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# Cosmic Classroom Guide


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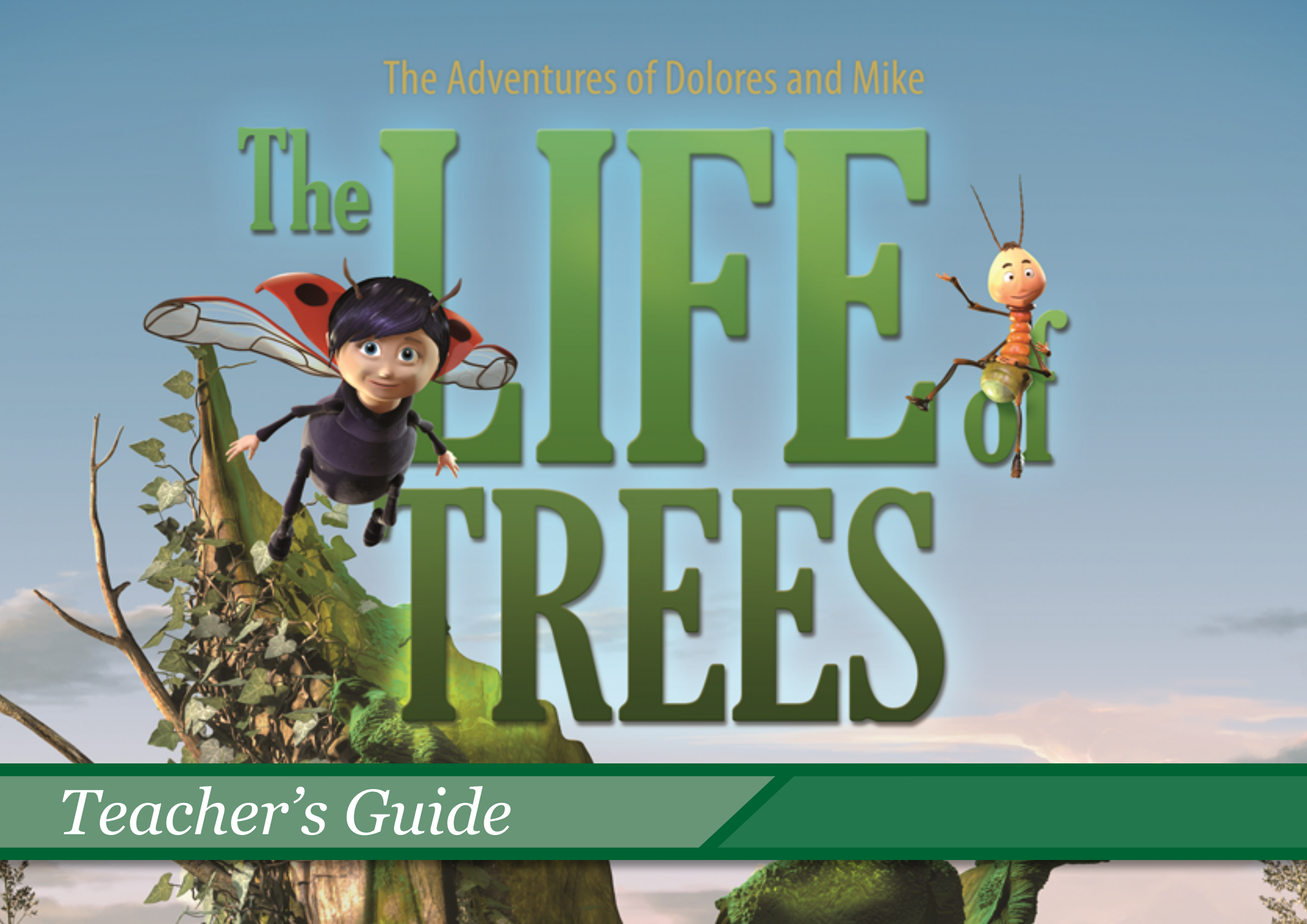
THE UNIVERSITY OF MAINE

