

From pristine to pasture in Paraguay

Paraguay is a land-locked South American country that was until recently a haven for a wide variety of thriving indigenous flora and fauna. However, this biodiversity is threatened by rapidly expanding agriculture. Award-winning conservation biologist Karina Atkinson describes the problem and explains how threats can be mitigated

Paraguay was, until about 100 years ago, a **pristine** land of plenty. Jaguars hunted in humid forests while giant armadillos and anteaters roamed the arid savannahs. The Guarani tribes lived comfortably with nature, enjoying a diet of brocket deer and mandioca. However, today the Paraguayan countryside is awash with chainsaws and trucks. Cattle farms and soybean fields have largely replaced the forests that extended to the horizon. The conservation movement must act fast to protect what's left of this little-known paradise.

Key words

- Conservation
- Biodiversity
- Atlantic Forest
- Cerrado
- Endemic
- Umbrella species

Problems in paradise

South America (see Figure 1) is one of the most biodiverse regions on Earth. Its deep jungles and ice-capped mountains host a disproportionate level of biodiversity, boasting around 40% of the world's plant and animal species. Although smaller than neighbours Argentina and Brazil, Paraguay is just as diverse (see Figure 2). Home to the Atlantic Forest, Chaco, Pantanal and Cerrado habitats, Paraguay is a biologist's dream. The Chaco and the Cerrado are hot savannahs with near impossible living conditions for humans, but other forms of life prosper. As a consequence of the intense heat on the surface, underground is much more habitable, and is home to burrowing mammals like the tuco-tuco, and **fossorial** reptiles like the amphisbaenid.

The Pantanal and Atlantic Forest are home to thousands of species of **endemic** birds and plants, making them key conservation habitats. The Cerrado and Atlantic Forest are known as 'biodiversity hotspots', but both are in serious danger of disappearing. Paraguay recently came lowest in a global deforestation analysis, meaning it is the country with the greatest proportion of deforestation. However, it's not all bad news. Paraguay's remaining habitat is still bursting with **neotropical** wildlife. Crucially, from a biologist's perspective, relatively little research has ever been done there, making Paraguay perfect for explorers in search of new species and ecological discoveries. Fortunately there is still time to protect what remains of these habitats and the species that inhabit them.

The Atlantic Forest and the fragmentation effect

The Atlantic Forest used to cover more than 100 million hectares, but has been subjected to exceptional levels of deforestation (see Figure 3). Less than 7% of its original area remains. Even worse, this 7% of original

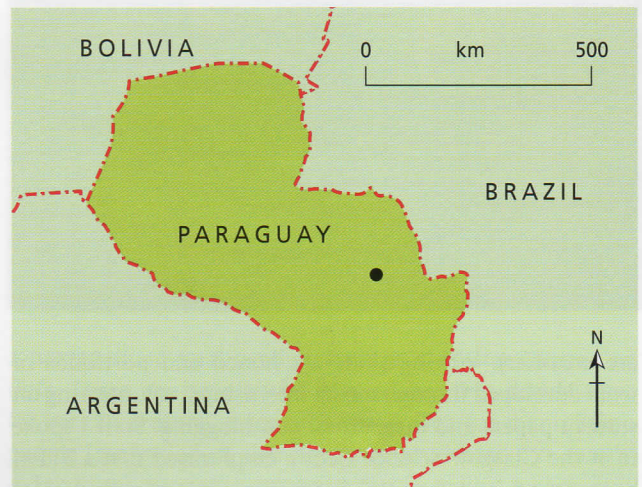


Figure 1 The location of Paraguay in South America. The black dot represents the ex-reserve Laguna Blanca



Burrowing and fossorial species found in Paraguay. The tuco-tuco (top) and amphisbaenid (bottom)

