

HOW DOES THE SEASONALITY OF RAINFALL AFFECT VEGETATION?

Seasonality of rainfall

A place close to the Equator, such as Yurimaguas, has a "double maximum" rainfall. The sun is directly overhead at midday at two distinct seasons of the year, as the sun swings from the northern tropic to the southern tropic and back again. As the overhead sun moves north or south, the Inter-Tropical Convergence (ITC) moves with it, and brings daily heavy rainfall.

At locations further from the Equator, the "high" sun and high rainfall is restricted to one period of the year. Also because the convergence of the wind systems is more distant for much of the year with less uplift of the air masses, total rainfall is lower.

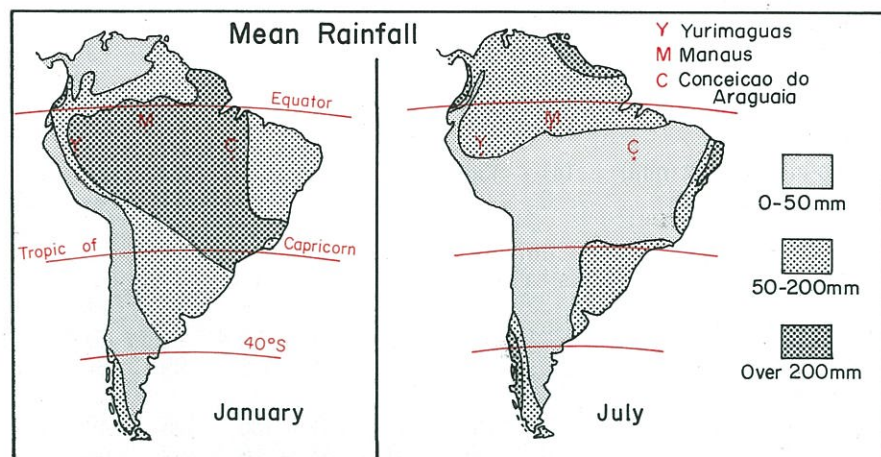
In June, July, and August, Yurimaguas has reduced rainfall because the ITC is furthest away, in the northern hemisphere. The rainfall that occurs in these months is partly due to the location of Yurimaguas, close to the Andes. The south-east trade winds, which reach the interior as fairly gentle winds, carry moist air up into the foothills of the Andes which act as a barrier to them. As the air masses rise above the mountains, they are cooled, water vapour condenses, and heavy rain falls. This is orographic rain.

The rainfall in these three months is less than evaporation and transpiration, so that there is a drying out of the forests. However, there is sufficient rainfall to maintain evergreen vegetation.

In the centre and the east of the Amazon basin, away from the influence of the Andes, the dry season of the low sun months is much more marked. Also, the rainfall in the dry season forms a smaller percentage of the annual average total. Because of the lower rainfall, the forest dries out to such an extent that the moisture needed to produce convectional rainfall is not available.

Variations in the seasonality of rainfall

It is clear from rainfall records that the "seasonality" of rainfall increases to the north and south from the Equator, because of the longer period outside the influence of the Inter-Tropical Convergence



Above: Rainfall patterns for January and July. The locations of Manaus, Yurimaguas, and Conceicao do Araguaia are marked in red.

(a) In 2-3 sentences explain why the Amazon rain forests have a high mean rainfall for the month of January.

(b) In 2-3 sentences explain why the southern area of the Amazon rain forests has a low mean rainfall for the month of July.

Variations in total rainfall

In some areas, the effect of the dry season is accentuated by a rain shadow. The south-east trade winds are intercepted by the mountain ranges along the coast of eastern Brazil, and the north-east trades are blocked by the uplands of the Guiana Shield and eastern Andes. This blocking and lifting feature along the coasts produces orographic rainfall for the coastal areas to the windward of the ranges. But to the lee of the ranges, the winds are drier and less likely to yield convectional rain, so the seasonal effect caused by the shift of the ITC is magnified by the rain shadow. This produces semi-arid conditions in a few areas.

Three types of rain forest

We have already noted that the forests depend hardly at all on the soils, and that rainfall and forests are interrelated. We will now see that it is rainfall that produces the variations in types of forest within the rain forests of Amazonia. Within Amazonia there are three types of rain forest, all of which merge into a mixed grassland and woodland region on one of their borders.

