
MESOAMERICA
THE GUARDIANS OF THE FOREST
BambooDoc

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Mesoamerica: The Guardians of the Forest

A wildlife documentary series

3x52min

Directed by Luis Miranda

A production by

BambooDoc

arte

Distributed by

off the fence.

SUMMARY

PITCH

Only five Central American forests remain from the huge biological gateway that once connected the northern and southern parts of the continent.

Fragmented and threatened by intensive logging, these forests must be allowed to grow back and connect up again together. This can only be done with the help of their faithful allies – the animals that live within them.

SYNOPSIS

Some 5 million years ago, Central America rose above sea level to create a natural bridge between the northern and southern parts of the American continent. For the first time, monkeys and sloths from the south, squirrels and raccoons from the North, along with thousands of other animal and vegetable species, were able to share a common territory in the brand-new forests of Central America. The isthmus became the third most biodiverse region in the world.

This biodiversity is, however, coming under increasing threat. The biological gateway which opened up the way to genetic exchanges between species has been dramatically reduced in size. Only five forests have escaped the massive deforestation: the **Maya Forest** in Mexico, Guatemala and Belize; the **Moskitia** in Nicaragua and Honduras; the **Indio Maíz-Tortuguero** in Nicaragua and Costa Rica; the **Talamanca Region** in Costa Rica and Panama; and the **Darien** in Panama and Colombia.

These **five great forests** are the last remaining guardians of Mesoamerica's extraordinary biodiversity. Environmental activists, indigenous peoples and a considerable section of civil society have been calling for the tide to be turned against their deforestation. The task is huge, as it means connecting the forests back together in a continuous belt and restoring genetic exchanges between the continent's many species. **The forests must be allowed to grow back, build up their health and expand to take over the land they used to occupy**.

While humans are at the forefront both of the forests' recovery and of the threat they face, it is the animals that are the main instruments of their ecological rehabilitation. **White-lipped peccaries, bats, spider monkeys** and **tapirs**, for example, are the ecosystem engineers, helping the forest to grow outwards, while **anurans** – frogs and toads – are the sentinels, their populations mirroring the forest's state of health. **Birds** are other key players, emissaries which, when they migrate, take with them a fragment of the biotope, creating an invisible link between marine and terrestrial ecosystems and between the Mesoamerican forests and those far away to the north. The forests are home to some of the world's most iconic birds, such as the **resplendent quetzal**, venerated by the Maya, the **harpy eagle**, the largest of all eagles, and the very rare **king vulture**.

Many of Central America's animals are under threat and theirs is a race against time. The survival of the five forests is directly linked to their coexistence.

This series of three films will take us deep down into the heart of the "Central American Amazon", tracking the engineers, sentinels and emissaries which drive its survival. We will examine the natural mechanisms developed by the species which keep the forest alive. We will follow them through the seasons and find out about their secret life and the social bonds which allow the group to survive, their dependence on other species, their reproductive behaviours and the dangers threatening their existence. Our cameras will penetrate areas never filmed before to demonstrate the magic and the majesty of the remaining five great forests. We will also be looking at the extraordinary beauty of each of the species we film. As humans, it is now our job, after destroying much of the forests, to protect them as much for our own good as for theirs. To do this, though, we first have to get to know them.


MEXICO
Selva Maya
BELIZE
HONDURAS
Moskitia
GUATEMALA
EL SALVADOR
NICARAGUA
Indio Maíz Tortuguero
COSTA RICA
PANAMA
La Amistad
Darién

FILMMAKERS STATEMENT OF INTENT

Mayan sculptures - jaguar and toad

Background

The countries of Central America are facing what may well be the most important ecological challenge in their history: preserving the last five great forests and helping them expand and connect up again.

Biologically speaking, the region is of vital importance, forming as it does a bridge between the northern and southern parts of the American continent. Before the arrival of European explorers and the massive exploitation of its natural resources, the ecosystems of Central America had formed an essential gateway. For millions of years, it allowed genetic exchanges between the fauna and flora of the two subcontinents.

The “great American faunal interchange” was an event in which land and freshwater animals migrated between the two Americas. The continual exchanges between the southern and northern forests gave rise to unique species that can be found in the territory today.

The gateway has been broken up after 5 centuries of exploitation of land resources and, over the last 3 decades, uncontrolled and illegal logging in most of the countries in the region. International demand for beef is bringing about a similar situation to that experienced currently in Brazil, with tropical forests being cut down to create vast swathes of grazing land. Over the last 15 years, we have lost over 30% of three of the five last great forests of Central America. In addition, the drought-like conditions caused by climate change have resulted in huge forest fires, the smoke from which has blocked out the sun and invaded the lungs of both humans and fauna. In some areas, these five forests are still considered as an obstacle to the economic development of the central American countries. They are, however, not only a crucial part of our future but also provide essential ecosystem services for over 5 million people who live in and around them.

In reaction to this crisis, the indigenous populations, NGOs and a number of regional governments got together last year to try to counteract its effects. Greta Thunberg, Leonardo DiCaprio, Christiana Figueres and other major figures in nature conservation have also spoken out in support of the scientists and activists.

The aim is not only to put a stop to logging but also, in the medium term, to ensure the future sustainability of these unique forests so that they can once again assume their original role as a biological gateway. Essentially, this means reversing the current direction to avoid the disastrous endpoint we seem to be heading towards.

