

ALL THE WAY DOWN



AMAZON RAINFOREST



ALEX WOOLF & ISOBEL LUNDIE

THE EMERGENT LAYER

THE CANOPY

THE UNDERSTOREY

THE FOREST FLOOR

THE RIVER



ALL THE WAY DOWN AMAZON RAINFOREST



Hatch



ALL THE WAY DOWN AMAZON RAINFOREST

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WHY ARE OUR RAINFORESTS SO IMPORTANT?

- 1 RAINFOREST TREES PRODUCE OXYGEN AND ABSORB CARBON DIOXIDE, HELPING TO REDUCE THE EFFECTS OF CLIMATE CHANGE.
- 2 RAINFORESTS HELP MAINTAIN THE WORLD'S WATER CYCLE. TREES AND PLANTS RELEASE WATER FROM THEIR LEAVES, WHICH CONTRIBUTES TO THE FORMATION OF RAINCLOUDS.
- 3 THE ROOTS OF RAINFOREST TREES HELP KEEP THE SOIL ANCHORED. WITHOUT THEM, SOIL CAN BE ERODED BY THE WIND AND RAIN.
- 4 TROPICAL RAINFORESTS PROVIDE A HABITAT FOR OVER 30 MILLION SPECIES OF PLANTS AND ANIMALS.
- 5 TROPICAL RAINFORESTS ARE KNOWN AS THE 'WORLD'S LARGEST PHARMACY'. MORE THAN 25 PERCENT OF MODERN MEDICINES ORIGINATED FROM RAINFOREST PLANTS.

INTRODUCTION

Tropical rainforests can be found in Asia, the Americas, Africa, Australia and on many Pacific Islands. They are warm, wet forests in the tropics (close to the equator), and they have a rich diversity of life. Although they cover just 6 percent of the planet's surface, they are home to around 45 to 80 percent of all plant and animal species.

LAYERS OF THE RAINFOREST

Tropical rainforests are structured in layers: emergent layer, canopy, understorey and forest floor. Each layer receives different amounts of sunlight and rainfall, and this affects what kinds of plants and animals live there. Rivers form another ecosystem of the rainforest. The layers of the rainforest aren't separate. The species from each layer interact with each other, and many move between layers.

HOW TO USE THIS BOOK

In this book, you can journey from the top to the bottom of a tropical rainforest, exploring each layer in turn. Discover the weird and wonderful animals that inhabit the rainforest and learn how they have adapted to their particular environment.

Have a good trip!

RIVER -30-0 M (-98-0 FEET)

Tropical rainforests have some of the largest rivers in the world, fed by countless smaller tributaries, streams and creeks.

EMERGENT LAYER 40-70 M (131-230 FEET)

This is made up of the tallest trees of the rainforest.

CANOPY 30-40 M (98-131 FEET)

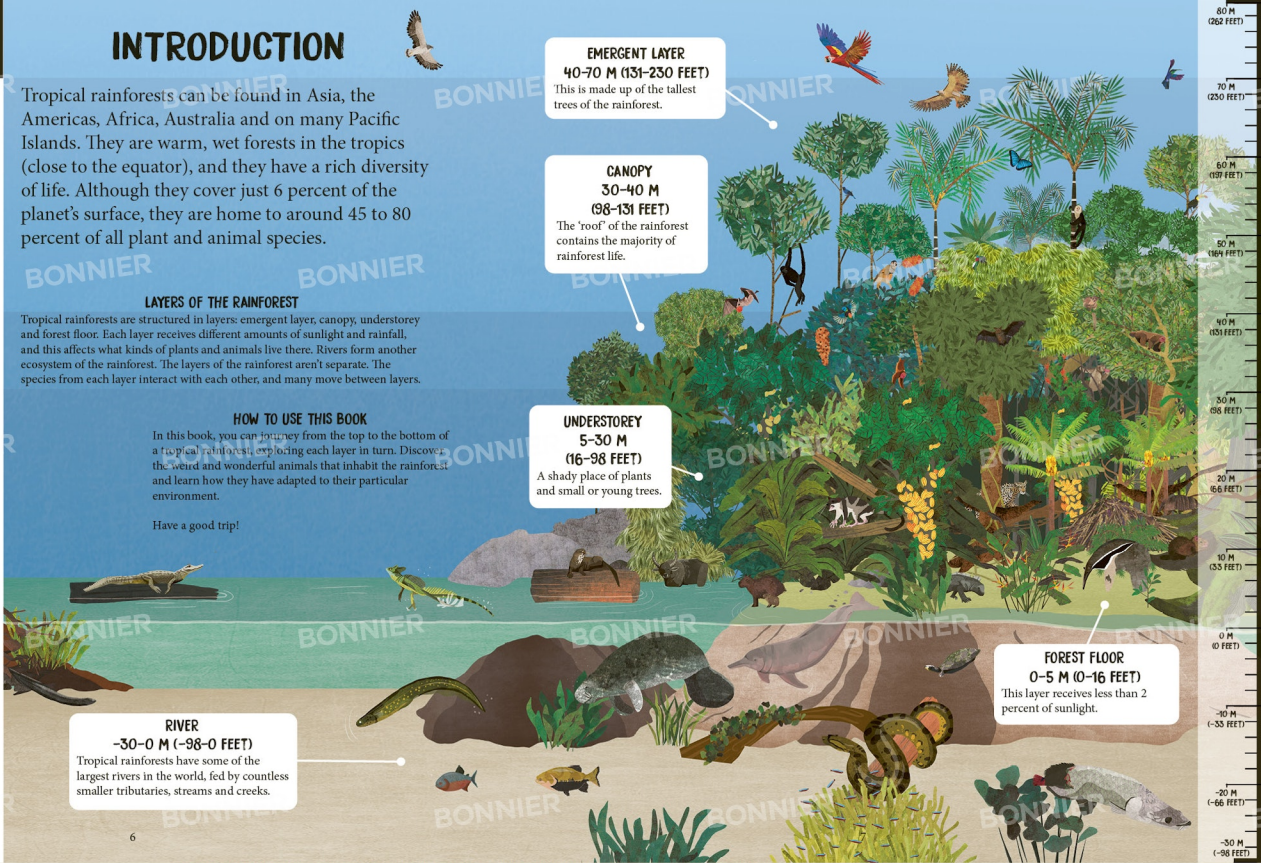
The 'roof' of the rainforest contains the majority of rainforest life.

UNDERSTOREY 5-30 M (16-98 FEET)

A shady place of plants and small or young trees.

FOREST FLOOR 0-5 M (0-16 FEET)

This layer receives less than 2 percent of sunlight.



THE EMERGENT LAYER

The emergent layer is the uppermost layer of the rainforest. Here we find the tops of the tallest trees. These are trees of 40 metres (131 feet) or higher, which are tall enough to break out of the canopy into open sunshine. The tallest of them can reach up to 70 metres (230 feet). Of all the layers, the emergent layer receives the most sunlight, rainfall and wind.

ANIMALS

Animals that inhabit the emergent layer tend to be small and light, so that the slender branches at the top of trees can support them. Some animals live in both the emergent layer and the upper canopy. They include sloths, squirrel monkeys, capuchin monkeys and spider monkeys, as well as several species of bats, snakes and spiders.

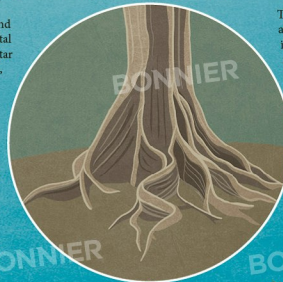


POLLINATION

The emergent layer is very windy, and this helps scatter seeds and pollen to other parts of the rainforest. This is necessary for pollination (plant fertilisation). Birds and insects of the emergent layer are also vital for pollination. As they feed on the nectar of flowers, grains of pollen fall on them, and they then transfer these to other parts of the forest.

BUTTRESS ROOTS

Tropical rainforest soils are not very deep or rich in nutrients, so for a tree to grow tall enough to reach the emergent layer, it needs buttress roots that grow on all sides of the tree and spread horizontally for up to 60 metres (197 feet), giving support and collecting nutrients from a wide area. The buttress roots of different trees intertwine with each other to give added support.



TREES

The trees of the emergent layer are called emergents. They include the kapok and the Brazil nut tree. Emergents are spaced widely apart, and usually have mushroom-shaped crowns. Their leaves tend to be small and pointed with a waxy surface to protect them from the sun. The weather varies greatly in the emergent layer, including hot sun, heavy rain and strong winds. Emergent trees must be tough to withstand these conditions.



HIGH FLYERS

THE EMERGENT LAYER OF THE AMAZON RAINFOREST IS HOME TO MANY SPECIES OF BIRDS. AT THIS LEVEL, THEY HAVE PLENTY OF SPACE TO ROAM THE FOREST, SWOOPING TO FEED ON PREY OR VEGETATION, AND THEIR NESTS ARE LESS VULNERABLE TO PREDATORS THAN THEY WOULD BE LOWER DOWN. THE APEX PREDATORS OF THIS LAYER ARE THE HARPY EAGLE AND THE WHITE-TAILED HAWK.



1. WHITE-TAILED HAWK
Length: 44–60 cm (1.4–2 feet)
Lifespan: 10–15 years

2. SCARLET MACAW
Length: around 81 cm (2.7 feet)
Lifespan: 40–50 years

3. HARPY EAGLE
Length: around 1 m (3.2 feet)
Lifespan: 25–35 years

4. KING VULTURE
Length: 67–81 cm (2–2.7 feet)
Lifespan: 20–25 years

5. HUMMINGBIRD
Species shown: T. colombica
Length: 5–13 cm (2–5 inches)
Lifespan: 3–7 years

6. BLACK-AND-WHITE OWL
Length: 35–40 cm (11–1.3 feet)
Lifespan: 20 years

- 1 WHITE-TAILED HAWK** This bird of prey likes to hunt in the emergent layer, where there are fewer trees than below to hinder its flight. It hovers in the air, scanning its surroundings, before swooping for its prey. It eats small mammals and reptiles, as well as birds and insects.
- 2 SCARLET MACAW** These large, colourful parrots live in the emergent layer and upper canopy. Here they have the space to fly at speeds of up to 56 km/h (35 mp/h). They mostly fly alone or in pairs, but sometimes as a flock. They feed on fruits and seeds.
- 3 HARPY EAGLE** These huge, fearsome raptors have wingspans of up to 2 m (6.6 feet), and 13-cm (5 inch) claws – longer than a grizzly bear’s. They nest high up in kapok trees and prey on sloths and monkeys, in addition to other mammals, reptiles and birds.
- 4 KING VULTURE** These large scavenging birds have very sharp eyesight. They perch in the topmost branches of the emergent layer and search for carrion (animal remains) below. If they see any, they swoop down in groups of up to twelve and push other scavengers aside to get at the food.
- 5 HUMMINGBIRD** This family of birds are amazing flyers. They can hover in mid-air, fly backwards and even upside down. Beating their wings at up to a 100 times a second, they dart from flower to flower among the treetops of the emergent layer, drinking nectar and eating insects.
- 6 BLACK-AND-WHITE OWL** This bird of prey hunts at night for large insects, as well as bats, rodents, birds and tree frogs. It builds its nest in the emergent layer to protect its eggs and chicks from climbing predators.

