

# Amazing Adaptations

This tour focuses on how plants and animals have adapted to living in a rainforest environment. Pupils will be shown a variety of plants and animals which highlight specific adaptations to tropical conditions, especially heavy rainfall, lack of light in the forest understorey, poor soils and competition against predators. As well as learning about these adaptations, pupils will also experience what it is like to visit a rainforest.

For this tour the children should have some knowledge of rainforests, especially their climate and the forest layers. The tour is particularly suitable for upper primary and lower secondary age children.

## Curriculum links

### Key stage 2

Science – Life processes and living things (Sc2)

- 3a) – the effect of light, air, water, and temperature on plant growth
- 3c) – that the root anchors the plant, and that water and minerals are taken in through the roots and transported through the stem to other parts of the plant
- 5a) – about ways in which living things and the environment need protection
- 5b) – about the different plants and animals found in different habitats
- 5c) – how plants and animals in two different habitats are suited to their environment

Geography

- 3d) – to explain why places are like they are
- 3f) – to describe and explain how and why places are similar to and different from other places in the same country and elsewhere in the world
- 6b) – a locality in a country that is less economically developed

### Key stage 3

Science – Life processes and living things (Sc2)

- 3a) – that plants need carbon dioxide, water, and light for photosynthesis, and produce biomass and oxygen
- 3c) – that nitrogen and other elements, in addition to carbon, oxygen, and hydrogen, are required for plant growth
- 5a) – about ways in which living things and the environment can be protected, and the importance of sustainable development
- 5b) – that habitats support a diversity of plants and animals that interdependent
- 5c) – how organisms are adapted to survive daily and seasonal changes in their habitat

## Geography

Breadth of study;

- 6a) – two countries in significantly different states of economic development
- 6e) – ecosystems – how physical and human processes influence vegetation including;
  - 1. the characteristics and distribution of one major biome e.g. rainforests etc

## Tour notes

The tour looks at adaptations in two types of forest environment: the shady forest floor (the 'Lowland humid' house) and the lighter canopy, riverbanks and forest clearings ('Amazonica' house). It will include a selection of the following plants and animals, depending on the season and the evolving nature of the rainforest garden.

### Part 1 – the 'Lowland humid' house

Most of the plants in this house grow on the forest floor and show adaptations to the low light levels found here.

#### 1. Giant taro (*Alocasia macrorrhizos*)

The taro is a member of the aroid family, and is sometimes known as the 'Elephant ear' plant. It has the biggest single (undivided) leaves in the world, which can reach up to 3m long and 2m wide. The underground stems (or rhizomes) are an important source of carbohydrate for millions of people in the tropics.

**Adaptations** – The very large leaves of this forest floor plant enable it to absorb more of the very low levels of light. Typically, only around 3% of the sun's rays reach the forest floor because of the dense foliage of the canopy trees.

#### 2. Salmon-pink bird eating spider (*Lasiadora parahybana*)

One of the largest spiders in the world, this hairy spider has long fangs (2 cm) which it uses to inject chemicals into the body of its prey. The chemicals dissolve the internal body and the spider sucks up the nutrients. The spider's bite is painful to us, but not usually fatal unless an allergic reaction sets in. Their main form of defence is the use of special 'urticating' hairs on its abdomen. These hairs have mini 'fish hooks' which stick on like Velcro and act as an irritant to potential predators, causing extreme pain to eyes and respiratory tract if they make contact.

**Adaptations** – The salmon-pink possesses excellent means of both killing its prey and fending off predators. Their venom injecting fangs and their intimidating size make them lethal hunters. They make the prey edible by injecting digestive juices into the body and sucking up the resultant liquid.

#### 3. *Calathea* 'Medallion'

Like many of the plants growing on the forest floor, this species has striking dark red undersides to its leaves.

**Adaptations** – Leaf colours maximise the ability to photosynthesise. The purple, or dark red underside reflects light energy back into the leaf tissues so chlorophyll has a 2<sup>nd</sup> chance to utilise what is left.