The first step towards reaching this aim means helping people to find out about these unique habitats and the life within them. The public needs to recognise the paramount importance they have for humankind. Most people living in Central America do not know anything about the five last great forests. This is a memory lost in time and it is vital to go back to

when man and forest once coexisted to their mutual advantage. As the forest no longer means anything to them, people are closing their eyes to its destruction.

To quote David Attenborough, ‘never has it been more important to understand how the natural world works and what we must do to preserve it’.

Our series sets out with this ambition in mind and with the intention of contributing to this unprecedented collective effort.

The series

We live on a planet where interrelationships exist between all forms of life. It is probably in the tropical forests where this is most visible, with each species a cog in the perfect mechanism of life. We have built up our documentary around this principle, in 3 episodes of 52 minutes each, which examine the vital role that animals play in these five forests of Central America.

The animals we call “the engineers” play a more active role than the others in the expansion and shaping of the ecosystems. The most important of them all, paradoxically, is also the least known – the white-lipped peccary, a distant cousin of the wild boar and, like the boar, considered as game. Other animals, “the sentinels”, give us the warning signs when danger lies ahead, when the forest is suffering. The sentinels include anurans, such as the golden toad of the cloud forests which, in the early 1990s, was thought to be extinct and was seen by the international community as the first victim of climate change. “The emissaries” are those animals which form an invisible link between near and faraway ecosystems. These are the birds, some of the most iconic of which live in the forests of the central American isthmus. If we can stop the destruction of the forests and allow them to regenerate, all these species will then be able to embark on a new mission, that of driving the forests’ development and expansion!

The symbiotic relationship between the plant and animal worlds will provide the dramatic backdrop to the series as a whole. Short sequences focused on these animals’ behaviour patterns will help us to get to know them better and to improve our understanding of their lives and relationships in the wild. Some of the animals will be looked at from a larger perspective, such as the white-lipped peccary in the first episode and the great green macaw in the third. By the end of each episode, their actions will have brought about a change in the forest.

We have learned from the lessons of our previous films. We have understood that constant improvisation is part and parcel of filming life in the wild. Unpredictability is an ever-present part of the process – behavioural changes due to multiple factors, prevailing weather conditions, unexpected animal migrations, not to mention the health crisis which caused the 12-month closure of all the national parks.

To produce the images for this series, we will be using various shooting techniques which have already proven their effectiveness in our previous films on the

Mayan sculpture - bat

Costa Rican fauna, including **camera traps, infrared cameras and ultralight silent machinery.** However, as the conditions here are more challenging, with a larger number of species to be filmed, we will also be using other techniques, such as **the latest large sensor cameras capable of filming**, for example, our many night-time sequences where the moon is the sole light source. We will also be filming with **very high-speed cameras,** to capture the beauty of birds in flight and the acrobatic leaps of the anurans – only a shutter speed of 1200 images per second allows

us to visualise the complex movement patterns and behaviours of species such as frogs, bats and birds.

A large part of the filming will be with **8K image resolution**, which will show the fine details of skin, eyes and plumage and also the composition, beauty and multiple facets of the surroundings.

The region in which we will be filming, the **Mesoamerican isthmus**, will be a central feature in all the episodes. We will be telling its geological history through **satellite images** edited in postproduction and showing how it has changed and is changing, through **sparingly-used integrated special effects**. These will allow us to see how the forest can develop over the next three decades, if it is allowed to do so, and how animals and their actions will help the five last great forests to once again connect up. We will be looking into a future which is still within our reach, provided we allow nature to follow its natural course.

In our Costa Rica series, we made a point of making live sound recordings of the animal sequences. Each species' call helps it stand out from others and from the elements of its surroundings. Recording these sounds also means preserving them for future reference. **The weird metallic sound of peccaries chattering their teeth has never been previously recorded professionally and neither have the calls of many of the birds which we will be filming. Every species of frog has its own call and recording these and all the other calls represents a singular technical and human challenge which we will be relishing.**

In wildlife films, more than in any other kind of film, music is of crucial importance, providing the subtext for characters without speech, putting across the hidden beauty and message of the creatures and their habitats. It helps guide the audience and gives a different shade of meaning to certain images which might otherwise be too obvious or too appealing, while emphasising the narration. **We will be continuing our successful partnership with English singer-songwriter Tom Baxter**, whose work on the Costa Rica series gave a new angle to wildlife film sound tracks, moving away from the often over-conventional format habitually used in the genre. His unintrusive orchestral music illustrates the immediacy of the images, while leaving a lasting impression.

Calakmul Reserve, Selva Maya, Mexico

EPISODE 1

THE ENGINEERS OF THE FOREST

The Maya Forest, stretching across Guatemala and Mexico. The sun is gently rising above **the majestic ruins of the ancient Maya city of Calakmul**. The forest is slowly waking up to the tune of a thousand bird calls ushering in another beautiful April day, one of the last of the dry season. The peaceful scene is interrupted by a far-off commotion of harsh, metallic noises gradually drawing closer, contrasting with peaceful voice of dawn. The noises are made by a remarkable and mysterious animal which once roamed across the vast open spaces of central and southern America, from Mexico to Argentina.

