



# ECUADOR'S CLOUD FOREST BIRDS

## How Habitat Fragmentation affects Bird Communities

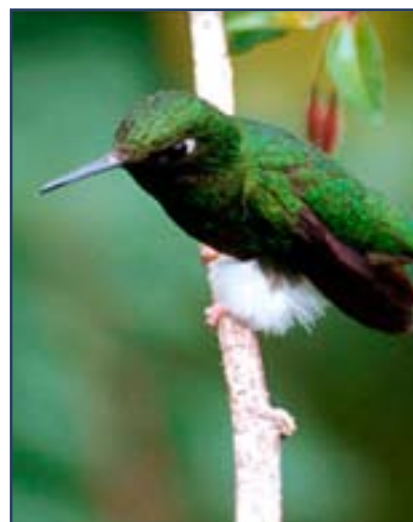


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*Plate-billed mountain toucan (Andigena laminirostris)*

### Summary of the research project

While Ecuador covers only 1.6% of South America, it is home to more than 50% of the bird species on the continent (1,570 out of 3,100). The dry and moist forests of western Ecuador are some of the most threatened ecosystems in the world. The arid region of south-western Ecuador harbours 55 restricted range species - the second highest total of 57 global "Endemic Bird Areas". The conservation objective of this project is to integrate local ecotourism and bird conservation and to monitor bird populations. The project studies the aggregations of birds in the lowlands and highlands to compare avian community structure. Besides contributing to ecological knowledge, the results will be used for local programmes in ecotourism and environmental education. Researchers set up and monitor mist nets (fine mesh nets) at forest sites, extract birds from nets for banding, and record basic ecological data.



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*Booted racket tail (Ocreatus underwoodii)*

## Research Location

Ecuador is just slightly larger than Great Britain, and has amazing physical and biological variety. The Ecuadorian Andes, crowned by the 6,310m peak called Chimborazo, separates the western coastal lowlands from the eastern jungles of the upper Amazon basin. In only 200km, as the condor flies, you can climb from the west coast to snow-caps, and descend back down to the steaming rainforest on the eastern side. In Ecuador, the lands east of the Andes are called the Oriente, while those to the west are called the Occidente. The Oriente is part of the Amazon river watershed.

This Earthwatch project takes place in two locations: Loma Alta Forest Reserve and Mindo Reserve. Loma Alta is dry and supports a unique spiny desert-shrub community. Archaeological evidence suggests that fishing and agricultural communities have lived here for more than 8,000 years. In the past 50 years, deforestation and population expansion have led to more extensive desertification of the region. Most of the coastal villagers are fishers or shrimpers, but are experiencing declining marine resources. At Mindo Reserve, elevation reaches 1,600m and provides a good site for exploring variation in bird communities in different tropical micro-habitats and in relation to altitude.



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## Components of the Research Ecosystem

### Hummingbirds

Hummingbirds are found only in the New World tropics and diversify in abundance in the Andes. There is such a wide variety in size, bills, plumage, and ornaments (head plumes and horns, tail streamers, gorget patterns) that more than 100 genera are currently recognised.

The beauty, (usually) tiny size, and their ability to hover and fly backwards makes hummingbirds unique. Their interdependence on and co-evolution with flowers provides a fascinating field of study. Because the sources of nectar constantly change as flowers bloom and fade, most hummingbirds live solitary lives, aggressively defending nectar sources from rivals. Yet despite the strong pressure to gather nectar rapidly, studies have shown that 70% of a hummer's time is spent doing little else than singing, self-preening, and sunbathing. Hummingbirds range in size from the smallest birds on earth to several quite large species in the Andes.

### Conservation of Birds

The tropical forests of western Ecuador are a global priority for conservation of biodiversity, especially bird populations. Mindo, in the foothills of the Andes, is also ranked by international conservation organisations as an Important Bird Area (IBA). The research tests several hypotheses about the ecological conditions that both sustain and generate the large number of endemic species in this region. The findings will contribute directly to basic and applied research in conservation biology in a global hotspot for biological diversity.

## Meet the Scientist

### Dr. Constance Dusti Becker



Dusti has more than 20 years of field research experience in conservation biology and ecology with birds and mammals. She was an ornithologist on a National Geographic survey of flora and fauna along the Omo River, Ethiopia and an ecologist for the Royal Society for the Protection of Birds (RSPB), UK. She has researched Grevy's zebra and game ranching in Kenya, Alpine Ibex populations in the Swiss Alps, red squirrel ecology in Canada, and the ecology of monkeys in Costa Rica.

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While the general ranges of endangered and endemic birds are known for western Ecuador, little is known about specific seasonal movements, seasonal habitat requirements, or the basic ecology of most of these birds.