THE CANOPY

Beneath the emergent layer, the tangled branches and leaves of the trees form a dense mass that hangs over the forest like a giant umbrella. This is the canopy. Some 80 percent of sunlight is absorbed by the leaves here, as well as most of the rainfall, and it contains around 70 to 80 percent of all the life of the rainforest. The canopy is typically 30 to 40 metres (98–131 feet) above the ground.

OBSERVING THE CANOPY

The canopy layer is hard to observe from the ground, and scientists have had to develop sophisticated methods to study it. Structures have also been built aimed at encouraging tourists to visit the rainforest.

HABITAT

The canopy provides an ideal habitat for the animals that live there. Its interior is protected from the extremes of temperature and weather found in the emergent layer, but it receives far more sunlight and rainwater than the layers below. Food is also plentiful, in the form of fruit, seeds, flowers and leaves.

AERIAL TRAM

Tourists can explore the rainforest of Costa Rica via a ski-lift style tram that glides through the canopy between observation platforms. Visitors can even fly through the trees on a zip line.

CANOPY CRANE

Based on cranes used on building sites, these massive steel structures place observers 40–50 m (131–164 feet) above the forest floor. They sit in a gondola below the crane's jib and it swings around, so they can observe different parts of the canopy.

AIRSHIP EXPLORER

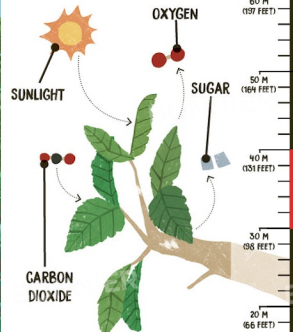
Some scientists pilot airships above the canopy, with gondolas suspended beneath so they can pass among the trees. The airship's electric motors are quiet enough not to disturb wildlife. They can even land briefly on treetops to collect specimens.

CANOPY WALKWAY

One way to observe the canopy is on a rope bridge linking platforms built within the trees and accessed by rope ladder. Today, many of the walkways, ladders and platforms are made of steel.

PHOTOSYNTHESIS

The billions of leaves in the canopy collect sunlight and carbon dioxide from the atmosphere and convert it into food for the trees as well as oxygen. This process is called photosynthesis, and it allows trees to grow and produce the food that attracts animals.



TREES AND PLANTS

Tall, broad-leaved evergreen trees provide most of the vegetation in the canopy layer. Thick climbing vines called lianas attach to these and grow towards the sunlight. Not all canopy plants have their roots in the ground. Many are epiphytes, or air plants, that grow on the trunks and branches of the trees. In the canopy they have more access to sunlight and rainwater than they would on the ground. Epiphytes include orchids, bromeliads, mosses and lichen.

SWINGERS AND GLIDERS

AT FIRST SIGHT, THE CANOPY CAN APPEAR AS AN UNBROKEN MASS OF FOLIAGE. YET CANOPY TREES RARELY TOUCH, AND ARE USUALLY SEPARATED BY A METRE (3 FEET) OR SO, POSSIBLY AS A PROTECTION AGAINST DISEASE AND INFESTATION. THE ANIMALS THAT LIVE THERE MUST FIND WAYS TO BRIDGE THESE GAPS BY CLIMBING, SWINGING, LEAPING AND GLIDING.

1 COMMON SQUIRREL MONKEY
Length: 25–35 cm (0.8–1.1 feet)
(excluding tail)
Lifespan: 15 years

2 BALD UAKARI
Length: 40–45 cm (1.3–1.5 feet)
Lifespan: 15–20 years

4 GLIDING TREE FROG
Length: 48–72 mm
(1.9–2.8 inches)
Lifespan: 5.5 years

3 GLIDING ANT
Length: around 12 mm
(0.5 inches)
Chance of landing on
same tree: 85 percent

6 BLACK SPIDER MONKEY
Length: 40–61 cm (1.3–2 feet)
(excluding tail)
Lifespan: 22 years

5 BEARDED CAPUCHIN MONKEY
Length: around 37 cm (1.2 feet)
(excluding tail)
Lifespan: up to 25 years

1 COMMON SQUIRREL MONKEY These small monkeys live in groups of up to 500 individuals. They move rapidly through the canopy and are light enough to climb to the ends of branches to pick fruit. They don't use their tails for climbing but for balance.

2 BALD UAKARI This monkey has a short tail, and moves nimbly through the canopy using just its arms and legs. It eats fruit, nuts, leaves and some insects, and can travel up to 4.8 km (3 miles) a day.

3 GLIDING ANT This tree-dwelling ant has evolved the ability to glide. So if it falls or gets knocked off a branch, it is able to steer itself through the air to return to the same tree. It uses its flat, wide head, hind legs and abdomen like wings to control its flightpath.

4 GLIDING TREE FROG This frog has fringes of skin on the outside of its limbs, and large webbed hands and feet. By spreading its hands and feet when leaping, the webbing acts as a parachute and the frog is able to glide 15 metres (49 feet) or more between branches to escape predators.

5 BEARDED CAPUCHIN MONKEY When climbing through the canopy, bearded capuchin monkeys rely almost entirely on their powerful hind limbs, so their arms are free to gather or carry food. They have even been observed walking up vertical tree trunks.

6 BLACK SPIDER MONKEY This monkey has very long limbs and a long tail (up to 85 cm / 2.8 feet), and is an agile climber. Its tail is prehensile, meaning it can grasp hold of branches, so it acts as a fifth limb when the monkey is climbing or swinging through the trees.





1. TOUCAN
Species shown: *R. sulfuratus*
Length: 29–63 cm (0.9–2 feet)
(bill: 19 cm / 7.5 inches)
Lifespan: 20–25 years

2. PARROT
Species shown: *A. festiva*
Length: 25–100 cm
(9.8 inches–3.3 feet)
Lifespan: 5–75 years

3. PARADISE TANAGER
Length: 13.5–15 cm (5–6 inches)
Weight: 17–23 g (0.6–0.8 ounces)

4. JACAMAR
Species shown: *G. ruficauda*
Length: 14–34 cm (0.5–1.1 feet)
Weight: 17–75 g (0.6–2.6 ounces)

5. RESPLENDENT QUETZAL
Length: 36–40 cm
(1.2–1.3 feet)
(tail: 65 cm / 2.1 feet)
Lifespan: 8–10 years

6. BLUE COTINGA
Length: 18–22 cm
(7–9 inches)
Weight: 76 g (2.7 ounces)

BIRDS IN THE BRANCHES

MANY BIRD SPECIES ARE ATTRACTED TO THE RAINFOREST CANOPY BECAUSE FOOD IS PLENTIFUL AND THEY HAVE SOME SHELTER FROM THE WEATHER. BIRDS HERE TEND TO HAVE LOUD CALLS, SO THEY CAN COMMUNICATE WITH EACH OTHER THROUGH THE DENSE FOLIAGE. SOME SPECIES HAVE A COLOURFUL PLUMAGE TO ATTRACT MATES.

- 1. TOUCAN** This family of birds are famous for their huge bills, which they use to pluck fruit from trees, as well as for grabbing insects, frogs and other small prey. Toucans rarely fly very far, and often simply glide between branches with their short wings.
- 2. PARROT** The Amazon rainforest is home to many parrot species. All have an upright posture, usually colourful feathers and a curved bill. Their long, sharp claws – two facing forward and two back – are used for climbing and manipulating food.
- 3. PARADISE TANAGER** This colourful songbird has a plumage containing seven separate hues. It spends most of its life in the upper canopy, occasionally moving lower to forage for fruit and insects.
- 4. JACAMAR** This group of birds perch on branches in the canopy or near forest streams, hunting for insects – often butterflies or dragonflies – which they snatch in mid-air with their long, sharp bills. Their plumage is bright and often iridescent.
- 5. RESPLENDENT QUETZAL** This beautiful bird has a green body and red breast, and the male has an amazingly long tail. Its feathers are shiny and green like canopy leaves, camouflaging it from predators, which is necessary because it is not a strong flyer.
- 6. BLUE COTINGA** This plump, dove-like bird feeds mainly on fruit. The male is bright blue and the female is dark brown. The male often perches motionless, high in the canopy, where his brilliant plumage camouflages him against the sky above, making him invisible to predators.



1. KINKAJOU

Length (including tail):
82–133 cm (2.7–4.4 feet)
Lifespan: 20 years

2. HOWLER MONKEY

Length: 56–92 cm (1.8–3 feet)
(excluding tail)
Lifespan: 15–20 years

5. DWARF LITTLE FRUIT BAT

Length: 4–6 cm (1.6–2.4 inches)
Weight: 7–14 g (0.2–0.5 ounces)

6. GOLDEN LION TAMARIN

Length: around 26 cm (10 inches)
(excluding tail)
Lifespan: 15 years

4. AMAZON DWARF SQUIRREL

Length: 12–16 cm (4.7–6.3 inches)
(excluding tail)
Weight: 86–132 g (3–4.7 ounces)

3. THREE-TOED SLOTH

Length: 42–80 cm (1.4–2.6 feet)
Lifespan: 25–30 years

FRUIT AND FLOWER FORAGERS

THE CANOPY IS HOME TO MANY MAMMALS THAT EAT THE PRODUCE OF TREES AND PLANTS. SOME, SUCH AS SLOTHS AND HOWLER MONKEYS, HAVE DIGESTIVE SYSTEMS ADAPTED TO EAT LEAVES. OTHERS, INCLUDING BATS AND RODENTS, PREFER TO EAT FRUIT, BERRIES, FLOWERS AND NECTAR.