White-lipped peccaries

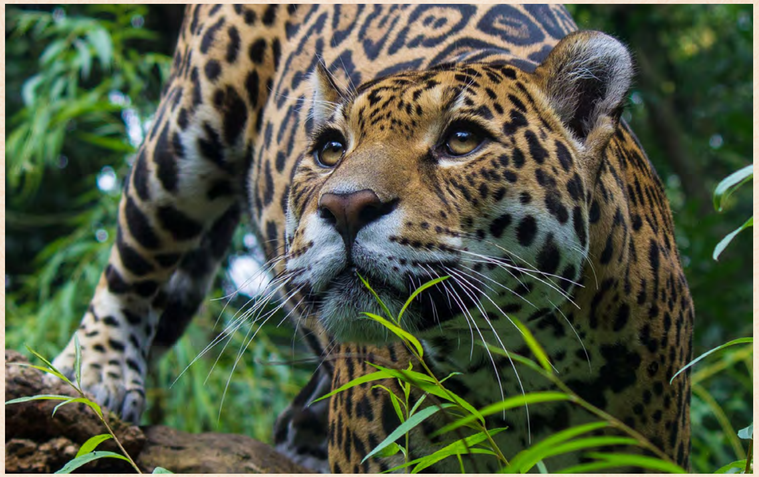
These animals still exist – but for how much longer?

These are the only large mammals to move around in such large herds within tropical forests. While at first sight they might look little different to a common or garden wild boar, they actually play a crucial role in maintaining the balance of tropical ecosystems. With their powerful jaws adapted to their mode of feeding, **white-lipped peccaries *(tayassu pecari)*** are the only species able to crush and ingest certain types of seeds. In their endless search for fruit and mud-filled wallows, they disperse the seeds across the forest, while creating freshwater habitats that benefit many other species, such as insects and amphibians. The peccaries live only in virgin or regenerating forestland, in other words where the forest is healthy.

They are the guardians of the forest's biological health, its architects and its builders. Their loss would trigger a cascade of extinctions in both flora and fauna, including the **jaguar** – a key predator and regulator of the ecosystem, which feeds mainly on the peccary. Without them, the very future of the American tropical forests would be under threat.

White-lipped peccaries are particularly endangered in Central America, where they are a favourite target for hunters. In Mexico, Guatemala, Costa Rica and Panama, they are on the brink of extinction, after having disappeared completely from El Salvador and Honduras, either at the hands of poachers or due to the loss of their habitat, split asunder by intensive logging.

White-lipped peccaries



Jaguar

Peccaries are constantly on the move in groups which can range over territories of up to 200 km^2. Despite all the drastic changes that have hit forestland in Central America, peccary herds have maintained their migratory patterns. Nowadays, they are having to cross rice fields, plantations of African palm trees and fields full of sugarcane. The more open their environment, the more vulnerable they are, and this their hunters know well. Weighing in at some 40 kg, they are easy targets. When one of the herd is shot, its companions stay close to the stricken animal to protect it, allowing the hunters to move in and kill dozens more. Only a couple of the corpses are taken away for food, the rest are left to rot.

Today, though, they are to be found in just 13% of their historical range in Mesoamerica.

No species represents the plight of neotropical forests as much as the white-lipped peccary.

Their ultimate refuge is the five last great forests, which rely on peccaries as much as peccaries owe them their survival. The animals play a key role in maintaining the biological diversity of plant species and the renewal of vegetation. The much hoped-for future re-establishment of connectivity between the forests, which will ensure vital genetic exchanges between the two Americas, cannot take place without them.

Surprising as it may seem, these irreplaceable animals remain pretty much unknown. They have been long neglected even by scientists and conservationists, who preferred to focus on more “visible” species.

Will the peccaries die out before they have yielded their secrets?

We will be following parts of the last remaining populations of white-lipped peccaries in Central America. This never previously attempted journey will bring into focus one of the most intriguing and least known species of the Neotropics. **For the first time, the secret life of peccaries will be filmed in detail,** revealing their unique ecological role and their complex social and reproductive behaviours. This is natural history at its rawest, filmed deep in the last five great Mesoamerican forests.

White-lipped peccaries, however, are not the only engineers of the forest. **Our film will also be looking at other seed dispersers** who play a major role in maintaining the balance of tropical ecosystems and the expansion of existing forests. The indigenous populations of Central America are well aware of the part these animals play and this can be seen through the rich collection of artefacts exhibited in the museums of Guatemala, Managua (Nicaragua) and San Jose (Costa Rica) and through the cave paintings which can be found within these countries. In Guatemala, even today, men of the Kachiquel population still wear clothing embroidered with the figure of a **bat**. The flight of the bat is also an emblematic feature of their dances, while their songs and prayers celebrate the animal’s divine status. This divinity comes from their nocturnal existence, but also because they use the darkness to perform the essential task carried out by birds and insects during the day – that of pollination.

Mexican long-nosed bat

Mexican long-nosed bats

On the Mexican side of the Maya Forest, the **Calakmul cave** is home to 4 million bats, which include 9 different species. Every day for the last several million years, come dusk, thousands of the creatures fly out the cave every minute over a two-hour period,

Spider monkeys

spiralling upwards to avoid their predators. The Maya Forest bats consume about 4 tonnes of insects every night, including disease-spreading mosquitoes and parasites that attack cotton and agave crops. While bats are undeniably friends of mankind, the opposite is certainly not true. The only winged mammals on our planet, bats are systematically exterminated, victims of our ignorance and superstitions. The picture people have of them as bloodsucking beasts and bearers of disease comes from a woeful misunderstanding of their natural history.