Evergreen lowland rain forest

The evergreen lowland rain forest covers about one third of Amazonia, notably those areas which have a short dry season. Because of the short dry season, there is no marked moisture stress which would cause the trees to shed their leaves at one particular season. Yurimaguas has a climate which is typical of locations in this type of forest.

This evergreen, ever-moist, forest presents special difficulties to farmers. They rarely find an opportunity to burn the logs and branches, which they have cut in order to start a fire which will clear an area of forest.

Evergreen montane rain forest

The evergreen montane rain forest is located in a narrow strip along the edge of the Andes and covers only about 2% of Amazonia. In this zone of uplift, the humid air is liable to produce rain day after day, without any respite. Even on days when it does not

rain, the skies are likely to be cloudy and the air very damp. In the highest areas, where the clouds form a constant fog among the trees, growth rates are limited by the lack of sunlight.

Because of the continual humidity, this type of forest is even more difficult for farmers to cope with.

Seasonal rain forest

The seasonal rain forest covers the greatest proportion of the rain forest region. The area where this type of forest grows has a dry season, which is long enough and dry enough to produce a flowering season. Farmers use this dry season to clear areas of forests to form new fields. There is more of a rhythm to the seasons here, and regular times for gathering the various nuts and fruit, turtle egg collection, and runs of fish.

The seasonal variations in this rain forest can be unreliable. The rains may come early, or persist longer than expected. Towards the northern and southern boundaries, the dry season may last long enough for all the trees to shed their leaves, and for fires to spread through the forest. It is in areas with these more extreme seasonal climates that the rain forests have suffered the greatest damage from land clearing and burning. Land clearing and burning are easier to do, and the damage done by them is less easily repaired by natural processes. The stress of drought reduces the energy available to the forest, and slows down recovery following cutting and burning.

Savanna and thorn forest

On the drier margins of the seasonal forest, there is a fluctuating boundary where the forest gives way to a grassland and broadleaf tree complex. Even though the soil type is the same and the rainfall is not much less, forest cover is low and sparse, except along the river flats.

Natural fires caused by lightning, and hunters' fires, prevent seedlings from spreading from the seasonal forest. The vegetation is a mix of grasses with tough roots which sprout new leaves after fire, and fire-resistant trees with thick, corky bark and tough leaves. One of them is known as the sand paper tree because its leaves are so coarse.

It is possible that forest could regenerate in the savannas if it could be protected from fire. But it would be a slow process, because the soils are very infertile after such a history of burning and weathering.

In a few areas, savanna gives way to an even drier vegetation type, thorn forest. A dry season of more than six months produces a xerophytic vegetation, including many varieties of cactus. In the wet season, the cactus and thorn scrub put on a display of flowers and leaves. But in the drought, nothing grows, and ranchers attempt to burn the thorns and spikes off the plants so that cattle can chew on the remains.

What is the critical feature in the ecosystem?

The important feature which defines forest types and creates regional boundaries is not the total rainfall. Neighbouring savanna areas have as much average annual rainfall as forest areas, but support only grassland and scattered trees. What creates and maintains a forest cover is the length of the growing season and the amount of moisture available during that time.

It has been found that the boundary between evergreen and seasonal rain forest can be defined in terms of the Wet Season Potential Evapo-transpiration (W.S.E.P.). It provides an easily obtained measure of the amount of energy available for plant growth.

CLIMATIC FEATURES ASSOCIATED WITH VEGETATION TYPES

Evergreen Rain Forest	W.S.E.P. Over 1300mm Dry season less than 3 months Mean Temperature up to 23.5°C
Seasonal Rain Forest	W.S.E.P. 1061-1300mm Dry season 3-4 months Mean Temperature up to 23.5°C
Savanna and Thorn Forest	W.S.E.P. 900-1060mm Dry season 4-6 months Mean Temperature up to 23.5°C



(a) Draw a table consisting of three columns. Head each column with one of the types of rain forest described on these pages. Then using the text on these pages and the map on the inside front cover, list contrasts between them in line with the following side-headings: area, rainfall, amount of seasonal change, other distinctive features, advantages for farming, disadvantages for farming.

(b) Describe the vegetation in each of the above pictures and classify it into one of the five types described on these two pages.