

## Chapter 9 The Tropical Rainforest

**In this brief introduction we will discuss the geographical location of rainforests, some of their main structural features, flora and fauna, effect on climate and human use.**

### 1) Main locations of Tropical Rain Forests

In the broadest terms we can find tropical rain forests around the equator between the Tropics of Cancer and Capricorn all around the world, in Asia, Africa, Central and South America, Australia and Pacific islands.

Basically speaking in the continents of the Americas they are spread across the following countries: Belize, Brazil, Colombia, Costa Rica, French Guiana, Guyana, Peru, Surinam and Venezuela. The Amazonian region is the biggest area forming more than half of the world's total rainforest area.

In Africa tropical rain forest is found in the following countries: Democratic Republic of Congo, Congo, Central African Republic, Cameroun, Gabon, Nigeria, Madagascar etc but African rainforest is mainly found in the Congo river basin. This covers an area of one third of the world's total rainforests. In Asia and we find tropical rainforest in Indonesia, Malaysia, Sri Lanka and some parts of India.

### 2) Rainforests

**Rainforests** are forests characterized by high rainfall, with definitions setting minimum normal annual rainfall between 1750 mm. The monsoon trough, alternately known as the intertropical convergence zone, plays a significant role in creating Earth's tropical rain forests. About 40 to 75% of all species on the world's habitats are indigenous to the rainforests. For example 90% of the Earth's insect species are to be found there. It has been estimated that many millions of species of plants, insects, and microorganisms are still undiscovered. Tropical rainforests have been called the "jewels of the Earth", and the "world's largest pharmacy", because over one quarter of natural medicines have been discovered there. Rainforests are also responsible for 28% of the world's oxygen turn over, often misunderstood as oxygen production, processing it through photosynthesis from carbon dioxide and storing it as carbon through biosequestration.

The undergrowth in a rainforest is restricted in many areas by the lack of sunlight at ground level. This makes it possible to walk through the forest. If the leaf canopy is destroyed or thinned, the ground beneath is soon colonized by a dense, tangled growth of vines, shrubs and small trees called a jungle. There are several main types of rainforest, but perhaps the two most important are tropical rainforest and temperate rain forest. In this articles we will be discussing the tropical rainforest only.

### 3) Structure of the Rainforest

A tropical rainforest is typically divided into four main layers, each with different plants and animals adapted for life in that particular area: the emergent, canopy, understory, and forest floor layers.

#### Emergent layer

The **emergent layer** contains a small number of very large trees called **emergents**, which grow above the general canopy, reaching heights of 45 m, although on occasion a few species will grow to 70 m tall. They need to be able to withstand the hot temperatures and strong winds in some areas. Eagles, butterflies bats and certain monkeys inhabit this layer.

#### Canopy layer

The **canopy** layer contains the majority of the largest trees, typically 30 m tall. The densest areas of biodiversity are found in the forest canopy, a more or less continuous cover of foliage formed by adjacent treetops. The canopy, by some estimates, is home to 50 percent of all plant species, suggesting that perhaps half of all life on Earth could be found there. Epiphytic plants attach to trunks and branches, and obtain water and minerals from rain and debris that collects on the supporting plants. The fauna is similar to that found in the emergent layer, but more diverse. A quarter of all insect species are believed to exist in the rainforest canopy. Scientists have long suspected the richness of the canopy as a habitat, but have only recently developed practical methods of exploring it. As long ago as 1917, naturalist William Beebe declared that "another continent of life remains to be discovered, not upon the Earth, but one to two hundred feet above it, extending over thousands of square miles." True exploration of this habitat only began in the 1980s, when scientists developed methods to reach the canopy, such as firing ropes into the trees using crossbows. Exploration of the canopy is still in its infancy, but other methods include the use of balloons and airships to float above the highest branches and the building of cranes and walkways planted on the forest floor. The science of accessing tropical forest canopy using airships, or similar aerial platforms, is called dendronautics.