With scientists' interest in bats reawakening, some 137 species have been recorded in Mexico alone and our knowledge of the animal has been steadily growing. Using the latest digital recording technologies, biologists recently discovered, for example, how mother bats teach their young to communicate by emitting ultrasounds which are reproduced by the pups until they are fully assimilated.

A quarter of the bat population is fruit eating and helps with the dispersion of seeds, while other species, such as ***Noctilio leporinus***, which lives in the forests of the central American lowlands, feed exclusively on fish which they capture acrobatically by scooping them up from the surface of the water.

Another species with complex social behaviour patterns also helps shape the forest as it moves around. It is only recently that scientists have begun to understand the crucial role played by the **spider monkey** in maintaining ecosystems. They have a fission-fusion social organisation unlike any other New World primate. Spider monkeys form groups of

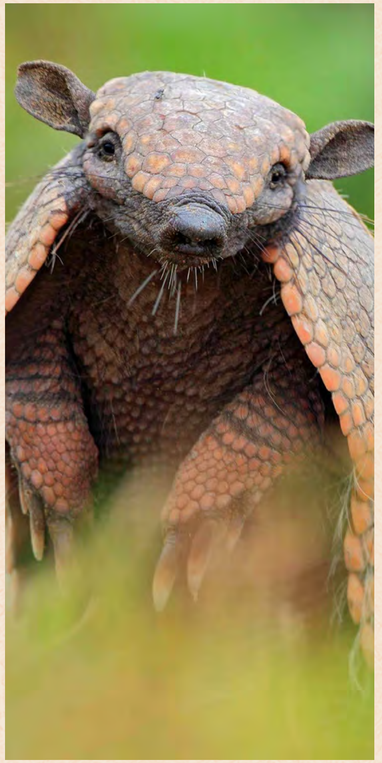
Tapir

around 30 individuals and during the rainy season, when fruit is hard to come by, they split in the morning into several subgroups, each of which moves off in search of fruit-bearing trees. While doing this, they disperse quantities of seeds over huge areas. Come dusk, the group comes back together at the top of a tree, where they communicate and take care of each other before peacefully falling asleep. The fission of the group during periods when food becomes harder to find reduces competition between its members. During the dry season, when fruit becomes abundant, fusion strategies are adopted, which encourage both competition and cooperation.

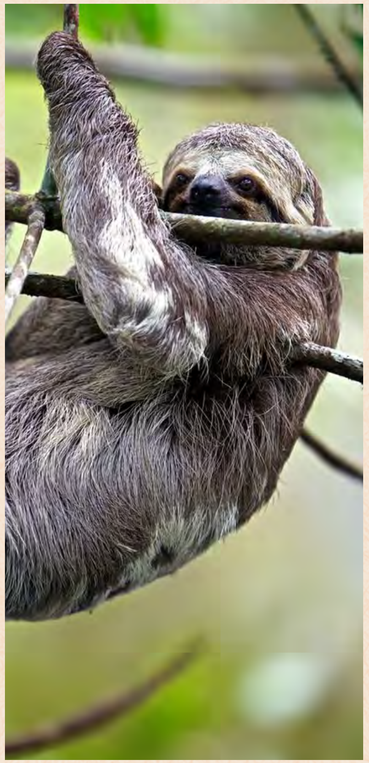
While spider monkeys used to be found throughout Central America, large groups are now restricted to a small number of protected forests. Out of all the engineers of the forest, these primates, which, unlike other monkeys, live in well-preserved old-growth forests, have a specific importance, with their presence signaling that the forest is in good health. With their fission-fusion organisation, they roam further into secondary forests, well beyond the boundaries of the primary forests. Spider monkeys therefore help forests grow outwards, while also enabling secondary forests to become rich ecosystems in which they will be able to live.

The last of the engineers of the neotropical forest is also the largest mammal living within it. The huge weight of its body crushes the seeds on its path dispersed by other creatures or by the **tapir** itself. Emerging at night, it covers long distances at a slow trot, carving out paths which will become tracks letting in the light to shine on the soil and encourage seeds to sprout. When unencumbered by human presence, tapirs often emerge from the forest, to weathered land where no other dispersers dare venture and where they will be the first to deposit the seeds for future green shoots. Tapirs are key not only to the restoration of the central American forests, but also for the absorption of CO^2, which recent studies have shown is taken up significantly less when the tapir is no longer present. A forest without tapirs is a forest which is suffering.

The combined effects of white-lipped peccaries, bats, spider monkeys and tapirs are what help sustain one of the richest natural environments of our planet, which is home to some 10% of the Earth's biodiversity. It is, however, not enough just to have these forests exist. The major ecological challenge facing the countries of Central America is re-establishing the links that once bound the southern and northern parts of the continent. The first step is to connect up these five last great forests. This will allow Xenathrans, which are endemic to the Americas, to once again cross over between the two sub-continents and help maintain the health of the ecosystems. The presence of **armadillos, sloths and anteaters** in central American forests, Mexico and the south of the USA is a relic of the not-so-distant past when a continuous biological bridge still existed.



Armadillo



Sloth

The separation of the forests has had an especially harmful effect on the **giant anteater**, which features prominently on just about every regional and national list of animals in danger. This large (it can reach up to 2 metres, snout to tail), slow-moving anteater, with its thick coat, is considered to be extinct in Costa Rica, Nicaragua and El Salvador, while in Guatemala the last individual was spotted several years ago. It is now only to be found in the forests of southern Panama.