- 1 KINKAJOU** This mammal, related to raccoons, is well adapted to tree-dwelling, with a prehensile tail and rotating ankles, so it can climb down trees headfirst. It eats fruit, especially figs, and flower nectar, scooping out the sweet liquid with its amazing 12-cm (4.7 inch) tongue.
- 2 HOWLER MONKEY** These big monkeys are well-known for their noisy howls, which can be heard from up to 5 km (3.1 miles) away. They have a keen sense of smell and can detect fruit and nuts at a distance of up to 2 km (1.2 miles). They use their long, prehensile tails for climbing and picking fruit.
- 3 THREE-TOED SLOTH** This family of mammals live high in the canopy, hanging from branches – their long, curved claws give them a strong grip. Their slow movement and greenish colour (from algae growing on their fur) make them hard for predators to spot.
- 4 AMAZON DWARF SQUIRREL** These rodents spend their whole lives in the trees, even building their nests there. They have unusually long limbs, well adapted for climbing large trees and leaping from branch to branch. They feed on fruit, nuts, tree bark and insects.
- 5 DWARF LITTLE FRUIT BAT** These tiny bats eat fruit, helping to disperse the seeds, which pass unharmed through their digestive system. They spend their days sleeping in tent-like structures built from leaves, and forage at night, mainly after dusk and before dawn.
- 6 GOLDEN LION TAMARIN** This small monkey has bright orange fur and a mane like a lion. It eats fruit in the early mornings, and insects in the late morning and afternoons, using its fingers to extract prey from crevices. It sleeps in tree hollows, vines or epiphytes.

CANOPY CARNIVORES

PREDATORS LURK AMONG THE FOLIAGE OF THE RAINFOREST CANOPY SPECIALLY ADAPTED TO HUNTING ABOVE THE GROUND THEY ARE OFTEN SMALL, QUICK, QUIET AND HIGHLY AGILE AS THEY MOVE AMONG THE BRANCHES TOWARDS UNSUSPECTING PREY

- 1 MARGAY** This small wild cat may spend its entire life in the trees, hunting birds and monkeys in the canopy. It is a highly skilled climber, able to grasp branches with both front and back paws and leap up to 3.7 m (12 feet). Its rotating ankles allow it to descend a tree head-first.
- 2 EYELASH VIPER** This highly venomous snake spends its life in the canopy, hunting small mammals and birds. It sometimes moves its tail like a worm to attract prey. It has heat-sensitive pits between its nostrils and eyes to detect warm-blooded creatures.
- 3 BRIDLED FOREST GECKO** This lizard lives its life in the canopy, feeding on cockroaches, caterpillars and ants. It does not actively hunt, but sits and waits for its prey to come close before flicking out its sticky tongue and grabbing it.
- 4 BOA CONSTRICTOR** The boa constrictor is a large, tree-dwelling snake. It has a strong, prehensile tail that allows it to hang from branches while capturing its prey, squeezing it to death and then eating it. Boas have camouflage colouring so they can hide from prey before striking.
- 5 COATI** The coati, or coatamundi, is a family of mammals related to the raccoon. They roam the canopy in groups of up to 25, foraging for fruit, insects, lizards, rodents and small birds. They communicate with loud chirps, snorts and grunts.
- 6 POISON DART FROG** These frogs have brightly coloured bodies to warn predators that they are toxic to eat. The golden poison dart frog has enough poison to kill 10 to 20 adult humans. Their poison may come from plant poisons in the ants, mites and termites that they eat.

1. MARGAY

Length: 48–79 cm (1.6–2.6 feet)
(tail: 33–51 cm / 1–1.7 feet)
Lifespan: up to 18 years

2. EYELASH VIPER

Length: 55–82 cm
(1.8–2.7 feet)
Lifespan: 10 years

3. BRIDLED FOREST GECKO

Length: 6–8 cm (2.3–3.1 inches)
Lifespan: 10–20 years

4. BOA CONSTRICTOR

Length: up to 3.96 m (13 feet)
Lifespan: around 20 years

5. COATI

Species shown: *Nasua nasua*
Length: 33–69 cm (1–2.3 feet)
(excluding tail)
Lifespan: 7 years

6. POISON DART FROG

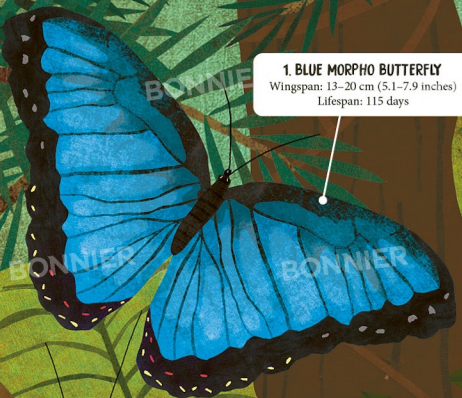
Length: 1.5–6 cm
(0.6–2.4 inches)
Lifespan: 3–15 years

BUGS IN THE TREES

AN ESTIMATED 25 MILLION SPECIES OF INSECT LIVE IN THE AMAZON RAINFOREST, AND THE GREATEST NUMBER OF THEM CAN BE FOUND IN THE CANOPY. AROUND 700 SPECIES OF BEETLE WERE FOUND ON JUST ONE TREE! TROPICAL RAINFOREST INSECTS TEND TO BE LARGER AND MORE COLOURFUL THAN THOSE FOUND IN OTHER HABITATS.



1. BLUE MORPHO BUTTERFLY
Wingspan: 13–20 cm (5.1–7.9 inches)
Lifespan: 115 days



2. ASSASSIN BUG
(Species shown: *T. dimidiata*)
Length: 4–40 mm (0.2–1.6 inches)
Lifespan: 1–2 years



5. ORCHID BEE
Length: 13 mm (0.5 inches)
Lifespan: 3–5 months (male)



6. LEAFCUTTER ANT
Length: 2–14 mm (0.08–0.6 inches) (worker)
Lifespan: 10–15 years (queen)



4. LEAF-MIMIC KATYDID
Length: 10–60 mm (0.4–2.4 inches)
Lifespan: 2–3 years

3. PRAYING MANTIS
(Species shown: *V. wherleyi*)
Length: 13–150 mm (0.5–5.9 inches)
Lifespan: 1 year



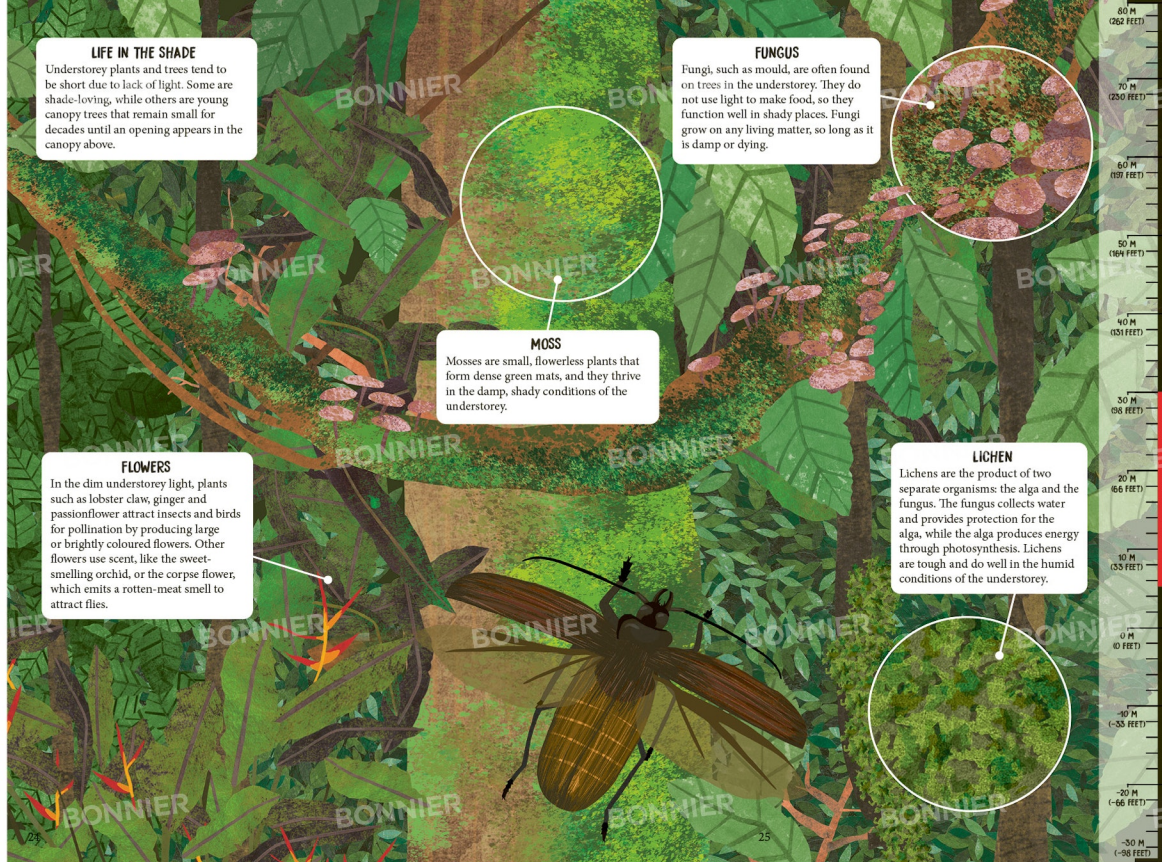
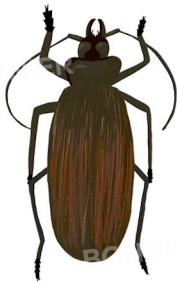
- 1. BLUE MORPHO BUTTERFLY** Its brilliant blue wings, when flashed, can startle other animals. While at rest, the butterfly shows the dull brown underside of the wings, camouflaging it. As a caterpillar, it releases a nasty-smelling oil that deters predators.
- 2. ASSASSIN BUG** This large family of insects kill ants and suck them dry, then attach the corpse to their body to disguise both their look and smell. These clever bugs also coat their legs with tree sap, making them sticky, then grab bees out of mid-air.
- 3. PRAYING MANTIS** This group of insects can turn their head 180 degrees to scan their surroundings with their 5 eyes. Their green or brown bodies are well camouflaged. Their front legs are armed with spikes and they can snatch prey with super-quick reflexes.
- 4. LEAF-MIMIC KATYDID** These insects have evolved the perfect disguise for canopy life: they look exactly like leaves. What's more, each individual looks slightly different, so their monkey predators must look very carefully at the leaves to find the insect hidden there.
- 5. ORCHID BEE** These bees are recognisable by their colourful metallic bodies. They are attracted to the scents of the orchid flowers that grow in the forest canopy, and many orchid species depend on these bees for pollination.
- 6. LEAFCUTTER ANT** These ants place leaves in their underground nests. As the leaves decay, a fungus grows on them, which the ants eat. The colony divides up jobs, with different ants cutting and carrying the leaves, defending the nest and farming the fungus.

