Grants, through the proposal sent by Mr. Julián A. García Giraldo in 2003.

On the other hand, thanks to your support in the achievement of my study I obtained my degree of Master in Conservation and Wildlife Management in the National University of Costa Rica, with headquarters in the city of Heredia, in December, 2005.

At present, I am residing in my country, Ecuador, where I have been working in the development of wild species management plans for the Amazon indigenous communities that guarantee the sustainable use of the wildlife and likewise their use give benefits to the minority and poor groups of my country. In the future, my objectives is to continue carrying out projects like this that contribute in the integral sustainable management of the perturbed and non-perturbed landscapes focused on the conservation of the biodiversity.

Some photos

- The five most common species of the agricultural landscape of Riofrío, Costa Rica

Artibeus jamaicensis (Frugivorous)

Sturnira lilium (Frugivorous)

Uroderma bilobatum (Frugivorous)

Carollia castanea (Frugivorous)

Glossophaga soricina (Nectarivorous)

- The different habitats types: secondary forest, riparian forest, forest fallows, live fences, pastures with high tree cover and pastures with low tree cover.






A charming farmer family of Riofrío

Me working…..