Giant anteaters are generally solitary animals and individuals are continually on the move, covering vast areas with their muzzle close to the ground, searching for insects. Like the bat, it is an important regulator of insect populations, consuming some 35,000 ants and termites every day. It can break into a gallop for finding food or to escape from a predator, against which it will defend itself with its claws, which jaguars, its main predator, have learnt can be quite a fearsome weapon. Its claws are also used to dig down into anthills, to open up a channel into which it inserts its long, sticky tongue, which can move in and out 160 times a minute, to catch the insects. The ants retaliate by stinging the invader and the anteater has to withdraw its tongue within about 60 seconds. Anteaters take great care not to destroy the anthill, to make sure its inhabitants can repair and repopulate it, making it available as a future source of food. Anteaters act as stewards of their main food reserve, in the same way as Amerindian populations used to protect their environment, a strategy that we have clearly forgotten.

Will the giant anteater once again be able to enjoy a sufficiently large and protected territory that will allow the species to restore its population in the old Central American biological bridge?

This will be the final stage of the greatest ecological challenge that Central America must face – creating connections between the five last great forests.

Giant anteater

EPISODE 2

THE SENTINELS OF THE FOREST

Late April.

Thunder is rumbling above the Central American isthmus. An electric atmosphere pervades the five last great forests. The first rains of the year are about to start. As the sky darkens, a raging chorus of swirling sound gradually draws nearer, so loud it manages to blank out even the peals of overhead thunder.

From the Maya Forest in the southern part of Mexico right across the peaks of the Cordilleras to the Darien forest in the south of Panama, the rainy season has begun, to the delight of the anurans.

Red-eyed tree frog

Come nightfall, under the deluge, they will crowd into any area where there is water and into every level of the forest, from the ground right up to the canopy layer. In no time at all, streams turn into torrents, ponds into lakes, river flow rates double and water pours over their banks and when they reach the ocean, they stretch out as far as the eye can see. The rain runs down giant trees like mini waterfalls. The green of the forest has given way to water.

Anurans (toads and frogs) were the first inhabitants of this geological bridge, which formed some 31 million years ago. They were also the first vertebrates to explore the young forests which would allow species to cross over between southern and northern America during the great American faunal interchange. They witnessed the first men coming in from the north to populate Central America, around 30,000 years ago.

Bare-hearted glass frog

Archaeological artefacts dating back to some 500 years before the Christian era illustrate the symbolic relations the indigenous peoples enjoyed with the anurans, which were seen as the messengers of the rain, symbols of fertility and cleanliness. The pre-Hispanic peoples were aware of the roles the anurans played in keeping the balance within their world.

Amphibians are **the sentinels of the forests** and when the forests suffer, they are the first to die out. When the forests are healthy, their bright colours and calls fill the air and mark the seasons. They are a reliable indicator of the health of ecosystems, interacting with their environment through their thin, fragile skin with its network of blood vessels.

Amphibians are vital elements in the tropical forests of Central America. Every anuran has two different lives, each of which is essential for maintaining the complex mechanisms which govern ecosystems. Tadpoles, before their extraordinary metamorphosis, are herbivores living in streams and rivers, ponds and lakes. They have an important effect on their habitat, playing a central role in the survival of aquatic insects and preventing algae from taking over their surroundings. By purifying their environment, they help produce the clean water which we consume. Once they turn into toads or frogs, they switch to a carnivorous diet, keeping down the populations of the invertebrates they feed on and becoming themselves the prey of snakes, mammals and birds. Anurans are a key part of food chains and if they were to disappear, the very existence of the five last great forests of Central America would be called into question.

Golden toad

It was in one of these forests, in the late 1980s, that biologists witnessed, virtually in real time, the extinction of the **golden toad**. Endemic to the cloud forests of Costa Rica, this striking amphibian has become the symbol of the country's extraordinary biodiversity. It was the first victim of a hitherto unmentioned danger – climate change. The golden toad's reproductive cycle was synchronised with the onset of the rains. The last time an individual was spotted was next to a dried-up pond. The disappearance of the golden toad set the scene for Earth's sixth mass extinction. New species of amphibians are continually joining the depressing list of animals vanishing all over the world.

Heredia robber frog

A number of other factors have aggravated the effects of climate change, including deforestation and the widespread use of pesticides, but especially chytridiomycosis, a disease that attacks the skin of anurans, eventually killing the host by disrupting its breathing. Climate change is helping to abet the expansion of the fungus that causes the infection. Amphibians can be compared to the canaries which used to be taken down the mines to give advance warning of the presence of toxic gases – when the bird stopped singing and fell off its perch, it was the signal to evacuate the area forthwith.

Amphibians are disappearing at an alarming rate, faster than any other terrestrial vertebrate. Their high vulnerability puts them at considerable risk of being the first victims of the Anthropocene, this new era which has seen biodiversity declining in the face of human activities.

Something totally unexpected has, however, raised the hopes of scientists. Several species of amphibians which were thought to have become extinct some decades ago have recently been spotted in Costa Rica, including the **Heredia robber frog *(Craugastor escoces)*** and **Holdridge's toad *(Incilius holdridgei)*.** This suggests that, despite the current ecological crises, anurans possess an extraordinary ability to adapt.