THE UNDERSTOREY

The understory of the rainforest lies beneath the canopy and above the forest floor. It's a warm, damp, gloomy place where the air is still and rain constantly drips through the canopy. With very little direct sunlight, it doesn't heat up or cool down as rapidly as the upper layers and it's always humid. This environment suits big-leaved, shade-loving plants, as well as ferns, mosses and fungi. These plants provide food and shelter for the animals that live here.

A WORLD OF BUGS

The warm, humid conditions of the understory are ideal for insects. The titan beetle, one of the largest beetles in the world at up to 17 cm (6.7 inches) long, feeds on decaying wood in the understory.



LIFE IN THE SHADE

Understorey plants and trees tend to be short due to lack of light. Some are shade-loving, while others are young canopy trees that remain small for decades until an opening appears in the canopy above.

MOSS

Mosses are small, flowerless plants that form dense green mats, and they thrive in the damp, shady conditions of the understory.

FLOWERS

In the dim understory light, plants such as lobster claw, ginger and passionflower attract insects and birds for pollination by producing large or brightly coloured flowers. Other flowers use scent, like the sweet-smelling orchid, or the corpse flower, which emits a rotten-meat smell to attract flies.

FUNGUS

Fungi, such as mould, are often found on trees in the understory. They do not use light to make food, so they function well in shady places. Fungi grow on any living matter, so long as it is damp or dying.

LICHEN

Lichens are the product of two separate organisms: the alga and the fungus. The fungus collects water and provides protection for the alga, while the alga produces energy through photosynthesis. Lichens are tough and do well in the humid conditions of the understory.

PLANTS AND TREES

THE PLANTS AND TREES OF THE UNDERSTOREY HAVE BIG LEAVES, SO THEY CAN CAPTURE THE SMALL AMOUNT OF SUNLIGHT AND RAINWATER THAT TRICKLES THROUGH THE DENSE CANOPY. EPIPHYTES ATTACH THEMSELVES TO TREES AND DRAW THEIR NUTRITION FROM THE AIR. CLIMBING PLANTS USE THE SUPPORT OF A HOST TREE TO GROW UP TOWARDS THE CANOPY.

- 1 BANANA TREE** The banana tree is well adapted to the understorey. It is short and fast-growing with big leaves to absorb the sunlight. The leaves have grooves that funnel the rain and dew towards its roots. Its roots spread 5.5 metres (18 feet) in all directions to gather nutrients from the soil.
- 2 CACAO TREE** The cacao tree thrives in the understorey, where its delicate seeds are protected from the Sun and wind. The tree attracts its main pollinators, midges, by providing them with homes – tiny pods called cherelles. Cacao seeds are roasted and ground to make chocolate.
- 3 ORCHID** Orchids produce extra stems that collect stores of water to get them through dry periods. Their brightly coloured flowers produce strong scents attractive to particular pollinating species, such as hawkmoths and orchid bees.
- 4 LIANA VINE** These woody climbing plants entwine themselves around trees in order to reach the sunlight above. Because they don't need strong stems, they can devote more energy to growing leaves.
- 5 LOBSTER CLAW** This plant relies on hummingbirds for pollination. Their beaks are perfectly shaped to reach the nectar in the lobster claw's long, curved, tubular flowers. The plant's leaves and flowers provide homes for some species of bats, insects and frogs.
- 6 BROMELIAD** Bromeliads have thick, waxy, overlapping leaves that form a bowl for catching rainwater. These pools provide homes for frogs, salamanders, snails, beetles and mosquito larvae. When these creatures die, they provide nutrition for the plant.

1. BANANA TREE

Height: around 5 m (16 feet)
Lifespan: around 6 years

2. CACAO TREE

Height: up to 15 m (49 feet)
Lifespan: around 25 years

4. LIANA VINE

Height: up to 100 m (328 feet)
Diameter: up to 60 cm (2 feet)

3. ORCHID

Species shown: *Dendrobium*
No. of known species: around 25,000
Lifespan: up to 100 years

6. BROMELIAD

Height: up to 10 m (33 feet)
No. of known species: around 3,590

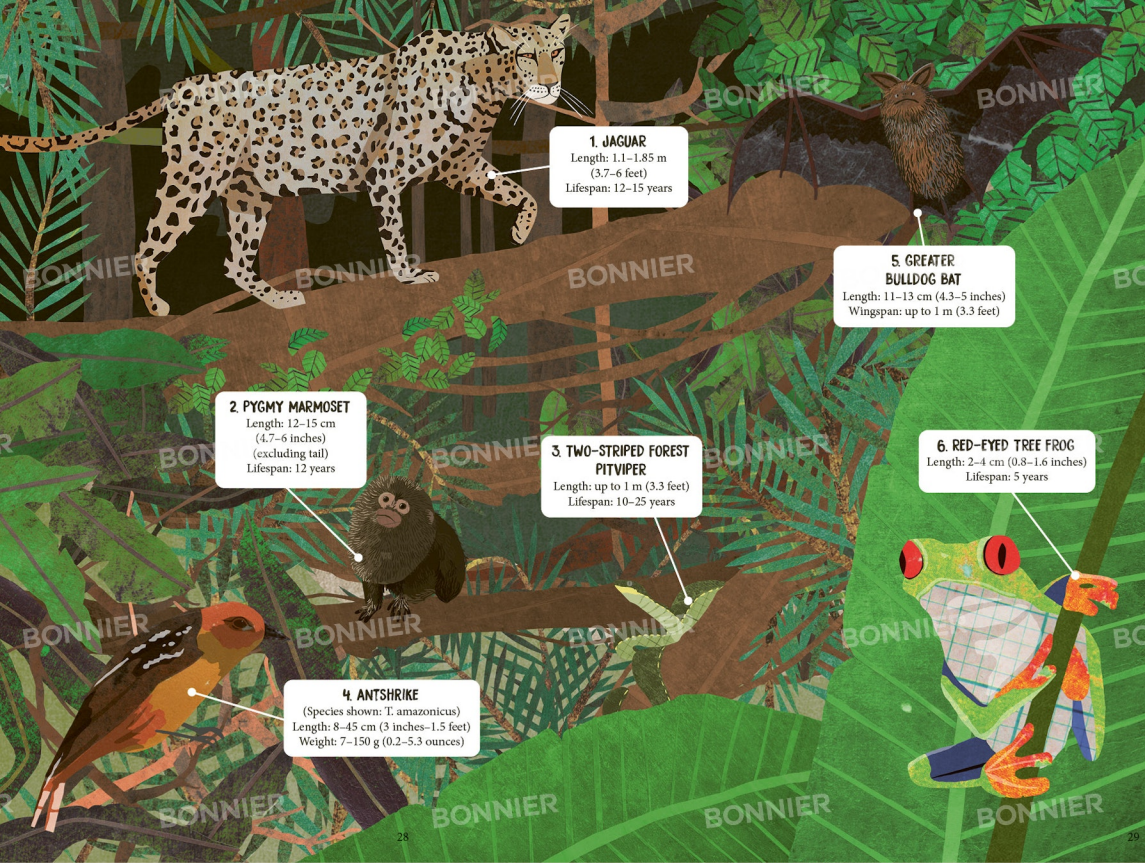
5. LOBSTER CLAW

Species shown: *H. latispatha*
Scientific name: *Heliconia*
No. of known species: 200–250

ANIMALS

MANY SPECIES OF BAT, MONKEY, SNAKE, LIZARD, INSECT AND FROG LIVE IN THE UNDERSTOREY. THE DIM LIGHT KEEPS THEM HIDDEN, AND MANY ARE WELL CAMOUFLAGED. THE BROWN VINE SNAKE, FOR EXAMPLE, IMITATES A TREE BRANCH, AND OWL BUTTERFLIES MIMIC OWL EYES TO KEEP PREDATORS AT BAY.

- 1 JAGUAR** The jaguar, apex predator of the lower rainforest, is an excellent climber and swimmer with powerful jaws capable of crushing the skulls of its prey. It's also well camouflaged, its fur covered in rosettes resembling leaves or light specks in the dappled understorey light.
- 2 PYGMY MARMOSET** The world's smallest monkey lives in the understorey and feeds on gum secreted by the trees. Its head can rotate 180 degrees to keep watch for predators, and it has sharp, claw-like nails for clinging to branches. It can leap up to 5 metres (16.4 feet).
- 3 TWO-STRIPED FOREST PITVIPER** This snake lives in the shrubs, palms and trees of the understorey, near streams and forest clearings. It anchors itself to branches with its prehensile tail, and ambushes prey such as mice, birds, lizards and frogs.
- 4 ANTSHRIKE** This group of birds make their nests in the understorey and eat insects by snatching them from the air or swooping to forage for them on the forest floor. Some antshrikes follow swarms of army ants and catch the insects fleeing from them.
- 5 GREATER BULLDOG BAT** This large bat hunts at night by echolocation. It eats insects, but also scoops fish from rivers with its sharp claws. It finds them by detecting ripples on the water surface. During the day it roosts in tree hollows.
- 6 RED-EYED TREE FROG** These frogs live in the trees of the understorey near water sources where they raise their young. They spend their days camouflaged on the underside of a leaf. At night they hunt for insects, which they catch with their long, sticky tongues.