#### 4. Epiphytes

These are plants which grow on other plants, using their host as a means of reaching the light, but not for food or water. Many orchids and bromeliads are epiphytic.

**Adaptations** – Epiphytes have developed various strategies to cope with the lack of a normal root structure in the soil. Some have aerial roots to capture moisture (and nutrients) from the frequent heavy rainfall in the canopy. Bromeliads capture water and nutrients at the base of their overlapping leaves. The ability to grow on other plants gives them access to the lighter conditions of the canopy.

### 5. Pitcher plant (*Nepenthes* spp.)

Many pitcher plants are epiphytic. The plant grows small containers (pitchers) at the end of each leaf that contain liquid which attracts insects by its smell. The insects fall inside the pitcher, are unable to escape and are then dissolved by the digestive juices in the pitcher. The largest ones have been known to contain small mammals and amphibians.

**Adaptations** – This insect-eating plant shows ingenious ways of supplementing its mineral intake to make up for a lack of roots and nutrients in its growing environment. The sophisticated pitcher even has a lid which helps to make sure the liquid does not become too diluted during heavy rainstorms.

### 6. Red bellied piranha (*Pygocentrus nattereri*)

Despite their reputation these fish are not normally harmful to people. A shoal of them (often up to 2,000 fish) can strip the flesh from a large animal in minutes, but they rarely attack large animals unless they are injured and bleeding. They have a nerve in their body which can detect blood in the water. They are found in the Amazon and Orinoco rivers, where they keep rivers clean by consuming dead and injured animals.

**Adaptations** – Their very sharp teeth, sense of smell and ability to work together as a group enable them to be very efficient predators.

### 7. Vanilla orchid (*Vanilla fragrans*)

This orchid produces vanilla pods, which makes it the only member of the Orchid family that we eat. It is a very expensive spice to produce because it needs to be pollinated by hand when it is grown in commercial plantations in non-native places such as Madagascar.

**Adaptations** – Like many rainforest plants, the Vanilla orchid is a climber, enabling it to scramble into the canopy to find more sunlight. It also has very thick, waxy leaves which have the dual purpose of retaining essential water within the leaves while allowing excess water to drip off.

## Part 2 – ‘Amazonica’ house

In the larger house there are many free ranging animals including butterflies, lizards and birds. Here it is generally more airy and the plants and animals are those found more commonly in the canopy and along the river banks and forest edges.

### 1. Weeping fig (*Ficus benjamina*)

Like many canopy trees, the leaves on this plant have special ways to get rid of excess water. They point downwards and have drip tips at the end of each leaf to allow the water to run off quickly.

**Adaptations** – The downward-pointing drip tips allow rapid removal of water from the leaf surface. This is important to enable leaves to breathe after tropical downpours. Leaves could rot if left with water on their surface, or could play host to other plants!

### 2. Red billed toucans (*Ramphastos tucanus*)

Toucans are noisy, colourful birds. They live in the canopy and are adept at hopping along the branches. They have very unusual and striking beaks.

**Adaptations** – Toucans have strong legs, with feet adapted for grasping, with two toes pointing forwards and two backwards. Their pronounced beaks are used partly for communication, as are the 'flash colours' underneath their wings and tail that show up well in the dark rainforest. The beaks are also useful for feeding, especially collecting fruit and insects.

### 3. Swiss cheese plant (*Monstera deliciosa*)

This plant is a rapidly growing climber, which gains its name from the holes in its leaves.

**Adaptations** – The holes in the leaves stop them being ripped by strong winds in the upper canopy. They also let rain pass through more quickly and allow more light to reach leaves below.

### 4. Water lettuce (*Pistia stratiotes*)

No-one is quite sure where this plants originates, but it is mainly seen as a weed in tropical countries, where it can clog up the waterways.

**Adaptations** - Tiny hairs on the roots and leaves enable the water lettuce to float, making sure that it does not drown in its watery environment.

### 5. Dasheen (*Colocasia esculenta*)

When it rains heavily, the leaves of this plant do not appear to get wet at all. Water rolls off as beads thanks to tiny bumps 5 to 10 thousandths of a millimetre high on the leaves. Water droplets roll off easily under their own weight. A rolling droplet also gathers dirt so cleaning the leaf.

