

Tropical Rainforests

This lesson was adapted from GrowLab: Classroom Activities for Indoor Gardens and Grow Lights by Eve Pranis and Joy Cohen

Overview: Students explore the adaptations of rainforest plants as they also discover the important role of the rainforest ecosystem on our planet.

Grade Level/Range: 6- 8th Grade

Objective

Students will learn:

- the rainforest has a unique ecosystem that allows for a diversity of living organisms to thrive
- rainforest plants are specially adapted for the environmental conditions present in their ecosystem
- rainforests provide products and environmental benefits that impact the entire planet

Time: 2 to 4 hours

Materials

- A selection of common indoor houseplants from tropical rainforest origins (suggested selection to include an orchid, a tillandsia (air plant), a bromeliad, a ficus, a monstera, a staghorn or other type of tropical fern, a philodendron, a croton and a pitcher plant)
- [Rainforest stories diagram](#)
- access to online or printed resource materials

Background Information

Although they cover just 6 percent of the Earth's surface, tropical rainforests serve as home to more than 50% of all of the plant and animal species on Earth! These diverse ecosystems are vital to the health of our planet. In addition to playing a key role in maintaining the balance of carbon and water in our atmosphere, tropical rainforests provide us with harvested treasures such as food, medicine and other products that we use daily. With such a diversity of organisms, who knows what other treasures they hold?

Located around the equator, tropical rainforests maintain a warm and moist climate year-round. The typical environmental conditions include an average rainfall of 60 to 200 inches per year, temperatures ranging from 70 to 90 degrees F, 12 hours of sunlight a day, and 70 to 95% humidity. An incredible array of plant and animal species has evolved to thrive in these conditions — and many of these species are ill-suited to survive outside the rainforest environment.

Layers of Life in a Rainforest



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A tropical rainforest is comprised of multiple layers of growth including:

The canopy. The uppermost story is the continuous leaf canopy formed by trees 60 to 100+ feet tall. The tallest trees, sometimes referred to as the **emergent** layer, tower 100 to 250 feet above the rainforest floor. The trees themselves support a diverse ecosystem. Vines climb the trunks and plants such as orchids grow on the bark, branches, and leaves. Innumerable insects, birds, mosses, fungi, lichens, and even some mammals make their homes in the trees.

The trees are adapted to endure the most intense impacts of sun, wind, and rain. Water continually lands on the canopy and falls through the sub-canopy to the forest floor. Many of the trees' leaves adapted to this constant deluge to have pointed tips, called drip tips, to shed water and prevent mold growth. The canopy's dense growth and shade also greatly reduces the rate of evaporation from the lower levels.

The understory. Defined as the level containing plants up to 15' tall, understory species are adapted to deep shade — only 2 to 5 percent of the sunlight reaches this layer. Many plants here have large leaves to absorb the limited sunlight; others are climbers with aerial roots that cling to the taller trees' bark. The air is very still, and humidity is high (above 70 percent).

The forest floor. Here the air is somewhat cooler (recall that heat rises). The air is still and humidity is almost always above 70 percent. Little light reaches this level, so the sparse vegetation is composed of seedlings, fungi, mosses, ferns, algae, and other plants that are adapted for surviving with low light. While people tend to think of a rainforest floor as a tangled jungle of vegetation, that description is accurate only where the forest has been cleared and a new second growth has developed. The forest floor is actually a very open, still habitat, often described as “cathedral-like,” referring to the great diversity of life grows and towers overhead.

Nutrient-Poor Soils

A complex web of animal and plant partnerships (for pollination, seed dispersal, etc.) has evolved over hundreds of thousands of years in the rainforest. This diversity of plant life thrives even though the rainforest soil is very nutrient-poor. When plants and animals die, the heat, moisture, specialized fungi, and bacteria cause rapid decomposition. The nutrients released by decomposition are immediately taken up and stored in new plants. The decaying processes are so fast that hardly any nutrients soak into the soil or are washed away by heavy rains. Rainforest plants have developed adaptations that enable them to support themselves on the poor soils.

Although rainforests are diverse systems, they're not necessarily tough – there is a fragile balance between every organism in the interdependent web. A change in any one species affects the whole intricate system.

Laying the Groundwork

Read *The Great Kapok Tree: A Tale of the Amazon Rain Forest* by Lynne Cherry. Give students time to research the diversity of plant and animal species that live in the rainforest and the products we harvest from the rainforest.

Some of the rainforest products we use in our daily lives include:

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- medicine – some of our most important pharmaceuticals are derived from rainforest plants
- coffee
- chocolate
- bananas
- spices such as cloves, vanilla, black pepper
- chewing gum
- oils such as coconut, camphor, sandalwood
- rubber – used for tires, erasers, balloons
- common houseplants – orchids, philodendron
- exotic hardwoods – such as mahogany, balsa, teak
- rattan and bamboo
- fibers – like burlap and ramie

Exploration

1. Give students a copy of the [rainforest stories diagram](#). Use the Background information (above) to talk about the different layers of the rainforest and the conditions present including the Emergent, Canopy, Understory and Forest Floor. On the handout, ask students to fill in adjectives describing each layer.