1. JAGUAR
Length: 1.1–1.85 m
(3.7–6 feet)
Lifespan: 12–15 years

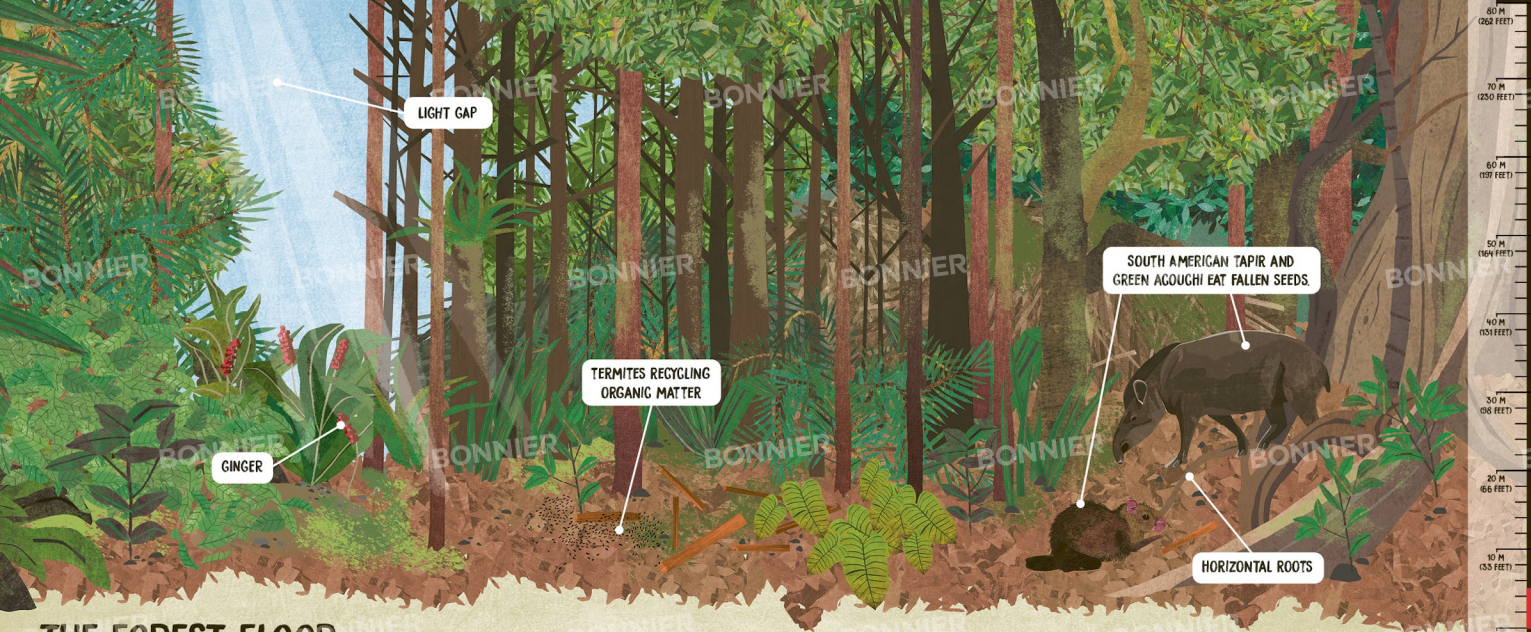
5. GREATER BULLDOG BAT
Length: 11–13 cm (4.3–5 inches)
Wingspan: up to 1 m (3.3 feet)

2. PYGMY MARMOSET
Length: 12–15 cm
(4.7–6 inches)
(excluding tail)
Lifespan: 12 years

3. TWO-STRIPED FOREST PITVIPER
Length: up to 1 m (3.3 feet)
Lifespan: 10–25 years

6. RED-EYED TREE FROG
Length: 2–4 cm (0.8–1.6 inches)
Lifespan: 5 years

4. ANTSHRIKE
(Species shown: *T. amazonicus*)
Length: 8–45 cm (3 inches–1.5 feet)
Weight: 7–150 g (0.2–5.3 ounces)



THE FOREST FLOOR

The forest floor is the darkest of all the rainforest layers, receiving just 2 percent of sunlight. The low light restricts plant growth, and much of the forest floor is made up of small plants, ferns, saplings, dead leaves fallen from above, and the root networks of the larger trees.

LIGHT GAPS

Although the forest floor is generally dark, occasionally a tall tree will fall, opening up a 'light gap'. This is rapidly filled by fast-growing plants like ginger, banana, balsa and rattan palm. These don't live long and are, in time, replaced by sturdier hardwood trees that fill the gap in the canopy. Many tree species depend on light gaps to complete their life cycles.

DECOMPOSITION

Most of the organic matter of the forest, including plant matter, animal waste and dead animals, eventually ends up on the forest floor. Here it is quickly recycled by termites, fungi and bacteria, which break down the decaying matter and absorb its nutrients. They do this so efficiently that few of these nutrients remain in the soil.

SEEDS AND FRUITS

Seeds fall from the trees to the forest floor where they are eaten by rodents, birds and other animals, which help disperse them in their dung. This is a necessary part of the life cycle of trees, and they make the seeds more desirable by encasing them in sweet fruit. Often the seeds themselves are toxic or foul-tasting, so an animal will eat the fruit and discard the seed.

ROOT SYSTEMS

The first 15 to 20 cm (6–7.9 inches) of the rainforest floor is rich with nutrients from decaying organic matter. Beneath this, the soil tends to be nutrient poor. Therefore tree roots must be shallow and stretch horizontally to collect as many nutrients as possible. Many roots actually grow out of the ground, forming a web across the forest floor.

PLANT EATERS

MOST OF THE RAINFOREST'S EDIBLE VEGETATION EXISTS HIGH ABOVE THE FOREST FLOOR IN THE CANOPY, SO GROUND-DWELLING PLANT EATERS MUST RELY FOR FOOD ON FALLEN FRUITS, SEEDS, LEAVES AND FLOWERS. FOR THIS REASON, HERBIVORES OF THE FOREST TEND TO BE SMALLER THAN THOSE FOUND IN OPEN GRASSLANDS. TYPICAL ARE CATSIZED RODENTS, SUCH AS AGOUTIS, AGOUCHIS AND PACAS.

1. GREEN AGOUCHI
Length: 30–39 cm (0.9–1.3 feet)
(excluding tail)
Lifespan: 10 years

2. WHITE-LIPPED PECCARY
Length: 90–130 cm (3–4.3 feet)
Lifespan: 10–24 years

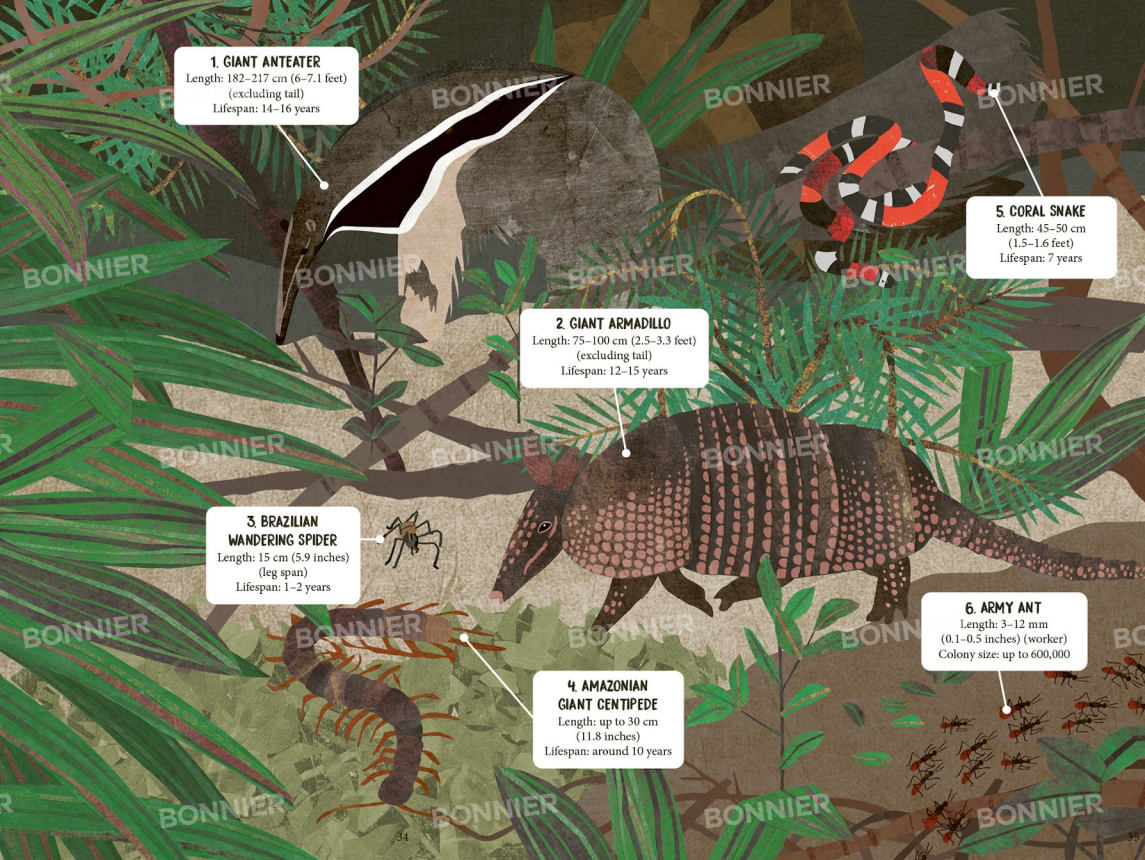
3. PACA
Length: 50–77 cm (1.6–2.5 feet)
(excluding tail)
Lifespan: 13 years

5. BLACK AGOUTI
Length: up to 60 cm (2 feet)
Lifespan: 20 years

4. SOUTH AMERICAN TAPIR
Length: 2 m (6.6 feet)
Lifespan: 25–30 years

6. BRAZILIAN GIANT TORTOISE
Length: 40–50 cm (1.3–1.6 feet)
Lifespan: 50–60 years

- 1. GREEN AGOUCHI** These rodents have long, slender legs with three hoof-like claws on their hind feet. They forage for nuts and seeds, which they bury in the forest floor to eat later. When alarmed, they emit bird-like whistles and escape by making long leaps with both hind feet.
- 2. WHITE-LIPPED PECCARY** These pig-like animals live in herds. Their jaws and tusks are adapted for slicing into plant roots and crushing seeds. They have glands that emit strong odours to identify themselves to other herd members and mark out their territory.
- 3. PACA** These rodents live in burrows up to 3 m (9.8 feet) deep, usually with two entrances in case they need an escape route from predators. They tend to live near water and will jump in and swim when they feel threatened. Pacas eat fallen fruits, seeds, leaves and roots.
- 4. SOUTH AMERICAN TAPIR** These pig-like animals have a flexible snout that they can move in all directions, allowing them to grab hard-to-reach vegetation. They are active in the evenings and at night, feeding on fruit, berries and young leaves.
- 5. BLACK AGOUTI** These tail-less rodents are related to guinea pigs. They sleep in burrows at night, and during the day they eat fallen fruit, leaves, roots and occasionally the eggs of ground-nesting birds. They often hoard food by burying it.
- 6. BRAZILIAN GIANT TORTOISE** This reptile thrives in the dim, humid environment of the forest floor. It is active during the day, eating fallen fruit, flowers, leaves, vines, roots, bark and mushrooms, as well as dead or slow-moving animals.