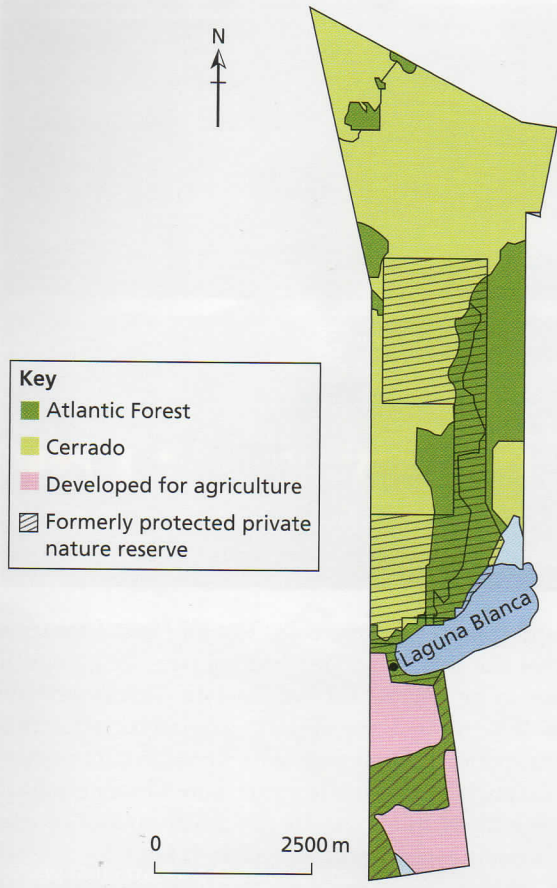


Figure 2 Map of the habitats of Laguna Blanca

forest is not a continuous tract of habitat, but instead is split into small fragments spread between Paraguay, Brazil and Argentina.

Conservation International, a US environmental organisation, considers Paraguay to be of 'highest conservation priority'. The problem is that the Atlantic Forest contains extremely fertile soil that is perfect for agriculture. More than 3 million hectares of forest — an area about the size of The Netherlands — have been cleared to make way for cattle ranching and soybean farming, leaving

less than 4% of Paraguayan Atlantic Forest intact. In addition, roads crumble under the weight of trucks taking their products for export, **indigenous** communities have been displaced, and **invasive species** such as African grasses out-compete native species and contribute to the **greenhouse effect**.

Despite these problems the Paraguayan Atlantic Forest still supports high levels of biodiversity. Between 5 and 7% of the world's total species are still found here, and of the 124 species endemic to the habitat, 81 only exist in the Paraguayan Atlantic Forest. Endemic species include hooded capuchins and the lancehead viper. However, the fragments exist in a delicate state, and if they disappear, this remarkable biodiversity may go with them.

Habitat fragmentation can have devastating effects on biodiversity. Animals with large home ranges, such as pumas, need plenty of space to be able to find food and may not be able to find enough to eat in fragmented environments. Similarly, animals requiring specific conditions in order to survive, such as frogs that need a wet environment, may be unable

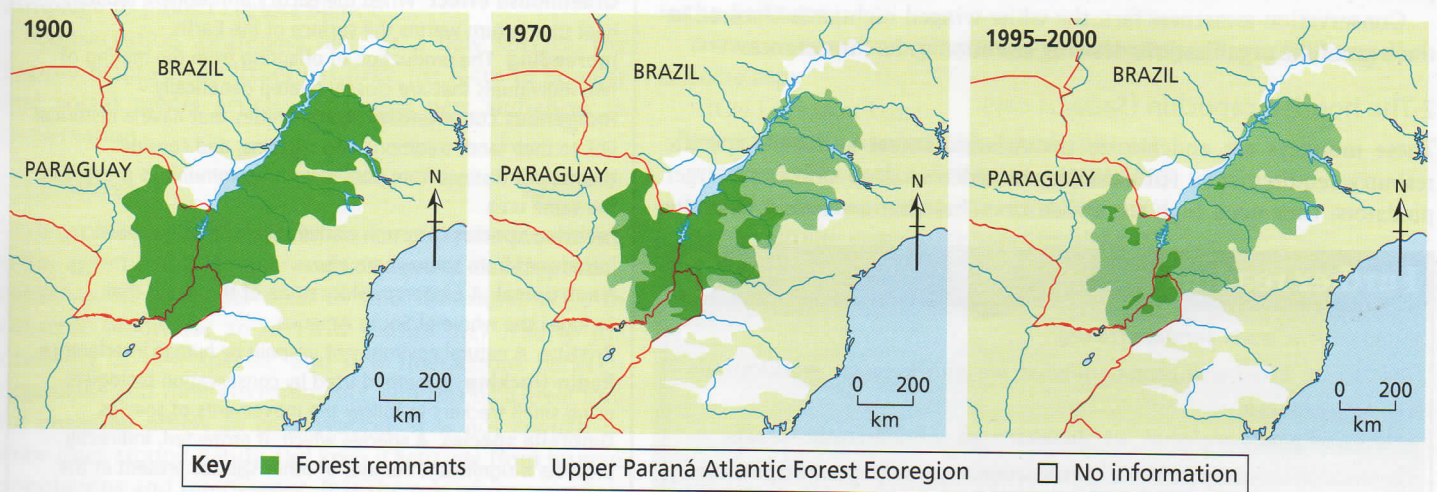


Figure 3 Atlantic deforestation

to find adequate resources to support a community. Populations living on fragments surrounded by agriculture will have reduced options for mating, which may lead to **inbreeding**, causing a reduction in gene pool diversity that could lead to the loss of an entire population.