2. Next provide an assortment of common houseplants native to the rainforest for the students to investigate. Break the class into groups and give each group one plant. Allow some time for the groups to inspect their plant and take notes on some of features they see that they think would be beneficial for their life in the rainforest. If time allows, you can rotate the plants so that each group takes observations on all of the plants, or just have them focus on one. Some possible specimen plants to acquire include:

- orchids
- tillandsia (air plant)
- bromeliad
- ficus
- monstera
- staghorn or tropical fern
- pitcher plant
- philodendron
- croton

3. Once they make their observations, allow them time to research the adaptations of their plant (or plants) online or in printed resource materials. As a class come back to share and discuss your observations and findings. Noted adaptations may include:

Aerial roots. Plants such as orchids and tillandsia are considered epiphytes – they live on other plants and their aerial roots grab onto the plants, but they do not actually steal nutrients from or harm their host. The main benefit they derive is to be off the forest floor away from predators and, if they're high in the trees, they also have access to brighter light. The aerial roots are also adapted to more easily absorb water and nutrients from the air rather than needing to be surrounded by soil.

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Buttressing roots/above-ground roots. Many tropical rainforest trees will develop roots from their trunks or branches that help provide additional stability as they grow tall and reach for the light. Although the tallest of rainforest plants are not good candidates for houseplants, you may see these develop on plants like ficus trees too.

Water tanks/reservoirs. The tightly whorled leaves at the base of bromeliads act as water reservoirs. Yes, these reservoirs provide water to the plant. But more importantly, they serve as homes for insects and other small creatures, and then the plant derives nutrients from the waste and decaying remains of their little friends.

Drip tips. Many tropical plants have leaves with pointy tips and waxy surfaces that help water slide off quickly. These help prevent water buildup that could lead to decay and mold. Ficus, philodendron, and monstera leaves provide good examples. Crotons have especially shiny leaves to shed water.

Large leaves. Many plant species that live on the floor or in the understory have large leaves that maximize the surface area for catching what little sunlight filters down to their level. Tropical ferns and monstera are good examples. The more shade you grow them in, the larger their leaves will be.

Carnivorous plants. Some plants are adapted to catch insects to access nutrients. Pitcher plants are a rainforest example of a plant with this adaptation. [Learn more about carnivorous plants.](#)

Smooth bark. Many rainforest plants have smooth bark so water runs off quickly. It also serves as a deterrent to climbing vines by giving them little to cling to. (Left to grow unchecked, vines can sometimes overtake trees, choking their trunks and shading their leaves from sunlight.) The ficus tree will provide an example of this for you.

Making Connections

After students learn about the unique adaptations and environment found in rainforest, introduce them to the dangers facing rainforests today.

Humans have been cutting down rainforests to make room for agricultural land at an alarming rate. Because rainforest soils are so nutrient-poor, they aren't well suited for crops and may only support one or two seasons of crop-growing before they're fully depleted. Instead of improving the soil, the farmers and agri-businesses simply abandon the ravaged land and expand further into the rainforest, razing more trees for the next few seasons, and on and on. Rainforests have also been cleared to harvest logs for furniture and houses and to create land for cattle to graze.

Because the rainforest ecosystem is so fragile and relies on the interconnection of so many species, it is almost impossible for them to regenerate. A forest that may have taken 100,000 years to establish can be destroyed in a matter of days. Some of the potential impacts include:

Loss of species. Plant and animal species are being lost forever at an unprecedented rate. In addition to the general tragedy of such losses, many species have potential value to us for things such as medicine. We have barely scratched

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the surface when it comes to identifying and understanding the vast potential for benefits such as cures for diseases, and every time a species is lost, a possible cure is lost as well.

Loss of habitats. Animals are losing their homes, which will increase the loss of species over time. A few species may be able to move on and adapt to slightly different environments, but most organisms are uniquely adapted to their specific rainforest's conditions.

Destruction of indigenous cultures. An estimated 140 million indigenous people live in the rainforests. Destroying their habitat leads to displacement (if not outright death) of individuals and the destruction of their cultures. Losing an indigenous group and culture is not only a profound loss for the diversity of our own human species, it also means losing the innate wisdom of that culture; for example, the uses of different plants that outsiders might never discover.

Climate change. The living plant material in a rainforest — especially the immense trees — stores an incredible amount of carbon. When those trees are cut and left to decay, the carbon is released into the air. There it is converted into carbon dioxide, one of the greenhouse gases that are contributing to overall global climate change. Additionally, water that had been pumped into the air through plant transpiration is being decreased, leading to a decrease in humidity and rainfall in the region — as well as potentially affecting weather patterns near and far from the forest.

Loss of topsoil. Without the tree roots for stabilization, precious soil is running off into streams, rivers, and ultimately oceans.

Watch the PBS News Hour clip: “How Amazon deforestation could push the climate to a ‘tipping point’” that was produced in response to fires ravaging many areas of the rainforest at: <https://www.youtube.com/watch?v=2yMnMJWyY7k>

Discuss the impacts humans are having on the environment through their actions regarding rainforests.

Branching Out

End the lesson by brainstorming and researching ways your students can help protect and preserve tropical rainforest. This may include things like launching an awareness campaign, writing local government representatives for their support on policies protecting the rainforest, hosting a special events, raising money to donate to nonprofit organizations involved in rainforest preservation efforts, and creating a list of sustainably sourced products.

Other ideas: Research “sustainably sourced” and certification organizations for things like coffee, certain types of wood, etc.

Link to Standards

MS-LS1-5. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.

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MS-LS2-1. Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.

MS-LS2-4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

MS-LS4-4. Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment.

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