Holdridge's toad

Our journey into the centre of the anuran world begins with this ecological miracle.

The five last great forests of Central America each have their sentinels, **who signal the availability of the element vital for the survival of both plants and animals – water.** When we talk about anurans, we are also implicitly talking about water, as their very existence is indelibly linked to water and water cycles.

The forests of the Caribbean side of Central America are among the wettest in the world and this is certainly one of the reasons why they also have the world's highest density of anurans. They are to be found everywhere in the forests, on the ground and up in the trees, from the flat plains to the towering, cloud-covered volcanic cordilleras.

We will be plunging deep into the five last great forests of Central America in search of the sentinels.

Gliding tree frog

In Costa Rica, the rediscovered species, thought to have been extinct, live for the most part in the high volcanic forests, where the once omnipresent clouds kept the forests at a constant rate of humidity.

Darien and Amistad, the 2 great forests of Panama, are home to the **poison frogs**, the only ones of their family to be active during the day. Their brightly coloured skin acts as a warning sign to predators and many birds have learned to avoid them.

Most anurans are nocturnal, as their fragile skin makes them vulnerable to sunlight. Their calls and croaks allow members of each species to recognise each other in the darkness. In Guatemala's Maya Forest, during the rainy season, the ruins of ancient temples echo throughout the night to the sound of their calls.

We will be looking at never previously filmed reproduction behaviours, such as the explosive breeding display of the gliding tree frog *(Agalychnis spurrelli)*. This remarkable climbing frog clings on to leaves of the tree canopy for most of the year, only coming down to ground to reproduce at the beginning of the rainy season. Once the rains begin, they descend in their hundreds to gather around pools and then to cover the whole of the surrounding areas with their eggs, which they lay on leaves hanging over the water, for the tadpoles to drop directly into once they hatch.

Strawberry poison dart frog

Granular poison frog

Other amphibians, such as the **strawberry poison dart frog *(Oophaga pumilio)***, lay their eggs on the forest floor and protect them against predators, watering the nests with their mouths to keep them hydrated. When the eggs hatch, the female carries the tadpoles on her back to drop them one by one into a water-filled bromeliad. She will then come back to the eggs every few days, feeding them by laying a couple of non-fertilised eggs in the flower, until the tadpoles metamorphose into froglets. The host plants are semi-carnivores and feed on the dejections and dead insects left by the tadpoles The young frogs begin to call at the age of 3 to 4 months and become sexually mature at around 6 to 7 months.

The **granular poison frog *(Oophaga granulifera)*** cares for its eggs in a similar way. The male attracts his mate with his cries, the female choosing the male

with the strongest cry. Once the eggs are fertilised, she lays them on a hollow in the earth on a bed of wet leaves and keeps guard on them.

In the forests of the Pacific coast, a number of species spend the dry season underground. When the first drops of rain begin, **Mexican burrowing toads *(Rhinophrynus dorsalis)*** emerge together as if by magic from their hideouts and travel up to several kilometres to find their mate in a water body.

There are several anurans which never come down to earth. The **spiny-headed tree frog *(Triprion spinosus)*** spends its life in the tops of high trees, alongside other animals of the canopy, such as spider monkeys and several species of birds. It has to jump from tree to tree to find its breeding mate and the eggs will be laid in water-filled hollows in a tree.

Through the anurans of Central America we will also find out about other species with which they are ecologically associated, including **New World snakes** which regulate the amphibian populations and birds such as **herons, pelicans** and **raptors**, which hunt frogs and toads during the breeding frenzy. We'll also be looking at cats like the **jaguar** and **ocelot**, which hunt anurans to supplement their diet.

These highly coloured sentinels are for the moment a delightful part of the five last great forests of Central America. Their calls echo through the nights and their presence helps conserve rivers and streams. **They are the showcase of life in the wild – but for how long?**

Spiny-headed tree frog

Mexican burrowing toad

EPISODE 3

THE EMISSARIES OF THE FOREST

Deep down in the Indio Maíz-Tortuguero forest, which reaches across Costa Rica and Nicaragua, a pair of **great curassows** make their way towards the only stream where water can still be found. They move forward cautiously, in single file. The male has the all-black plumage which sets curassows apart from the other members of the cracidae family, ground-feeding birds native to the new continent. Females are polymorphic, the colour of their plumage varying from one individual to another.

Great curassow (female)

Great curassow (female an male)

Despite the cloud-laden skies, the dry season drags on and the rains are long in coming. The forest is thirsty. On the trees surrounding a water body, a small group of birds wait patiently. They have to make sure that it is safe to go to the water and that no predator hides ready to pounce. An agouti makes the first move and this is the signal for the birds to make for the pool to slake their thirst.

The great curassow has had caution bred into it for millions of years. If ever a single species were to embody the geological history of the continental bridge formed by Central America and the impact it has had on the animal population, it would be this bird.

Its fate is intimately linked to that of the forests of Central America.

The great curassow is part of a family of birds which have been living in the northern part of South America for about 9 million years. When the Colombian Andes emerged some 6 million years ago, the ancestors of the grand curassow were separated from the rest of the population living in the south-east, which would become Albert's curassows, now living in the Colombian forests. The great curassow's forebears settled in a strip along the Pacific coast of the Andes and in Central America during the Pliocene and Pleistocene periods and were part of the great American faunal interchange. They are considered to be some of the earliest known inhabitants of the region and their physiognomy has changed little over this vast period.

