



WHAT IS THE NATURE OF TROPICAL RAIN FORESTS?

A huge area of rain forest

If we stand on the edge of the Andes in Ecuador, on the Equator, we can look east across more than 3000 kilometres of forest. There are many varieties of trees and shrubs within the forest, as many as 2000 different species in a one hectare plot. But if we flew over all 3,000 kilometres of it along the Equator, we would see that the forest tends to look the same right across the expanse of the Amazon Basin. These forests of the Amazon Basin form the world's major example of a forested natural landscape.

Dense canopy, open forest floor

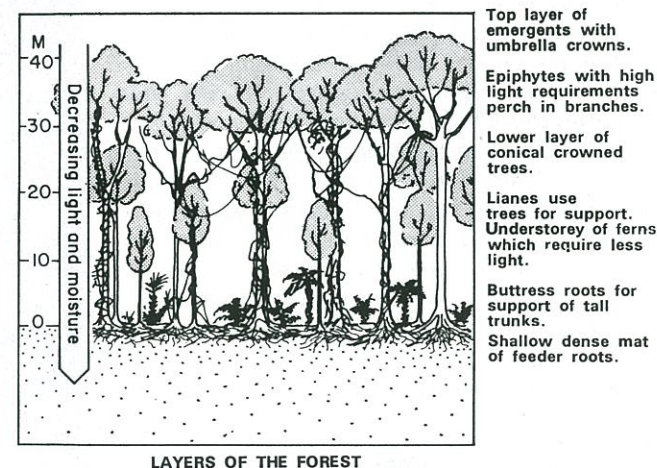
The forest resembles a New Zealand rain forest, with an upper layer of dominant trees like rimu or kahikatea, and an understorey of young trees, shrubs and ferns. Although the tallest trees in the tropical rain forest are no higher than those of North Island forests, the forest canopy (the top layer of branches and leaves) is much denser and shows the signs of a great amount of competition between species.

The amount of light which reaches the floor of the forest is very limited, so there is little undergrowth. Despite the popular idea of explorers cutting their way step by step through dense vegetation, the forest floor is quite open. The canopy, which is the layer most open to sunshine, is where most of the activity of plants and animals takes place, 40-50 metres above ground. The warmth and moisture make everything grow so quickly that every space in the canopy is quickly filled.

Rapid growth all year round

In the tropics there is no winter, in the sense of a cool season. Provided there is enough moisture, growth occurs at almost the same speed, day after day. Compared with a temperate evergreen forest such as New Zealand's, the tropical rain forest

Above: One edge of a huge unbroken area of forest. If we fly east from this road near the edge of the Andes, we will not cross another road for 1800 kilometres.



has three to four times the weight of vegetation per hectare, and grows at a speed three to four times as fast. In other words there is a great deal of energy available in the tropical forest, and competition for its use gives the forest its special character.

Competition for energy from sunlight

The competition for sunlight implies that any plant which fails to reach the top of the canopy has a limited chance of surviving and reproducing itself. Every species has to take advantage of its special qualities or fail to thrive and reproduce. Energy is required for growth and for producing seed, but energy is very scarce in the twilight zone below the canopy.

There are plants which are specially adapted to life in the twilight zone – parasites which tap the energy of other species, and scramblers which send out feelers in all directions to collect the pinpoints of light which filter through. But most of the understorey is composed of seedlings and small trees which have grown from stored energy in the seeds and then wait in a dormant state until one of their dominant neighbours dies. When a big tree dies or falls, a "light well" appears, and hundreds of seedlings and small trees begin a surge of growth which takes them toward the top of the forest.

Epiphytes

One special technique for gaining the sun's energy is to begin growth at the top of the forest, rather than at the level of the soil. This saves the energy cost of growing up 40 metres – but is done at the risk of running out of moisture, since the only storage is in the plant itself.

Some of these epiphytes (perching plants) are adapted to a complete life on the boughs of a dominant tree. Usually they store water internally, and have tough leaves, so that if there is a dry spell they can continue to convert energy. Some epiphytes have deep pockets at the angle of their leaf and stem and can hold several litres of water.

An epiphyte which perches on another tree is totally dependent on its host, and some hosts shed their branches to avoid the competition created by epiphytes. A much better solution is to begin life as an epiphyte, but then put down roots to the water store in the soil. As these roots become stronger, the epiphyte can also survive the death of its host or a part of the host.

The forest is full of climbing and twining plants, which began life in the canopy. Some of these lianas dangle from the canopy, others cling around tree trunks. Some lianas will develop into tough networks of a size large enough to choke the original host. As the host decays, the epiphyte will be left up in the treetops, but supported now by a hollow tube of roots.

The dominant trees

Although some of the epiphytes survive to become trees in their own right, they still need the dominant trees of the canopy in which to begin life. The most successful trees in the forest are those which not only survived the competition to reach the light at the top of a light well, but continued growing and began to shade their neighbours. The top of the forest is not a smooth carpet of green, but consists of a surface studded with the big umbrella tops of emergent trees. These umbrellas can be 50 metres across – big enough for bush pilots to land a light plane on if there is an emergency.

Despite the great size of the trees, they have a very precarious foothold on the soil. All their energies went into reaching the light, because the soil is so infertile that there is little to be gained by putting down long, deep roots. So the fifty metre trees, with huge crowns of foliage, are literally standing on a shallow saucer of roots. Many species have a special system of buttresses above the soil surface. Also, each tree is supporting its neighbours by providing protection from wind, and lianas tie them all together in a web of vines.

- Draw a half-page sketch of the root system (above and below the soil surface) of a tall forest tree. Label the main components. In three or four sentences explain why the dominant trees require these adaptations.
- Why is growth so rapid in tropical rain forests?
- Suggest reasons why the tropical rain forest is so rich in plant species.
- In 12 words or less, define what is meant by an epiphyte. List the special techniques which epiphytes use to enable them to survive in the intense competition for sunlight.



Above: Strangler plants send down roots from seedlings in the crowns of trees. As the stranglers grow, they choke the host tree to death.



Above: At ground level, the buttress roots of this tree extend over a circle with a diameter of seven metres and reach to a height of four metres. Above that height, the trunk of the tree has a diameter of only a little over a metre.



Above: Soil has been removed around this tree to reveal the shallow horizontal rooting system.