*A Member of the University of Maine System*

The Adventures of Dolores and Mike

# The LIFE of TREES



## *Teacher's Guide*

*“Look deep into nature*

*and then you will understand everything better.“*

Albert Einstein

German Physicist

1879 - 1955

# The Life of Trees

The adventures of Dolores and Mike

The LIFE of TREES

# Contents

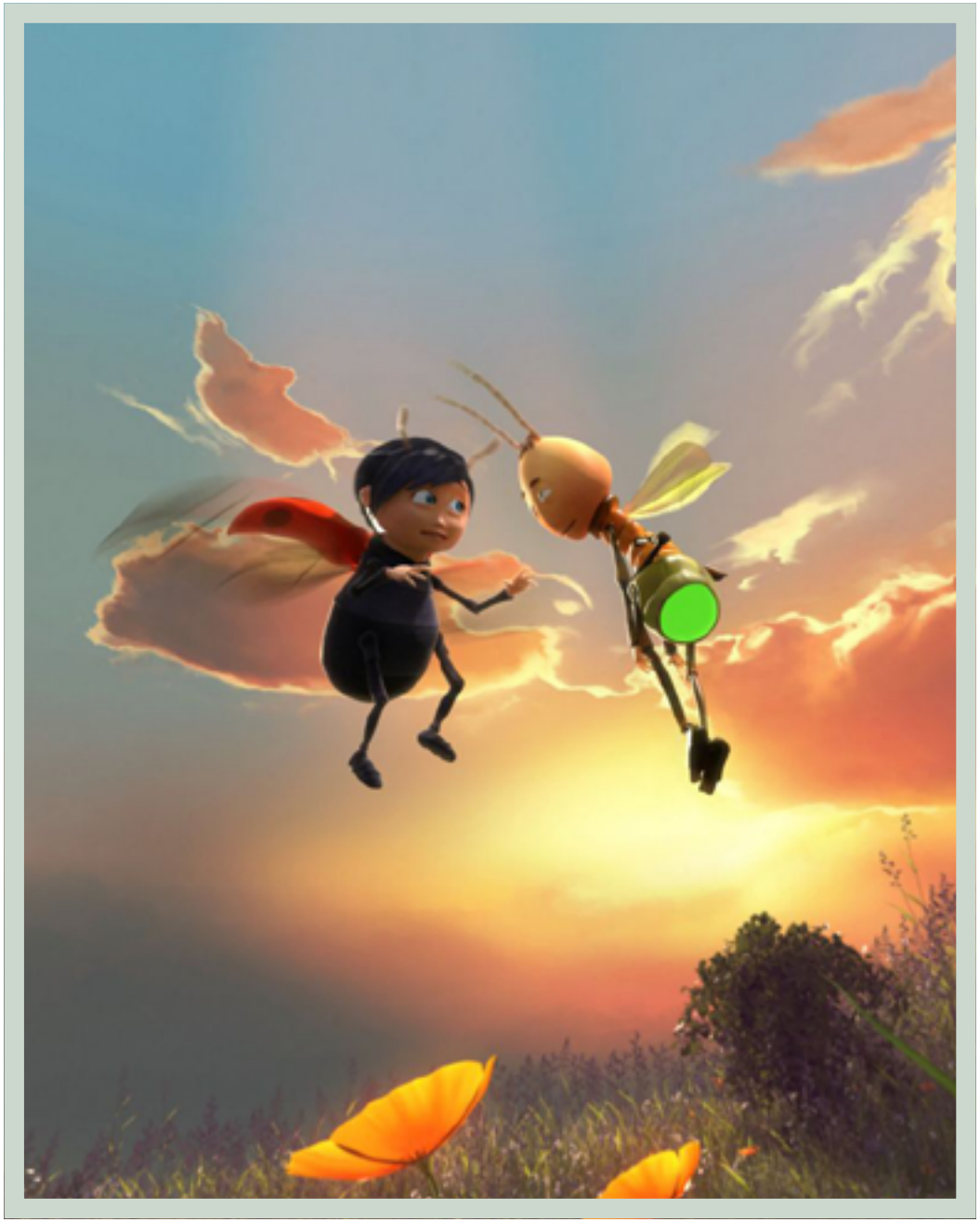
# *Introduction*

## The Teacher's Guide

The Life of Trees represents a new dimension of planetarium programs known as EDUTAIN-MENT. Entertainment and education are woven into a unique phenomenal film effect. Being both appealing and informative at the same time, this combination creates a nonpareil learning result.

Watching The Life of Trees the spectator becomes part of an awareness-raising narration, dives into a never-before-seen world of trees and learns about their utmost importance for our lives. The ani-mated insect characters, Dolores and Mike, with their patently human traits are role models not only for children.

This companion booklet serves as an info source for all who are interested in these topics, but it may also be used to acquaint students with themes that appear in the movie. Nonetheless, the teacher's guide stands by itself as an educational resource independent from the movie.