The great curassow is a terrestrial bird which nests in trees and lives only in areas with at least 80% plant cover in both the rainy and dry seasons. It can therefore only be found in intact, preserved and healthy forests. Like the jaguar, the white-lipped peccary and the spider monkey, it is an excellent indicator of an unspoiled tropical forest. While once it could be found throughout Central America, it can now only be spotted in the depths of the few primary forests that still exist, including the five last great forests. It is still a target for local hunters, which consider it as a game bird, but is now critically endangered.

While the indigenous peoples long considered curassows as a traditional source of protein and of materials for making tools (the bird also had religious connotations), they were aware of its role in the complex dynamics of tropical forest ecosystems. Humans, though, have not always been its main enemies. Great curassows are a food source for top and medium-level predators (mammals, reptiles and raptors) and they help control invertebrate population levels and shape their habitats by dispersing seeds. This delicate balance was fractured with the arrival of the Europeans and the beginning of the subsequent breakup of the central American forests.

Our journey with Central American birds starts off with the great curassow. After filming at ground level, the camera will move upwards to some of the world's most extraordinary observation points. Most of the filming will be done in the tree canopies, at bird height – technologically challenging, but crucial if we want to show the complexity of their social behaviours and the fundamental biological role

they play. The remarkable aerial choreographies and striking colours of these elegant creatures draw millions of visitors each year, the “pajareros” attracted also by the number and variety of birds in the 5 last great forests. And this fascination is nothing new.

Artefacts, stone carvings and sculptures bear eloquent witness to the importance that birds had in Pre-Columbian cultures. For the Ancient Mayans, the **vulture**, which for many people is the most unpleasant-looking of all birds, had an exalted status. Even now, several indigenous peoples associate the vulture with purification and regeneration, considering the bird to be the bearer and protector of the fire which cleans the earth in spring, before the rains and the sowing of the fields. In the same way as fire prepares the fields for sowing, vultures clear rotting remains away from the ground, making it clean and preparing it for the return of life. As a guardian angel of crops, it cut an important figure in Mayan agricultural rites.

The most impressive of the American vultures is certainly the largest, the **king vulture**. Capable of gliding effortlessly hour upon hour, it is a diurnal bird which, like the great curassow, lives in the primary forests. With its great size setting it apart from other vultures, it has first peck at fresh carcasses. It will push its way through any waiting birds to tear off the first strips of flesh, which it will continue to eat until full, at which point the other vultures can have their share. The king vulture is a silent bird, the only sound it makes being the beating of its wings. It needs large quantities of water and bathes several times a day. Once it has finished washing itself, it settles on the

King vultures

Harpy eagle

top of a tree and stretches out its wings to dry its feathers and eliminate infections.

The king vulture did not, however, always have things its own way in Central America. The **harpy eagle**, the largest and most powerful raptor of the tropical forests, used to be the undisputed ruler of the central American isthmus, right down into Argentina. Its claws, longer than a brown bear's, are like steel hooks.

The only remaining refuge of harpy eagles in Central America is now the Darien Forest in Panama and Colombia, where they live alongside the Emberá people, who protect them and have made them a source of income from tourists who flock in to see this highly impressive bird.

The harpy eagle, along with the jaguar, is one of Central America's key predators and it feeds on tree-living mammals such as monkeys, sloths and coatis, as well as reptiles and birds such as macaws and black vultures.

It is December. The nest of one of the few remaining harpy families is to be found in this ceiba tree. The chick is 2 months old and its father lays the lifeless body of a sloth in the nest for its mother to tear into strips to feed it. The two adults will then fly off to hunt for more food, leaving the chick alone in the nest. 6 months later, the chick has grown considerably and can now venture across to other trees 150 m away from the nest. Despite its size, which is about the same as its mother's, it is still dependent on its parents and will be until it is 2 years old.