## Understory layer

The **understory** layer lies between the canopy and the forest floor. The understory (or understory) is home to a number of birds, monkeys, snakes, lizards, as well as predators such as jaguars, boa constrictors and leopards. The leaves are much larger at this level. Insect life is also abundant. Many seedlings that will grow to the canopy level are present in the understory. Only about 5 percent of the sunlight shining on the rainforest reaches the understory. This layer can also be called a *shrub layer*, although the shrub layer may also be considered a separate layer.

## Forest floor

This is a much understudied area - perhaps less glamorous than the other layers to some. The **forest floor**, the bottom-most layer, receives only 2 percent of sunlight. Only plants adapted to low light can grow in this region. Away from riverbanks, swamps and clearings where dense undergrowth is found, the forest floor is relatively clear of vegetation because of the low sunlight penetration. It also contains decaying plant and animal matter, which disappears quickly due to the warm, humid conditions promoting rapid decay. Many forms of fungi grow here which help decay the animal and plant waste. As an example of the incredible diversity of fungi we have a recent update from Bolivia. On a 2007 expedition one researcher found over 276 different mushrooms in the jungle:

" there were *Ganoderma lucidum*, the medicinal reishi or lingQi mushroom; 3 or 4 species of edible oyster mushroom, growing on tropical palm or hardwood; over 20 collections of conks, wood-decomposing brown rot fungi that slowly decompose the tropical hardwood trees; a large variety of *Marasmius* mushrooms, a genus not much found in the north; 2 species of *Boletus*, 2 unique mushrooms that seem to be *Amanita*, several *Cortinarius*, 6 collections of *Cordyceps*, a group of insect-killing fungi; 3 *Auricularia* (tree ear) species; 3 species of *Cotylidia*, a tropical cartiliginous mushroom, over a dozen species of *Lepiota*, 3 *Oudemansellias*, 5 or 6 *Agaricus*, one with amazing blue gills; two species of mushroom cultivated by termites or ants, one of which produces large edible fruits; a *Volvariella* on a fig tree; a host of fungi in the *Xylaria* family, some with white tufted heads, others branched like barbed wire, some long and wiry, others short and corky; two adorable little scarlet cup fungi of the *Cokeina* genus, about a dozen other species that were members of familiar North American genera, two very different coral mushrooms, at least one species of mushroom that displays bioluminescence, and probably 40 or 50 species of fungi which were new to me. The physical specimens remain in Bolivia at the national herbarium for reference. "

## 4) Flora and fauna

.More than half of the world's species of plants and animals are found in the rainforest. - Rainforests support a very broad array of fauna including mammals, reptiles, birds and invertebrates. Mammals may include primates, felids and other families. Reptiles include snakes, turtles, chameleons and other families while birds include such families as vangidae and Cuculidae. Dozens of families of invertebrates are found in rainforests. Fungi are also very common in rainforest areas as they can feed on the decomposing remains of plant and animal life - see the extract about Bolivia above. These species are rapidly disappearing due to deforestation, habitat loss, and biochemical releases into the atmosphere.

Lets take some specific geographical examples of animal communities. In the Amazon for example we can find: Spider monkeys, Golden Lion Tamarins, Sloths, Giant River Otters, Toucans, Macaws, Pink River Dolphins, Electric Eels, Piranhas, Black Caiman, Anaconda, Jaguar, and poison Arrow Frogs just to name some of the more famous species. In the Congo we can find Chimpanzees, Western Lowland Gorillas, Okapi, Forest Elephants, Bonobo, Bongo, Warthogs etc, Perhaps the most famous residents of the tropical rain forest in Asia are the orangutan (*Pongo pygmaeus*), proboscis monkey (*Nasalis larvatus*), gibbon (*Hylobates muelleri*), and long-tailed macaque (*Macaca fascicularis*). In Borneo we also have the banteng (*Bos javanicus*), a species of wild ox; the highly endangered Sumatran rhinoceros (*Dicerorhinus sumatrensis*); the Asian elephant (*Elephas maximus*), which is smaller in stature than mainland elephants; the Sambar deer (*Cervus unicolor*), the clouded leopard (*Neofelis nebulosa*) and the sun bear (*Helarctos malayanus*).