1. GIANT ANTEATER
Length: 182–217 cm (6–7.1 feet)
(excluding tail)
Lifespan: 14–16 years

2. GIANT ARMADILLO
Length: 75–100 cm (2.5–3.3 feet)
(excluding tail)
Lifespan: 12–15 years

3. BRAZILIAN WANDERING SPIDER
Length: 15 cm (5.9 inches)
(leg span)
Lifespan: 1–2 years

4. AMAZONIAN GIANT CENTIPEDE
Length: up to 30 cm
(11.8 inches)
Lifespan: around 10 years

5. CORAL SNAKE
Length: 45–50 cm
(1.5–1.6 feet)
Lifespan: 7 years

6. ARMY ANT
Length: 3–12 mm
(0.1–0.5 inches) (worker)
Colony size: up to 600,000

PREDATORS

WITH SO MUCH OF RAINFOREST LIFE DWELLING IN THE CANOPY, MOST PREDATORS ARE ADAPTED FOR LIVING IN THE TREES. HOWEVER, THERE ARE A NUMBER OF PREDATORS THAT SPECIALISE IN HUNTING GROUND-DWELLING ANIMALS. THESE INCLUDE SNAKES, SPIDERS, INSECTS AND SOME MAMMALS.

- 1. GIANT ANTEATER** As its name suggests, this mammal feeds on ants and termites, using its sharp foreclaws to dig up their nests, and its long, sticky tongue to scoop them out. It has poor eyesight, but a powerful sense of smell.
- 2. GIANT ARMADILLO** This mammal is covered with armour made of plates of horn-covered bone. It lives in burrows beneath the forest floor during the day and is active at night. The armadillo uses its large front claws to dig up the nests of its main food source – termites.
- 3. BRAZILIAN WANDERING SPIDER** These large, furry spiders do not build nests but wander the forest floor at night hunting for prey. They eat insects, other spiders and sometimes small reptiles and mice, killing them by ambush or by direct attack.
- 4. AMAZONIAN GIANT CENTIPEDE** This large, aggressive centipede feeds on any animal it can catch and kill, including insects, spiders, lizards, frogs, snakes, birds, mice and bats. It kills by capturing its prey in sharp pincer-like claws in its head and injecting it with venom.
- 5. CORAL SNAKE** The coral snake is among the most colourful and deadly snakes of the rainforest. The bright colours act as a warning to would-be predators. The snakes are also able to burrow quickly into the ground if threatened. They feed on small mammals, birds, lizards and frogs.
- 6. ARMY ANT** Army ants move along the forest floor in swarms of up to 200,000 individuals. These trails can be over 20 m (66 feet) wide and up to 200 m (656 feet) long, and are capable of consuming some 500,000 prey animals a day, including insects, spiders and other small animals.



LIFE IN A RAINFOREST RIVER

Some of the biggest rivers in the world are found in tropical rainforests. They are fed by thousands of tributaries and streams. The Amazon, for example, has 1,100 tributaries, 17 of which are over 1,600 km (994 miles) long. Tropical rivers tend to meander slowly through the flat terrain of the rainforest. The Amazon descends at a rate of just 2.8 cm (1.1 inch) per km.



LOW WATER

When the dry season comes, the waters recede, leaving islands in the river and dried-up creeks and streams. Fish become trapped in lakes in the forest or in river shallows and are easy targets for predators such as arapaima and anaconda. Some fish have adapted to these conditions by developing lung-like organs to breathe air.



CRACKED MUD

HIGH WATER

At certain times of year, tributaries bring large quantities of meltwater from the snowy mountain peaks, causing the river's water levels to rise several metres, flooding the forest. This is a time of plenty for fish that swim into the forest and eat the falling fruit and seeds. Many tree species depend on these floods for seed dispersal.



FLOODED RAINFOREST

WHITewater AND BLACKwater

Rainforest rivers are either whitewater or blackwater. Whitewater rivers are actually a muddy brown colour, because of sediment washed into them from the surrounding forest. Blackwater rivers have a dark colour from decaying vegetation. They are quite acidic and are inhabited by fish such as discus, angelfish, arowana and cardinal tetras.



WHITewater

BLACKwater

FLOATING MEADOWS

Plants with roots in the riverbed can struggle when the water is high. Other plants have adapted by floating on the surface, taking their nutrients from organic matter in the river. These plants can form large floating meadows, which host a rich diversity of life, including insects, molluscs, worms, spiders, crabs, as well as mammals such as capybaras and manatees.



RIVER MAMMALS

THERE ARE SOME 420 SPECIES OF MAMMAL LIVING IN THE AMAZON RAINFOREST. MANY OF THESE HAVE BECOME ADAPTED TO LIFE IN AND AROUND THE RIVER AND ITS STREAMS. THEY INCLUDE FULL-TIME WATER MAMMALS LIKE THE PINK DOLPHIN, AS WELL AS LAND-BASED SWIMMERS LIKE THE CAPYBARA.

1 GIANT RIVER OTTER This large otter is well adapted to the aquatic lifestyle with dense fur, a fin-like tail and webbed feet. It eats mainly fish, but also crabs, turtles, snakes and small caimans. It's a very noisy animal, barking or snorting to scare away intruders or sound the alarm.

2 WATER BUFFALO Water buffalo were introduced to the Amazon River basin in 1895, and have thrived there. They eat aquatic plants, especially reeds, and when the river floods they continue grazing underwater, raising their heads only to breathe.

3 AMAZONIAN MANATEE These enormous mammals have paddle-like forelimbs for swimming, and a hippo-like snout. They spend the wet season grazing on water plants, consuming up to 8 percent of their body weight per day. In the dry season, when there's less food, they live off their fat reserves.

4 WATER OPOSSUM This marsupial lives in burrows in the riverbank, coming out after sunset to hunt for fish, crabs and other small river animals. Its short, dense fur repels water, and its webbed hindfeet and long tail help push it through the water.

5 CAPYBARA The capybara live in groups of 10 to 30, near lakes, rivers, swamps and streams. They are excellent swimmers thanks to their webbed toes, and can hold their breath underwater for up to 5 minutes to avoid predators.

6 PINK DOLPHIN Pink dolphins live in small groups of 2 to 4 in the fast-flowing rivers of the Amazon. They are active in the daytime, feeding on fish, turtles, crabs and shellfish. Males will carry tree branches in their mouths to attract females.

1 GIANT RIVER OTTER

Length: 1–1.7 m (3.3–5.6 feet)
Lifespan: up to 12 years

2. WATER BUFFALO

Length: 2.6 m (8.5 feet)
Lifespan: up to 25 years

4. WATER OPOSSUM

Length: 27–32.5 cm (0.9–1 foot)
(excluding tail)
Lifespan: 3 years

5. CAPYBARA

Length: 130 cm
(4.3 feet)
Lifespan: 4–8 years

3. AMAZONIAN MANATEE

Length: 2.8 m (9.2 feet)
Lifespan: 30 years

6. PINK DOLPHIN

Length: 2.8 m
(9.2 feet)
Lifespan: 30 years



RIVER REPTILES

THERE ARE MORE THAN 450 SPECIES OF REPTILES IN THE AMAZON BASIN, MANY OF THEM LIVING IN OR AROUND ITS RIVERS, STREAMS AND CREEKS. THESE INCLUDE PREDATORS LIKE THE ANACONDA, AND CREATURES THAT EAT MAINLY PLANT MATTER, LIKE THE GREEN IGUANA.

- 1 SPECTACLED CAIMAN** This relative of the crocodile lives in wetlands and rivers of the lower Amazon. It hunts at night, eating snails, crabs, fish and mammals. It gets its name from the spectacle-like bony ridge between its eyes.
- 2 BASILISK LIZARD** This lizard lives near rivers and streams and has evolved the ability to run across water as a means of escape from predators. Young basilisks can run 10–20 m (33–66 feet) before sinking. Adults, being heavier, sink more quickly. The basilisk then completes its escape by swimming.
- 3 GREEN IGUANA** These reptiles are active during the day, feeding on flowers, leaves and fruit. They live near water and, to escape a predator, will leap from a branch into the river – often from a great height – and swim to safety.
- 4 ARRAU TURTLE** This river turtle feeds mainly on fruits, seeds, leaves and algae, but may also eat sponges, eggs and animal carcasses. It lays its eggs in a nest on the beach during the dry season, and the eggs hatch when the waters start to rise.
- 5 GREEN ANACONDA** The world's heaviest snake lives in the swamps and slow-moving streams of the Amazon. With its camouflage colouring and eyes and nostrils on top of its head, it can lurk submerged and unseen before ambushing its prey, which it constricts in its coils.
- 6 ORINOCO CROCODILE** This apex predator is found in the Orinoco River and its tributaries. As well as fish, it eats birds, mammals and reptiles, including the occasional caiman. Its narrow snout reduces water resistance when capturing prey in the river.



1. SPECTACLED CAIMAN

Length: 1.4–2.5 m (4.6–8.2 feet)
Weight: 7–40 kg (15–88 pounds)



3. GREEN IGUANA

Length: around 1.5 m (4.9 feet) (including tail)
Lifespan: 20 years



6. ORINOCO CROCODILE

Length: 4.1 m (13.5 feet)
Lifespan: 70–80 years



2. BASILISK LIZARD

Length: 76 cm (2.5 feet) (excluding tail)
Lifespan: 7 years



5. GREEN ANACONDA

Length: up to 5 m (16.4 feet)
Lifespan: 10 years



4. ARRAU TURTLE

Length: 40–71 cm (1.3–2.3 feet)
Lifespan: 20 years



FISH

THE AMAZON RIVER AND ITS TRIBUTARIES CONTAIN MORE THAN 3000 SPECIES OF FISH. MANY FEED ON ALGAE AND OTHER PLANT MATERIAL. SOME 200 SPECIES ARE FRUIT AND SEED EATERS, DEPENDENT ON THE PRODUCE OF TREES GROWING ON THE RIVER BANK. OTHERS, SUCH AS PIRANHA, ARAPAIMA AND ELECTRIC EELS, ARE PREDATORS.