The Cerrado

The Cerrado is less uniform than the forests, being composed of grassland, scrubland, wetland and woodland, and any combinations of the four may be found in the same place. The situation in the Cerrado is even worse than in the forest. Only the very southern part of the Cerrado reaches through from Brazil into Paraguay, and Conservation International estimates 2.6 football pitches worth of Cerrado are lost every minute.

The Cerrado's biodiversity is harder to see than that of the Atlantic Forest, but it is home to the greatest number of species of any savannah habitat in the world. The Cerrado needs to withstand natural burning events approximately every 4 years; many trees have trunks made of material similar to cork, keeping the live tree inside safe from the flames. Cerrado plants grow on sandy soils that are nutrient-poor for growing soybean. Invasive African grasses planted by farmers to feed their cattle now dominate the landscape. Using lime-based fertilisers to neutralise soil acidity means that soybean can now be farmed in the Cerrado, bringing deforestation to new parts of the country.

Conservation biology

Conservation groups in Paraguay agree that habitat loss urgently needs to be addressed. In a research station in the transitional zone between the Atlantic Forest and Cerrado, students and professional researchers at Fundacion Para La Tierra are working on projects to promote awareness and protection of these remarkable ecosystems. By ensuring the protection of one key **flagship** or **umbrella** species the public care about in each habitat, a whole ecosystem can be protected. For example, conservationists use the spotted owl to protect ancient forests and all of the species living in them. Para La Tierra chose three species to focus on as conservation priorities.

1 The white-winged nightjar (*Eleothreptus candicans*)

This enigmatic flagship species prefers shrubby-grassy Cerrado close to water, and with only a few locations left that fit this description, they are running out of habitat. Scientists at Para La Tierra are using **radio-tracking** technology to learn more about the **ecology** of these birds in the hope of discovering new populations and developing a long-term conservation plan to protect the remaining 1000 individuals.

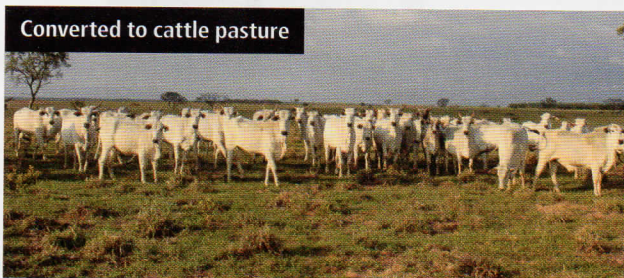
Conservation awareness fact: the white-winged nightjar is featured in the logo of the organisation, drawing attention to its importance.

2 The hooded capuchin (*Sapajus cay*)

These monkeys are endemic to the Atlantic Forest and have specific resource requirements. For example, in order to sleep safe from larger predators, they need high trees with branches that are strong near the



Pristine Cerrado



Converted to cattle pasture

trunk and spindly near the ends. Not all forest fragments host trees like this, or enough fruiting trees for groups of monkeys to be able to survive. Para La Tierra's primate team is looking into the specific requirements for this umbrella species in forest fragments. Through reforestation projects it might be possible to create more adequate habitat for capuchins. Helping prevent the disappearance of this species from the fragments that remain is key.

Conservation awareness fact: as a charismatic species the hooded capuchin is used as a mascot for community education and features in a number of children's story books.

Terms explained



Ecology The study of relationships between organisms and their natural environments.

Endemic A plant or animal native to, and only found in, a specific and limited area.

Flagship species A species that acts as an ambassador, icon or symbol for a particular habitat, issue, campaign or environmental cause.

Fossorial A burrowing animal, adapted to life underground.

Greenhouse effect When the Earth's atmosphere radiates heat that in turn warms the surface of the Earth.

Inbreeding The production of offspring from the mating of two individuals that are closely related genetically.

Indigenous communities Communities that have a historical link to their land, traditions and customs, and consider themselves distinct from post-invasion communities present in the same area.

