HM233 Factors affecting bird communities in cloud forest, Honduras

Tom Martin, University of Lancaster

Parque Nacional Cusuco (PNC) supports a highly diverse bird community, with over 200 species having been recorded within its borders. These include important Mesoamerican flagship species such as the Resplendent Quetzal, colourful parrots and toucans, and tiny hummingbirds. This high diversity is in part a product of the complex and inter-related ecological, biogeographical and anthropogenic variables which influence the structure and distribution of avian populations throughout the park.

Altitude is one of the main drivers of speciation in PNC. From the lowest Park boundaries at around 500m above sea level to the highest peaks at 2200m, abiotic factors such as temperature, precipitation and relief change dramatically. This in turn affects the Park's vegetation structure, giving rise to a series of different forest ecosystems along its 1700m altitudinal gradient. These range from tropical lowland forest to Pine-Oak woodland, cloud forest and, at the very highest altitudes, Bosque Enano elfin forest. These variable forest habitats provide different ecological niches and require different evolutionary adaptations, hence very different species and community assemblages can be found at varying altitudes throughout the park.

While altitude accounts for much of the variability in avifaunal communities across PNC, human activity has also had an important influence in characterizing the Park's avifauna. Agricultural activity and logging have significantly altered ecosystems in some areas, particularly (but not exclusively) in the buffer zone which encompasses much of the Park's lower altitudes. Extensive forest clearance has occurred in places, with natural vegetation being replaced by cultivated land, creating very different ecosystems which support bird communities with differing ecological adaptations and tolerances. Substantial areas of forest in the buffer zone and near the edge of the core zone have also been disturbed by human activity to varying degrees, and these patches of disturbed forest possess differing habitat structures from the more pristine forest ecosystems found deeper within the Park's interior. This could also facilitate different bird community structure. It is also possible that a range of further environmental factors such as topography, drainage, geology, microclimates and edge effects could influence bird assemblages on a smaller spatial scale, further adding to the complexity of variables governing species distributions within the Park.

PNC therefore provides excellent opportunities for examining how a range of ecological and anthropogenic factors can influence the composition of Neotropical bird communities, and there are a number of possibilities for university students wishing to conduct research projects in this area. Altitudinal effects and anthropogenic activities are inextricably linked in PNC, as human activity and related environmental disturbance are concentrated at lower altitudes due to the more optimal climate and topography, greater accessibility and the less-stringent regulations of the buffer zone. However, it would be possible for students to focus on either one of these two major variables as long as the other was taken into careful consideration. Students could, for example, concentrate principally on examining how altitude influences the composition of bird communities by comparing data from a range of forested sites at different altitudes, all with relatively low disturbance levels, to gauge how increasing elevation influences species richness, community compositions and species turnovers without significant influence from other factors. They could then also compare differentially disturbed sites at various altitudes to ascertain whether the more specialized, highly endemic avian assemblages at higher elevations are less tolerant of environmental disturbance than their lowland counterparts; an avenue of research which would have important conservation implications.

Similarly, it would be possible for students to focus primarily on examining how environmental disturbance influences bird communities by looking at a range of relatively undisturbed, disturbed and cleared sites which all lie within a similar altitudinal range. It would then be possible to evaluate how species richness and abundance, community composition, and proportions of various avian sub-groups such as feeding guilds or endemic species change across this gradient of disturbance. It would also be possible to examine the extent to which PNC's management zones are able to influence the impact of disturbance on bird communities by comparing avifaunal assemblages at sites in the higher elevations of the buffer zone with sites within a similar altitudinal zone within the core zone.

There is a large scope for students to choose either one of the two key themes of altitudinal influence and disturbance influence, and there are also possibilities to incorporate both to determine which environmental variables are most important in governing the structure of PNC's bird communities. A project along these lines could collect data from a wide range of sites across different altitudes, disturbance levels and managemental zones, and then use a series of General Linear Models, Principal Component Analyses or other multivariate statistics to determine the most influential variables governing the distribution of bird species and the structure of communities. There is also the possibility

of combining bird census data collected in the field with the Park's pre-existing GIS databases to produce a series of distribution maps which describe key environmental variables affecting spatial distribution patterns and identifying diversity hotspots.

The primary method students will use to investigate any of these research questions will be circular-plot point counts. These involve surveying a range of study plots scattered throughout various altitudes and habitats across PNC. There are currently 145 of these study plots, although the number used by students will depend on the specific research topic addressed. Each of these sites will be surveyed at least twice during the course of the season, with each survey consisting of a 10-minute timed count whereby all birds seen and heard within a fixed radius are recorded. These point-counts are conducted just after dawn each morning, this being the period when most bird species are active and vocalizing, thus yielding the most contacts. Most birds are detected by call; students will be assisted with this by experienced ornithologists familiar with the local avifauna, and will also be trained to recognize most of the Park's common species within their first week of survey work. Mist-netting surveys will also be conducted at a number of points over the course of the season, allowing the detection of cryptic species not easily detected by counts.

Upon completion, students undertaking this project will have produced a very large ornithological dataset that can then be compared with detailed habitat structure data collected at each survey site by dedicated survey teams, and a range of environmental variables stored on PNC's GIS system. This will allow for a range of robust statistical and spatial analysis capable of addressing a range of questions relating to how environmental variables influence the bird communities in PNC.

Suggested Reading

Aldrich M, Billington, C, Edwards M, Laidlaw R. (1997) Tropical Montane cloud forests: an urgent priority for conservation. In World Conservation Monitoring Centre. Biodiversity bulletin No. 2. Cambridge WCMC

Bibby CJ, Burgess ND, Hill DA, Mustoe, SH. (2002) Bird Census Techniques (Second edition). Academic press: London

Cayuela L, Golicher DJ, Rey-Benayas JM. (2006) The extent, distribution and fragmentation of vanishing montane cloud forest in the highlands of Chiapas, Mexico. Biotropica 38 (4) 544 – 554

Howell SNG, Webb S. (2005) A Guide to the Birds of Mexico and Northern Central America. Oxford: Oxford University Press

Jankowski JE, Rabenold KN. (2007) Endemism and local rarity in birds of neotropical montane rainforest. Biological Conservation 138 (3-4) 453 – 463

Navarro SAG. (1992) Altitudinal distribution of birds in the Sierra Madre Del Sur, Guerrero, Mexico. The Condor 94; 29-29

Peterson AT, Flores-Villela OA, Leon-Paniagua LS, Llorente-Bousquets JE, Luis-Martinez MA, Navarro-Siguenza AG, Torres-Chavez MG, Vargas-Fernandez I (1993) Conservation priorities in Mexico: moving up in the world. Biodiversity Letters 1 (1) 33 – 38

Renjifo LM, Servat GP, Goerck JM, Loiselle BA, Blake JG. (1997) Patterns of species composition and endemism in the Northern Neotropics: a case for conservation in montane avifaunas. In: Remsen, J.V. (Editor) Studies in neotropical ornithology honouring Ted Parker. Ornithological Monographs 48 577 – 594

Solorzano S, Castillo-Santiago MA, Navarrete-Guiterrez DA, Oyama K. (2003) Impact of the loss of neotropical highland forests on the species distribution: a case study using Resplendent Quetzal an endangered bird species. Biological Conservation 114 (3) 341 – 349

Wunderle JM. (1994) Census Methods for Caribbean Land Birds. New Orleans: United States Department of Agriculture