- 1 ARAPAIMA** The arapaima is a fierce predator and one of the world's largest freshwater fishes. Although it mainly eats other fish, it can leap out of the water to grab lizards, birds and small mammals from low-hanging branches. It must surface every 10–20 minutes to breathe.
- 2 TAMBAQUI** This large fish helps in seed dispersal. It eats the seeds that fall from the trees in the flooded rainforest. The seeds pass through its body and are excreted to sprout elsewhere. During the dry season, it moves to the deeper parts of the river.
- 3 ELECTRIC EEL** Despite its name, this creature is a kind of fish. It lives on the muddy bottoms of shallow rivers and has organs in its abdomen that can create a powerful electric current, which it uses to detect, stun or paralyse its victims.
- 4 SOUTH AMERICAN LUNGFISH** These eel-like air-breathers are found in the swamps and shallow, slow-moving waters of the Amazon and other South American rivers. They survive the seasonal drying-out of their habitat by burrowing into mud and aestivating (existing in a dormant state) until the waters return.
- 5 RED-BELLIED PIRANHA** Piranhas have big, sharp teeth and one of the strongest bites of any fish. They live in schools and feed mainly on fish, as well as small mammals, birds and reptiles. Despite their reputation as fierce predators, they also eat fruits, seeds and leaves.
- 6 CARDINAL TETRA** The cardinal tetra inhabits the blackwater environment of the Rio Negro, a tributary of the Amazon. Its brilliant, iridescent colouring allows the fish to find others of its kind in the dark waters. It feeds on the tiny larvae of insects hidden among underwater plants.

1. ARAPAIMA

Length: over 2 m (6.6 feet)
Lifespan: up to 20 years

2. TAMBAQUI

Length: 70 cm (2.3 feet)
Lifespan: 40 years

3. ELECTRIC EEL

Length: 2 m (6.6 feet)
Electrical charge: up to 600 volts

4. SOUTH AMERICAN LUNGFISH

Length: 125 cm (4.1 feet)
Lifespan: about 8 years

5. RED-BELLIED PIRANHA

Length: 12–35 cm
(4.7 inches–1.1 feet)
Lifespan: around 10 years

6. CARDINAL TETRA

Length: 3 cm (1.2 inches)
Lifespan: around 1 year

PEOPLES OF THE RAINFOREST

There are around 50 million tribal people living in the world's rainforests. Historically, they have relied on the forest for food, shelter and medicine. Today, few forest people lead entirely traditional lifestyles. While they still hunt and gather food in the forest, many also farm crops and sell their food and wares in town and village markets. Even so, they retain a deep knowledge of the rainforest, including the use of medicinal plants to treat illness.

YANOMAMI PEOPLE

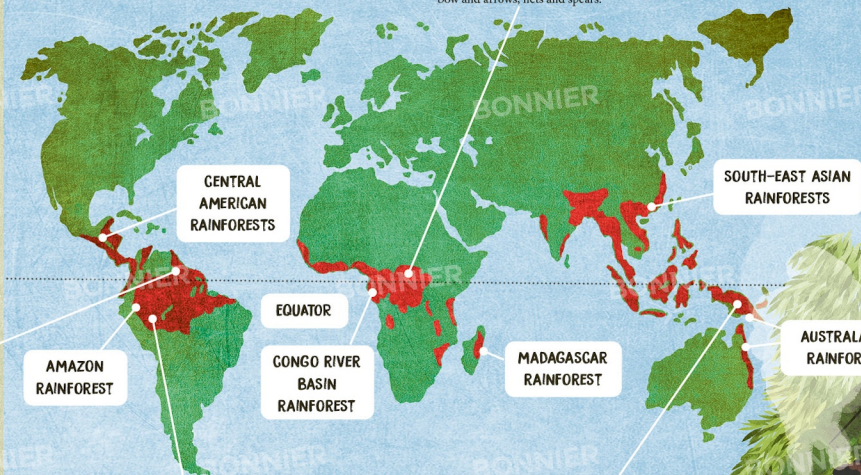
The Yanomami people of South America live in a large, doughnut-shaped communal house called the Yano, made of vine and leaf thatch. Its central courtyard is used for dancing and ceremonies. Their celebrations can last several days! They have no chiefs, and believe all people are equal. Today, the Yanomami mostly eat farmed produce but they continue to hunt and gather food in the forest.



THIS MAP SHOWS THE AREAS OF RAINFOREST AROUND THE WORLD

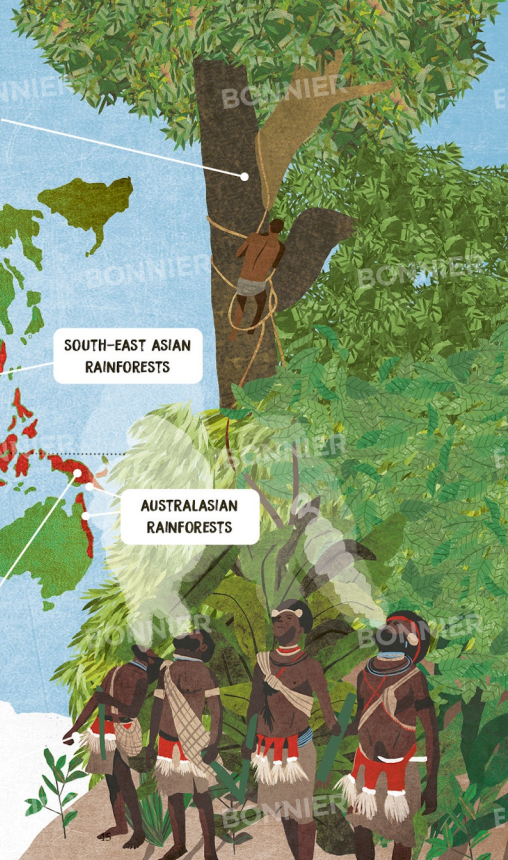


LAND COVERED IN RAINFOREST



MBUTI PEOPLE

The Mbuti of the Congo River Basin rainforest lead a nomadic lifestyle, moving from place to place. At each new camp they clear the undergrowth but leave the canopy intact for shade. The men will climb more than 30 m (98 feet) into the trees to collect honey from beehives. They hunt using a bow and arrows, nets and spears.



CENTRAL AMERICAN RAINFORESTS

SOUTH-EAST ASIAN RAINFORESTS

AMAZON RAINFOREST

EQUATOR

CONGO RIVER BASIN RAINFOREST

MADAGASCAR RAINFOREST

AUSTRALASIAN RAINFORESTS

ACHUAR PEOPLE

The Achuar have lived in the Amazon rainforest for thousands of years. Women gather foods from the forest, cultivate gardens and catch fish with baskets. Men hunt and make hunting tools such as blowguns and traps. Dreams are important in Achuar culture because people believe they can foretell the future.

HULI PEOPLE

The Huli live in the highland rainforests of Papua New Guinea. They are hunters, gatherers and farmers and live in round grass huts. Traditionally, men and women live in separate huts. They have celebrations called sing-sings at which the men wear elaborate headdresses and cover themselves with yellow and red clay.

LOGGING

The world's rainforests are facing a major threat: deforestation. Trees are being cut down for all sorts of reasons. For example, timber companies fell rainforest trees to make timber products. Power plants cut down and burn trees to generate electricity. Paper makers turn rainforest timber into pulp for paper products. More trees are cleared to build roads, so that trucks can carry the felled trees to where they are needed.

ILLEGAL LOGGING

Timber companies must obtain permission from governments to cut down trees, but once they've built roads into the forest, illegal loggers can easily follow them in and cut down more. As much as 80 percent of Peru's timber comes from illegal logging.

COMMERCIAL LOGGING

Logging by international timber companies is a major cause of rainforest deforestation. The hardwood trees that grow in the tropics are especially valuable for products such as furniture, but these are slow-growing trees and it can take the forest many years to recover from their loss.

SELECTIVE LOGGING

Some timber companies practise 'selective logging'. Instead of clear-cutting an entire section of forest, they will fell only the trees they want, leaving the rest standing. This is a more sustainable form of logging, but it does have negative impacts. For example, it means building more roads, as the selected trees don't all grow in the same place.

ROADS

Roads slice through the rainforest, giving access to remote areas for loggers, farmers and miners. Around 95 percent of deforestation in the Brazilian Amazon occurs within 5 km (3.1 miles) of a road or river. The network is constantly expanding, and many of the roads are illegal, branching off official ones.

WHAT'S IT USED FOR?

Timber from tropical rainforest trees is used for all sorts of things, including furniture, flooring, boat fixtures, garden furniture, doors, window frames, coffins, wooden bowls, faïenca utensils and even toilet seats.



BIOFUELS

Plants known as biofuel crops are often grown as a source of fuel for cars. These include sugar cane, palm oil and soya beans. They are converted into the fuels ethanol and biodiesel. This may seem like a green alternative to burning fossil fuels, but it leads to widespread deforestation. Every year, 325,000 hectares (803,092 acres) of Brazilian rainforest is cleared for the farming of soya beans.



CATTLE FARMING

Cattle farming is the biggest cause of deforestation in the Amazon rainforest. In Brazil, some 450,000 square kilometres (173,746 square miles) of deforested land is now cattle pasture. Cattle farming causes soil erosion and the silting up of rivers, and adds to the greenhouse gases present in the atmosphere.



AGRICULTURE

Every year, thousands of square kilometres of rainforest are cleared for cattle grazing and for growing crops. Some of this is done by poor farmers who fell sections of forest to grow food to feed their families. Far more of it is cleared by large agricultural companies that convert former forest into giant farms for growing cash crops such as soya beans. This results in habitat loss, disruption of the water cycle and increased soil erosion.

SLASH-AND-BURN

Farmers convert forest to farmland using the slash-and-burn method: cutting down and burning areas of vegetation. Because rainforest soil is nutrient-poor, it loses its fertility after just two or three years, and farmers must move to a new site and the process begins again. Sometimes the farmers' fires get out of control and burn down large areas of rainforest.

AGROFORESTRY

Many rainforest farmers practise a more sustainable form of agriculture called agroforestry. This farming doesn't require the felling of trees and is done under the rainforest canopy. Coffee, cacao, avocado, guava, citrus and plantains are frequently cultivated in this way, and the crops benefit from being grown in the shade. What's more, they require fewer fertilisers and pesticides than those grown in full sun.