Invasive species Any non-native species that has been introduced from somewhere else.

Neotropical A biogeographic region of the world that includes the whole of South America.

Pristine A natural environment unspoilt by human interference.

Radio-tracking A method used by conservation biologists using small trackers to follow the movements of species.

Umbrella species A species which, if protected, indirectly protects a significant number of other species present in the same habitat.

Further reading



Para La Tierra: www.paralatierra.org

The Cerrado: http://wwf.panda.org/what_we_do/where_we_work/cerrado

The Atlantic Forest:

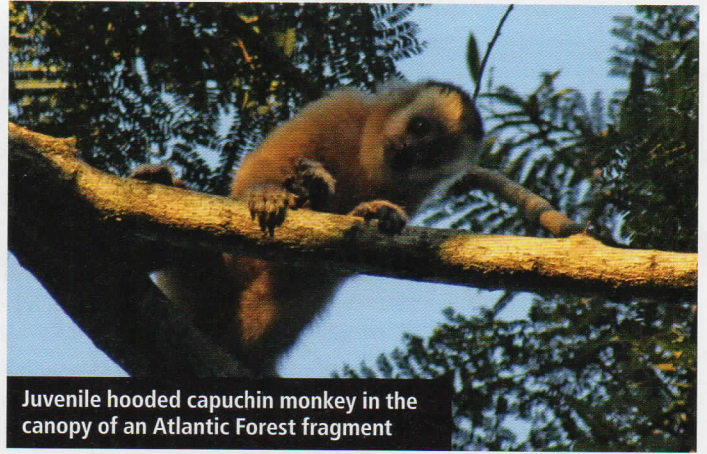
http://wwf.panda.org/what_we_do/where_we_work/atlantic_forests

Conservation International: www.conservation.org/how/pages/hotspots.aspx

Laguna Blanca: <https://vimeo.com/96335488>



White winged nightjar



Juvenile hooded capuchin monkey in the canopy of an Atlantic Forest fragment



Using radio-tracking technology to search for the white-winged nightjar



The Laguna Blanca spiny lizard (*Tropidurus lagunablanca*)

3 The Laguna Blanca spiny lizard (*Tropidurus lagunablanca*)

This lizard is found in only one location — the Para La Tierra research station at Rancho Laguna Blanca. As a new species, first described at the beginning of 2016, relatively little is known about it. What do they eat? How do they reproduce? How big is their home range? How do they defend their territory? How do they attract a mate? Understanding the ecology of this species will facilitate conservation of the entire area. This species does not fit the classic flagship or umbrella species model, but it is vitally important to the campaign to protect Laguna Blanca.

Conservation awareness fact: as a new species, the Laguna Blanca spiny lizard has been the focus of popular and social media articles, engaging new audiences in conservation.

The future

With problems of deforestation in Paraguay so intertwined with agriculture, social and economic development, conservation biologists need to find innovative ways to conserve biodiverse areas. Field studies may lead to the discovery of new species, and new interactions between organisms and their environments, and can be a great tool for engaging others in conservation. It is not enough to draw lines around nature and keep it separate from human populations and interference. It is the role of conservation biologists to present novel solutions to these problems,

working together with farmers, communities, economists and politicians to find a way to ensure the continued survival of wild places.

Things to do

Watch the following videos and learn about how to engage people in conservation. Can you create your own funny or serious script to get people talking?

Conservation International Nature is Speaking:

www.conservation.org/nature-is-speaking/Pages/Julia-Roberts-Is-Mother-Nature.aspx

www.conservation.org/nature-is-speaking/Pages/Edward-Norton-Is-the-Soil.aspx

www.conservation.org/nature-is-speaking/Pages/Reese-Witherspoon-Is-Home.aspx

IUCN Love. Not Loss:

www.youtube.com/watch?v=BvldwOEzreM

www.youtube.com/watch?v=wwwviMBEABIQ

www.youtube.com/watch?v=RXzhOjSi_rw

www.youtube.com/watch?v=xQUObI-AzAM

www.youtube.com/watch?v=I_fuZxShrs

Karina Atkinson graduated from the University of Glasgow with a genetics degree in 2007. She founded Fundacion Para La Tierra, a conservation organisation in Paraguay, in 2010. She now works towards raising awareness and funds for conservation projects in the Atlantic Forest and Cerrado biomes. In 2012 Karina won the Rolex Award for Enterprise for the development of Fundacion Para La Tierra as a model organisation for conservation in Paraguay.