In 1996, Dr. Becker decided to monitor bird diversity at Loma Alta to determine the conservation value of the new protected area. Birds are well-known, fairly easy to monitor, and have increasingly been used by conservation planners to prioritise and monitor habitat conservation efforts throughout the world. Many people enjoy bird watching and can be lured off the normal tourist track to Loma Alta, thereby boosting the local economy.

The first bird monitoring project in December 1996 discovered a rather spectacular concentration of globally threatened species. This finding showed that the reserve was of international importance to bird conservation.

### Birds and Habitat Degradation

Like most endangered species, the birds of western Ecuador have suffered habitat loss due to deforestation. The current research is trying to determine which species cope with habitat degradation and which species do not. In South America, tropical

forests are rapidly being destroyed and replaced by vegetation associated with human economic gain, especially pasture and food crops. Indicator species are therefore needed to inform when forest loss is threatening particular ecosystems, and birds are useful in this way.

The dramatic decrease in forest in western Ecuador has isolated animal populations, making them more vulnerable to extinction. For many species in fragmented habitats, survival in the long-term future may depend upon a combination of metapopulation dynamics: sustaining genetic diversity via regional migrations to other populations in suitable habitat. While birds are more likely to survive fragmentation than less mobile animals, bird species vary in their behavioural capacity for dispersal, and this may play an important role in explaining losses and gains of certain species in forest patches. Earthwatch has collected blood samples in the Andes and in forest patches on the coast to determine how genetically isolated the coastal birds are, and found that grey-breasted

woodwren populations are more closely related to populations in the northern Andes than the southern Andes, suggesting that birds disperse using habitat islands or corridors between the coast and the north. Genetic diversification in moist forest patches may be one of the mechanisms leading to the evolution of new endemic species.

**Climate**  
Humidity: 10% to 100%  
Temp. range: 10°C to 32°C  
Altitude: 0m to 800m  
Rainfall: Up to 25cm per month

### The Forest as a Watershed

Highland forests are crucial for local water supply, and studies have shown that water supply depends as much upon fog as on rainfall. Despite desert-like levels of precipitation, the Ecuadorian forests are covered with lush humid forest. This lush growth is due to fog capture associated with the cold ocean currents arriving from Antarctica, from July to November. Dense fog banks drift inland and the fog is captured by the hill vegetation resulting in a humid highland forest ecosystem. Fog capture varies with plant cover, slope orientation, and altitude and the amount of fog influences the type of species found in the forest. Fruiting and flowering schedules follow the typical tropical pattern whereby fruits are most abundant in the rainy season and flowers are most abundant just before the rains begin. Plant schedules shape animal schedules.

Earthwatch research has helped to reveal the link between water supply in lowland streams and fog capture in the highlands. This understanding has convinced citizens of Loma Alta to establish a 3,000 hectare community ecological reserve. This is the first community-owned reserve to be established in Ecuador.



Forest habitat clearing for agriculture

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*Researchers climbing into the cloud forest to survey birds*

## Objectives of the Research Project

Due to habitat degradation in the study locations, many bird populations are isolated from one another. By exploring the questions below, the researchers hope to build up a picture of the bird species' behavioural capacity for dispersal; determining how this dispersal behaviour may be affected by habitat fragmentation and informing how conservation management of habitats (through habitat restoration or providing wildlife corridors) could ease the impacts of fragmentation for birds.

### The project explores the following questions:

1. How independent are lowland and highland bird communities?
2. What bird species make altitudinal vs. regional migrations?
3. What resources play a role in structuring communities seasonally?
4. How do the social and breeding systems of birds differ in the dry and moist forests?

## Methods

To explore the above questions, the following methods are used:

### Bird Ecology Research

Data about the composition of bird communities in different seasons, habitats, and regions are collected using a variety of methods. The researchers use mist nets (fine mesh nets) to capture flying birds for identification, measuring and banding. Researchers then take body measurements (wing, tail, weight, age, sex, body fat, reproductive status and molt) and blood samples to extract mitochondrial DNA (MtDNA) to determine the gene flow within the Andes.

Mist nets are used to sample birds in forest patches that are degraded and non-degraded. The goal is to apply a consistent effort toward mist-netting, so that an assessment of population abundance can be made.

Birds are also counted while walking along transects and at specific points. The observer makes a note of the following:

- species
- sex
- vocalisations
- altitude
- habitat
- date
- number of individuals
- age
- breeding activity
- location
- time
- foraging and flocking behaviour

Vegetation sampling is also completed around each net and point count site to correlate bird species and abundance with characteristics of the flora. Stem counts, dbhs (diameters at breast height) for woody stems greater than 5cm, and proportions of plants fruiting and flowering are recorded in 12 x 12m quadrats around the nets.