MINING AND POWER

The Amazon basin is rich in precious metals, including iron ore, copper, tin, aluminium, manganese, bauxite, nickel and gold. Areas of the forest are cleared to mine these resources. Hydroelectric power stations built in the Amazon basin have led to the flooding of the rainforest to create reservoirs and dams.

HYDROELECTRIC POWER

Hydroelectric dams built on rivers in the Amazon produce the power for mining operations as well as towns and cities. Hydropower may be a renewable form of energy, but the dams have a significant environmental impact. They prevent fish from migrating. They also block the flow of sediment and organic nutrients and cause water levels to fall, drying out wetlands, and threatening the wildlife of the river and the livelihoods of fishing communities.



FLOODING

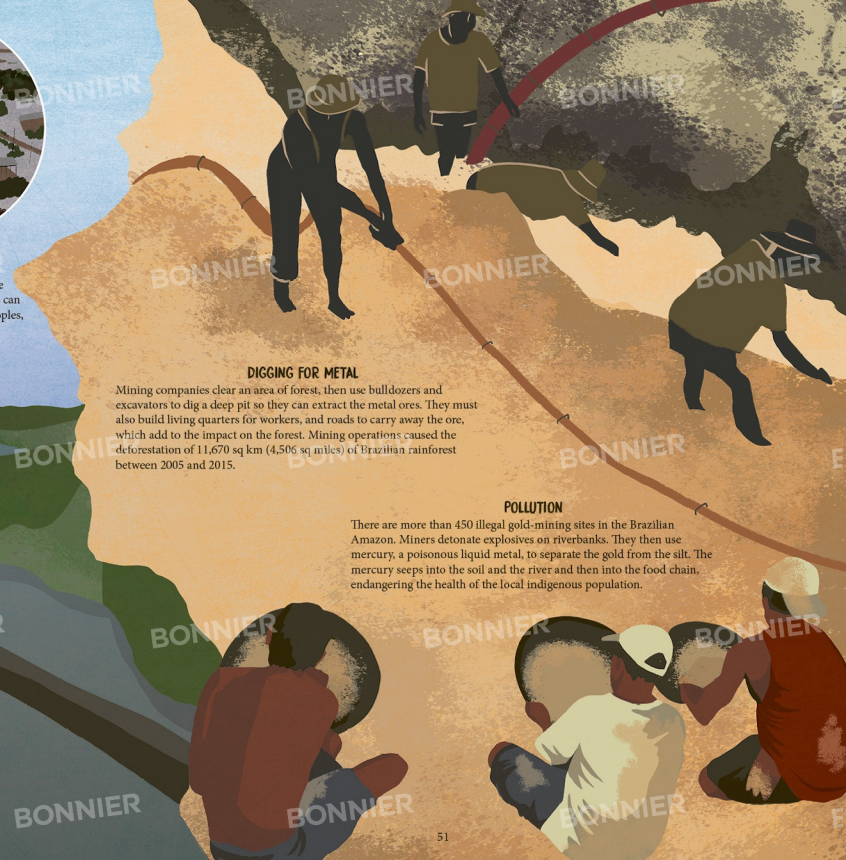
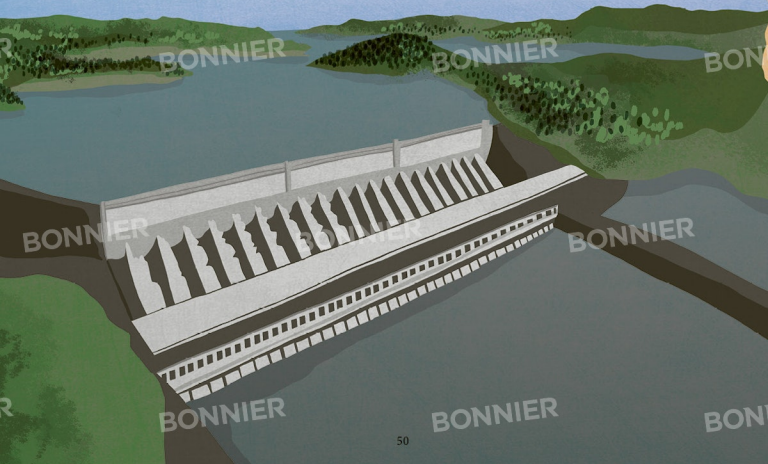
Hydroelectric dams often require the flooding of large areas of forest. This can cause the displacement of native peoples, and the submerged vegetation emits methane, a greenhouse gas.

DIGGING FOR METAL

Mining companies clear an area of forest, then use bulldozers and excavators to dig a deep pit so they can extract the metal ores. They must also build living quarters for workers, and roads to carry away the ore, which add to the impact on the forest. Mining operations caused the deforestation of 11,670 sq km (4,506 sq miles) of Brazilian rainforest between 2005 and 2015.

POLLUTION

There are more than 450 illegal gold-mining sites in the Brazilian Amazon. Miners detonate explosives on riverbanks. They then use mercury, a poisonous liquid metal, to separate the gold from the silt. The mercury seeps into the soil and the river and then into the food chain, endangering the health of the local indigenous population.





COFFEE

BUY RESPONSIBLY

When you shop with your parent or carer, buy foods from a sustainable source. Brazil nuts and cashews, for example, are good because they can only be harvested from a healthy rainforest. Check the ingredients of what you buy and avoid palm oil, a product that contributes to deforestation. Avoid any product made from tropical hardwoods such as mahogany, rosewood or ebony.

WHAT CAN WE DO ABOUT IT?

The world's rainforests are under severe threat. The good news is that there are a lot of organisations out there trying to save them. But they need your help. We can all play our part in saving the rainforests and their wildlife by taking action now, and by making our voices heard.

HELP MIGRATING BIRDS

Many of the birds we see in our gardens and window ledges migrate each winter to the rainforest. Why not put out a bird feeder or bird house for them? Fix a plant saucer to a large upturned plant pot to make a bird bath. Plant hawthorn, honeysuckle, holly, ivy, teasel, cotoneaster or sunflowers – plants that provide berries and seeds for birds, or that attract the insects that birds eat.



RAISE FUNDS

Why not raise funds for a rainforest charity? You could set up an event at your school, such as a concert, comedy show, poetry slam or cake sale. Or you could ask people to sponsor you for a run or some other sporting activity. You could even organise a talk on the rainforests, and request donations at the end.



A PRECIOUS RESOURCE

As we have learned in this book, tropical rainforests are among the most beautiful parts of our world, filled with many extraordinary plants and animals. We must do all we can to save them.

CONTACT GOVERNMENTS

Governments of rainforest countries can pass laws to protect areas of forest from logging, agricultural and mining activities, to preserve biodiversity, save endangered species and defend the rights of indigenous peoples. Why not email governments and help put pressure on them to safeguard our precious rainforests?



GLOSSARY



ABDOMEN The hind part of the body of an insect.

ALGAE Plural of alga, a simple, non-flowering, usually aquatic plant. Seaweeds are a form of algae.

APEX PREDATOR A predator at the top of a food chain, with no natural predators.

BIODIVERSITY The variety of plant and animal life in a particular habitat.

CAMOUFLAGE The natural colouring or form of an animal, which enables it to blend in with its surroundings.

CANOPY The leaves and uppermost branches of the trees in a forest.



DECOMPOSITION The process of rotting and decay.

DEFORESTATION The action of clearing large areas of trees.

ECHOLOCAION Finding objects using reflected sound; used by animals such as bats.

ECOSYSTEM All the plants and living creatures in a particular area and their environment.

EMERGENT A tree that is taller than the surrounding trees in a forest.

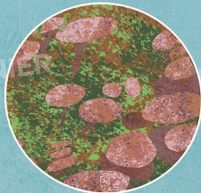
EPIPHYTE A plant that grows on another plant, such as ferns, bromeliads and orchids growing on tree trunks in tropical rainforests.

FOLIAGE A mass of tree and plant leaves.

FORAGE Search for food.

FOSSIL FUEL A fuel such as coal or oil formed millions of years ago from the remains of living organisms.

FUNGUS A member of a group of organisms, including moulds, yeast and mushrooms, that feed on organic matter.



GLAND An organ in an animal that secretes particular chemical substances for use in the body or to release into the surroundings.

GONDOLA A compartment hanging from an airship, balloon or ski lift.

GREENHOUSE GAS A gas such as carbon dioxide or methane that contributes to the greenhouse effect – the trapping of the Sun's warmth in the atmosphere.

GLOSSARY

HABITAT The natural home or environment of an animal or plant.

HARDWOOD TREE A slow-growing, broad-leaved tree.



HIBORVORE An animal that feeds on plants.

HUMID Describing a climate that is warm with a high level of water vapour in the air.

HYDROELECTRIC POWER The production of electricity by using flowing water (usually held in a reservoir behind a dam) to drive a turbine, which powers a generator.

INDIGENOUS PEOPLE The native people of a particular place.



IRIDESCENT Luminous colours that seem to change when viewed from different angles.

LARVA The active, immature form of an insect.

MEANDER Follow a winding course.

MOLLUSC A member of a large family of soft-bodied animals that include snails and slugs.

NECTAR A sweet liquid made by flowers to attract insects and other animals to pollinate them.

NUTRIENT A substance that keeps a living thing alive and helps it to grow.

ORGANIC MATTER Material composed of living or dead organisms.

PHOTOSYNTHESIS The process by which plants use sunlight to obtain nutrients from carbon dioxide (CO₂) and water, and release oxygen.



PLUMAGE A bird's feathers.

POLLEN A fine powdery substance produced by the anther (male part) of a flower.

POLLINATION The process of pollen entering a flower or plant so that it produces seeds. Flowers rely on pollinators (wind, water, birds, insects, butterflies and other animals) to carry pollen from one flower to another.

PREHENSILE Capable of grasping.

RAPTOR A bird of prey.

SCAVENGER An animal that feeds on dead animals or plant matter.

SECRETE (of a cell, gland or organ) Produce and release a substance.

SEDIMENT Matter that settles at the bottom of a body of water.

SOIL EROSION The removal of the upper layer of soil by wind, water, animals or human activity.

TOXIC Poisonous.

TRIBUTARY A river or stream flowing into a larger river or a lake.

UNDERSTOREY The layer of vegetation that grows beneath the canopy of a forest.

VENOMOUS (of an animal) Secreting a poisonous liquid or capable of injecting venom through a bite or sting.



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