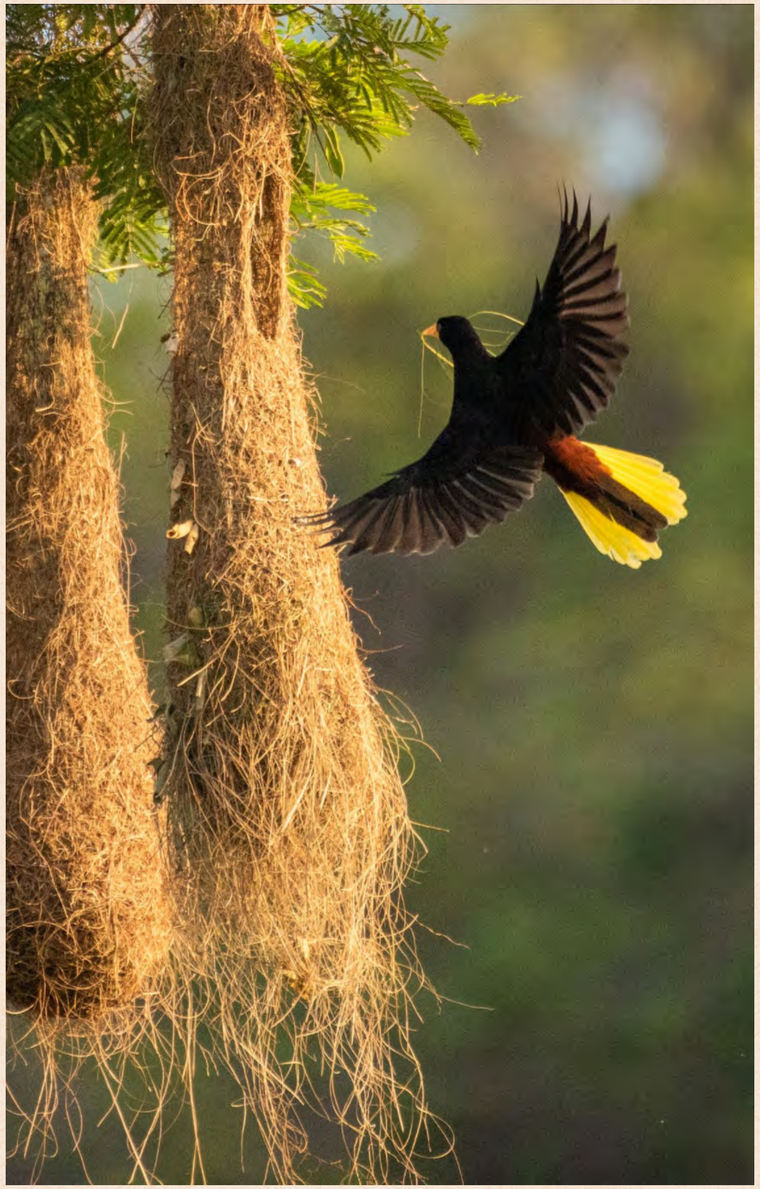
When the father comes back with food, the juvenile eagle will jump up and wolf it down. The young, they're all the same...

The harpy eagle builds its nest at the top of the tree canopy, leaving it open. As the king of the predators, it has nothing to fear.

Other, more vulnerable birds native to Central America have developed extraordinary techniques for protecting their progeny. **Oropendolas** and **caciques**, for example, build bag -shaped nests which hang from the branches of trees, forcing potential predators to climb up the trunks and along the branches, few of which are prepared to do so. As a further precaution, the nests are very often built next to active wasp or ant nests, which are usually more than enough to put off would-be predators.

Other species, such as the legendary **resplendent quetzal**, use hollows they find high up in trees, helping to protect their young from predators. Venerated by the Maya and the Aztecs, the brightly coloured quetzal, with its long feathers, is endemic to the Central American forests, but can now only be spotted in the Maya and Amistad forests at altitudes of over 1500 m.

The **great green macaw** is another bird to have lost a substantial part of its original habitat and is a perfect example of how a species can be dependent on a specific tree, in this case the mountain almond. The tree provides the macaws with food (80% of its diet comprises almonds), shelter and a hollow for its nest. Should the mountain almond vanish, then the



Oropendola

Cacique

Resplendent quetzal

Great green macaw

green macaw will also disappear and both species are currently on the brink of extinction. The last remaining mountain almonds, which survived the intensive logging in Costa Rica in the 1970s and 80s and which is still going on in other Central American countries, are to be found scattered around the forests of the Caribbean plains, in Costa Rica and Nicaragua. These trees are home to the surviving green macaws. Although the macaws are seeing their population gradually increase in Costa Rica, with some 500 individuals remaining today, compared to 200, 10 years ago, the world's second-biggest macaw is anything but out of danger. The great primary forest of Indio Maiz-Tortuguero has become its ultimate refuge. It would be fair to say that every single bird of Central America has been adversely affected one way or another by human activity.

Unfortunately, logging and poaching are no longer the only dangers facing the winged fauna of Central America. The five last great forests have been hit hard by global warning and exceptional weather events and several species of birds have seen their ability to adapt severely curtailed. 2020 was a particularly catastrophic year with Iota, a category 5 hurricane, devastating Nicaragua and Honduras just 2 weeks after category 4 hurricane Eta. The latest research shows that the increasing frequency of such extreme weather events will not allow ecosystems to recover and renew their resources. Trees are particularly affected and, by association, the birds which live on them and see their main source of shelter and food destroyed. While the overall picture is bleak, **birds, the emissaries of the forest, are bringing us a message of hope**. Researchers from the University

Frigate birds

of Alberta have been studying several types of forests destroyed or adversely affected by human activities and have discovered that after only 20 years, a secondary forest will grow back naturally and offer birds similar habitats to those in forests over 60 years old. Field research has confirmed these findings, which give us reassurance that once a forest disappears, it can grow back again out of its ashes to re-become a haven for fauna.

The five last great forests of Central America must expand and connect up to each other, a process which needs to be helped and protected by us, so that they can offer home and shelter to the innumerable and often unique species which inhabit or visit them.

In October, up to half a million migrant raptors, fleeing from the northern winter, fill the sky and trees of the five forests. Along the central American

coastline, islands act as nurseries for vast numbers of seabirds. Bolaños island to the north of Costa Rica, is a nesting site for hundreds of magnificent **frigate birds** and **brown pelicans**. In February, at the peak of the mating season, the whole of the island is covered with frigate bird and pelican nests. A few months later, the chicks will be ready to fly and will, in turn, become the bearers of a message as old as the world itself.

Brown pelican

TECHNICAL SPECIFICATIONS

Mesoamerica: the Guardians of the Forest
A wildlife documentary series

3x52min

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