Lets take a look at two geographical examples or case studies:

### Biodiversity Case Study One - The Amazon

Wet tropical forests are the most species-rich biome, and tropical forests in the Americas are consistently more species rich than the wet forests in Africa and Asia. As the largest tract of tropical rainforest in the Americas, the Amazonian rainforests have unparalleled biodiversity. One in ten known species in the world live in the Amazon Rainforest. This constitutes the largest collection of living plants and animal species in the world. The region is home to about 2.5 million insect species, tens of thousands of plants, and some 2,000 birds and animals.

According to one estimate to date, at least 40,000 plant species, 3,000 fish, 1,294 birds, 427 mammals, 428 amphibians, and 378 reptiles have been scientifically classified in the region. One in five of all the birds in the world live in the rainforests of the

Amazon. Scientists have described between 96,660 and 128,843 invertebrate species in Brazil alone.

The diversity of plant species is the highest on Earth with some experts estimating that one square kilometer may contain over 75,000 types of trees and 150,000 species of higher plants. One square kilometer of Amazon rainforest can contain about 90,790 tonnes of living plants. The average plant biomass is estimated at  $356 \pm 47$  tonnes  $\text{ha}^{-1}$ . To date, an estimated 438,000 species of plants of economic and social interest have been registered in the region with many more remaining to be discovered or catalogued.

The green leaf area of plants and trees in the rainforest varies by about 25% as a result of seasonal changes. Leaves expand during the dry season when sunlight is at a maximum, then undergo abscission in the cloudy wet season. These changes provide a balance of carbon between photosynthesis and respiration.

## **Biodiversity Case Study Two - Borneo**

Borneo's forests are highly biodiverse. According to WWF, the island is estimated to have at least 222 species of mammals (44 of which are endemic), 420 resident birds (37 endemic), 100 amphibians, 394 fish (19 endemic), and 15,000 plants (6,000 endemic) -- more than 400 of which have been discovered in surveys since 1994. In fact new species are being discovered here still:

Discovery of new species of bird in Borneo in 2009

While walking along a 250 meter-high canopy-walkway set-up for tourists, Richard Webster discovered a bird he didn't recognize feeding on mistletoe berries. He took photos of the individual and later shared them with Dr. David Edwards, an ornithologist from Leeds University who has been studying birds in the area for three years. After checking with several museums, they realized that no one had ever recorded such a bird.

"This discovery shows once more how little is known about the diversity of life on our planet," Jean-Christophe Vié, Deputy Director of IUCN's Species Programme said. "2010 is the International Year of Biodiversity. It is an opportunity to increase our knowledge of nature and its functioning, explain its importance to the wider public, and most of all, undertake action to reduce the current threats in order to allow thousands of more discoveries like this one in the future."

The discovery has been published in the latest issue (Jan 2010) of the Oriental Bird Club's magazine, BirdingASIA. The species, known only as the 'spectacled flowerpecker, has not yet received a scientific name.

## **5) Effect of Tropical Rainforests on global climate**

A natural rainforest emits and absorbs vast quantities of carbon dioxide. On a global scale, long-term fluxes are approximately in balance, so that an undisturbed rainforest would have a small net impact on atmospheric carbon dioxide levels though they may have other climatic effects (on cloud formation, for example, by recycling water vapour). No rainforest today can be considered to be undisturbed. Human induced deforestation plays a significant role in causing rainforests to release carbon dioxide as do natural processes such as drought that result in tree death. Some climate models run with interactive vegetation and predict a large loss of Amazonian rainforest around 2050 due to drought, leading to forest dieback and the subsequent feedback of releasing more carbon dioxide. We need to increase efforts to preserve large tracts of the rainforests in all locations to combat this. Please see Dr Simon Harding's article "A Brief History of the Earth's Climate".

## **6) Human uses**

Tropical rainforests provide timber as well as animal products such as meat and hides. Rainforests also have value as tourism destinations and for the ecosystem services provided. Many foods originally came from tropical forests, and are still mostly grown on plantations in regions that were formerly primary forest. Also, plant derived medicines are commonly used for fever, fungal infections, burns, gastrointestinal problems, pain, respiratory problems, and wound treatment. In fact the human uses for the products of the rainforest are so diverse and numerous they should form the basis of another article.