*Dusti Becker taking morphological measurements with callipers*



*Collecting a bird from the mist net*

## Results

[Click here](#) for sample datasets and statistics exercises

[Click here](#) for guidelines on how to do statistics

## Applications of the Data – Conservation Management

The results of the research will inform regional conservation management plans, and decision-makers who influence local land use. In 2004, Loma Alta was classified as an internationally-recognised Important Bird Area and this should have significant benefits for the community's goal of attracting nature tourism to their protected area.

Providing ecological knowledge to the users of tropical ecosystems can play an important role in the

conservation of these beautiful and valuable plants and animals. The local economy of Loma Alta has certainly benefited from this project, as members of the local community have learnt to carve tagua palm nuts to make earrings, necklaces, key rings, and other items from the "vegetable ivory", which can be sold to tourists. The local community, therefore, has more interest in conserving this native tree. This Earthwatch project has also created impetus for ecological tourism initiatives, which employ local Ecuadorians and boost the local economy.

How sustainable local conservation efforts will be for the future remains to be seen, but for now, the highland forest at Loma Alta is much more protected than it was before the Earthwatch project started. Local people are certainly more aware of the value of the forest for maintaining their water supply, and actions to protect the forest are more frequent than before. One of the ranching families encroaching on highland forest has agreed to cease exploitation of the community forest. Earthwatch volunteers have reforested this pasture and 75% of the 400 seedlings they transplanted have now established themselves.

The Ecuadorian coastal range is becoming more recognised as an important area for harbouring many endemic species of birds, plants, amphibians, and invertebrates. The reserve is mentioned in the new field guide to the birds of Ecuador. The information provided to the Loma Alta community has profoundly affected its policies on forest use, monitoring, and sanctioning in the forest.

*A hummingbird extracting nectar from a flower. There are over 3,000 bird species in South America, which is 32% of the world total*



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## Glossary

**Restricted range species** – endemic species or species that only occur in a certain area

**Endemic Bird Areas** – areas that contain species that have restricted ranges. See [http://www.birdlife.org/action/science/endemic\\_bird\\_areas/index.html](http://www.birdlife.org/action/science/endemic_bird_areas/index.html)

**Community owned forest** – forests that are managed cooperatively by the local community, in which every member gains from forest resources in equal share

**Community structure** – the density, species composition and age/sex of a community of plants and animals

**New World** – one of the names used for the Americas. When the term originated in the late 15th century, the Americas were new to the Europeans, who previously thought of the world as consisting only of Europe, Asia, and Africa – the Old World

**Genera** – the name of an organism is composed of two parts: its genus name (always capitalised) and the species name (lower case). An example is *Homo sapiens*, the name for the human species which belongs to the genus *Homo*

**Global hotspot** – the biodiversity hotspots hold especially high numbers of endemic species, yet their combined area of remaining habitat covers only 2.3 percent of the Earth's land surface. Each hotspot faces extreme threats and has already lost at least 70 percent of its original natural vegetation. Over 50 percent of the world's plant species and 42 percent of all terrestrial vertebrate species are endemic to the 34 biodiversity hotspots. See <http://www.biodiversityhotspots.org/xp/Hotspots/>

**Globally threatened species** – species that are facing extinction. The IUCN Redlist is a comprehensive list of globally threatened species. See <http://www.iucnredlist.org/info/introduction>

**Indicator species** – offer a signal of the biological condition of an ecosystem, and can indicate that (for example) pollution has entered the food web

**Forest resources** – some examples of the products and processes supplied by forests are timber, medicinal and food plant products, bushmeat, fertile soil, prevention of soil erosion and water supply

**Conservation management plans** – involve a two-stage process. The first step is to describe accurately the area to be conserved (resources, habitats, species etc) and possible constraints to conservation. The second step is to work out what needs to be done and how

## Useful websites and sources of information

Birdlife Ecuador: <http://www.birdlife.org/worldwide/national/ecuador/index.html>

Important Bird Areas: <http://www.birdlife.org/action/science/sites/index.html>

WWF website about Andean Forests: [http://www.panda.org/about\\_wwf/where\\_we\\_work/ecoregions/tumbesian\\_andean\\_dry\\_forests.cfm](http://www.panda.org/about_wwf/where_we_work/ecoregions/tumbesian_andean_dry_forests.cfm)

Birdlife website about Andean Forests: <http://www.birdlife.org/news/news/2005/11/tumbesia.html>



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*A hummingbird extracted from the mist nets*

*Earthwatch is an international environmental organisation which promotes the understanding and action necessary for a sustainable environment.*

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