**Adaptations** – The tiny bumps on the leaves are very effective at repelling water.

### 6. Pygmy marmosets (*Callithrix pygmaea*)

These are the smallest primates in the Americas, possibly in the world, weighing only 50 grams. They possess claws, not nails, and are specialist sap, gum and insect eaters.

**Adaptations** – The monkeys are well camouflaged against the bark of trees, which they climb with the aid of their sharp claws. Their sharp teeth enable them to get sap from under the bark.

### 7. Leaf-cutter ants (*Atta cephalotes*)

The workers in the colony spend all day cutting leaves which they carry back to their fungal garden. They cultivate the fungus to provide food for their larvae and in turn provide the fungus with food and shelter.

**Adaptations** – This type of fungus only seems to be found in association with these ants. The relationship appears to be symbiotic (mutually beneficial).

### 8. Goeldi's monkeys (*Callimico goeldii*)

Goeldi's monkeys are small, new world primates found mainly in the upper Amazon. Although they spend most of their time in the lower five metres of the forest, they are very agile and are able to leap several metres between branches (they have been known to leap as much as 4m horizontally).

**Adaptations** – Their long, curved claws help them to cling on to branches, while their tails allow them to balance on narrow branches. Their ability to leap from one branch to another is helped by having eyes on the front of their heads, allowing 3D vision to judge distances.

### 9. West African dwarf crocodile (*Osteolaemus tetraspis*)

The crocodile often looks like a statue as it has the amazing ability to be really still. It is a timid and slow moving creature, but has a flat tail to power out of the water.

**Adaptations** – The strong tail and powerful jaw muscles make the crocodile a very effective predator. Their grey colouring and ability to be still allows them to ambush their prey.

### 10. Home's hingeback tortoises (*Kinixys homeana*)

These tortoises are very hardy and long-lived. They are omnivores, with a preference for giant African millipedes. However, the bulk of their diet consists of plant material so their beaks have evolved to chew through tough vegetation. Their most distinguishing feature is a moveable hinge on the underside of the shell which provides protection for their hind legs and tail.

**Adaptations** – Their hard shells, which are formed from modified skin and are physically attached to the rest of their bodies, and their special hinges, enable them to fend off most predators.

### 11. Bromeliads (Bromeliaceae family)

Bromeliads are a distinctive family of tropical plants which includes the pineapple. Their leaves overlap at their bases to form a 'vase' into which water and nutrients (leaf litter, droppings, dead animals) collect. Many animals drink from them, and some animals, such as tree frogs, live in them.

**Adaptation** – The pools collect moisture and nutrients which is important as many bromeliads are epiphytic and so do not obtain these essentials from the soil through their root systems.

## 12. Boa constrictors (*Boa constrictor*)

The boas will grow to about 5 metres. They kill their prey by coiling their body around and slowly strangling it. Once the prey is dead they can open their mouths very wide, as they have very flexible jaws, and consume the animal whole. This species would be able to eat a small gazelle.

**Adaptations** – Their strong bodies and flexible jaws enable them to be effective predators.

## 13. Poison dart frogs (Dendrobatidae family)

The poison dart frogs are brilliantly coloured and easily spotted in the forests. Special glands in their skin secrete a deadly poison, probably the result of their diet of poisonous ants. They rear their tadpoles in bromeliad pools high up in the canopy.

**Adaptations** – The bright colours warn enemies that they are dangerous. They also have 'sucker like' toes that make it possible to climb up trees to reach the bromeliads.

## After the tour

After your guided tour you will be able to take the children around the greenhouses in small groups. This is a good opportunity to complete worksheets, or to spend time looking in more depth at some of the plants and animals. There are many good opportunities for both artwork and creative writing.



### The Living Rainforest

Hampstead Norreys

Berkshire UK

RG18 0TN

T 01635 202444

F 01635 202440

E [enquiries@livingrainforest.org](mailto:enquiries@livingrainforest.org)

W [www.livingrainforest.org](http://www.livingrainforest.org)