## *The Adventures of Dolores and Mike*

In The Life of Trees a cheeky ladybug called Dolores and a quirky firefly called Mike take the audi-ence on an adventurous journey of exploration into the wondrous world of trees.

Taking the perspective of insects, the full dome film reveals the magic of the microcosm.

On their excursion these two creepy-crawlies zip around a trees, and by doing so, playfully learn its secrets:

- How do plants get their nutrition from the sun?

- How do they grow? How does water get from the roots to the top of the crown?

- And how does all this make life on our planet possible?

The teacher's guide contains absorbing and impressive back-ground information about fundamental topics concerning our live on earth such as the biochemical process of the photosyn-thesis, the trees' capacity to transport water against gravity to the top of the crown, how their reproduction works and how they enable diverse life on earth by producing oxygen.

# *Photosynthesis*

# *The process in which light energy is converted to chemical energy*

**What makes a plant?**

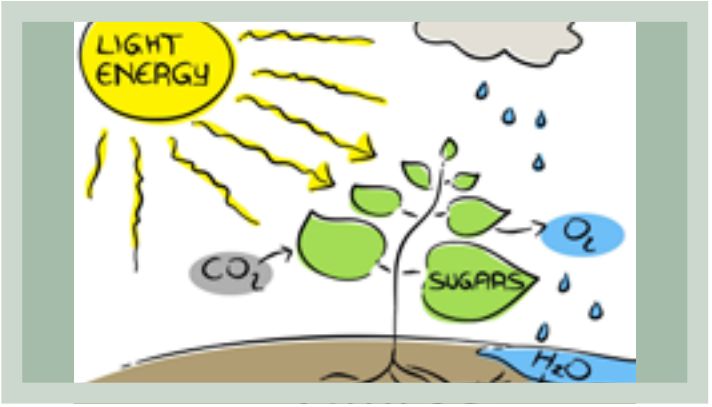
The big thing that connects plants is photosyn-thesis. Photosynthesis is the process that al-lows plants to take energy from the Sun and create sugars. Not all plants go through the process of photosynthesis.

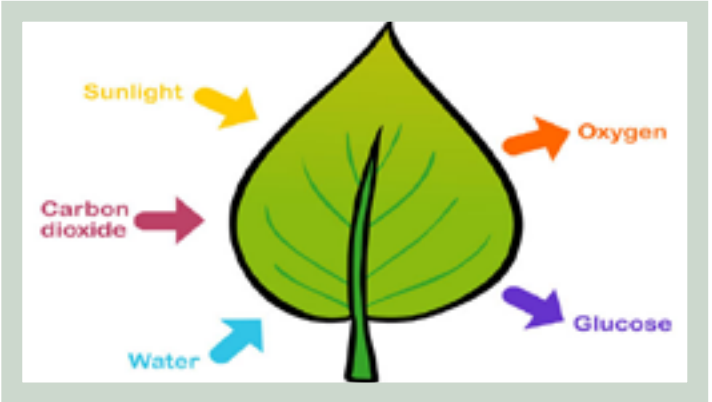
In photosynthesis, solar energy is converted to chemical energy. The chemical energy is stored in the form of glucose (sugar). Carbon dioxide, water, and sunlight are used to produce glucose, oxygen, and water. The chemical equation for this process is:

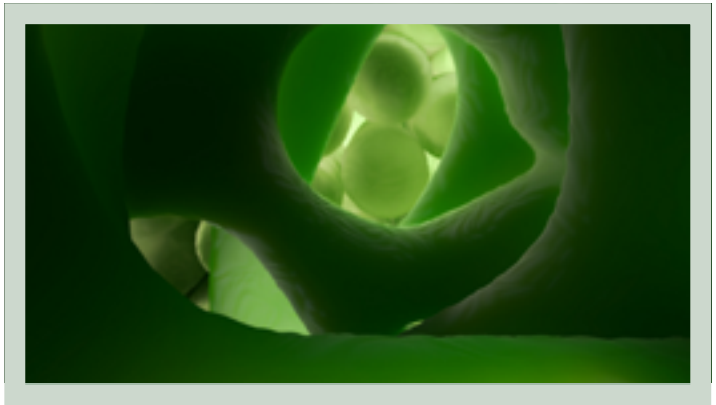
6 molecules of carbon dioxide (6CO2) and 12 molecules of water (12H2O) are consumed in the pro-cess, while glucose (C6H12O6), six molecules of oxygen (6O2), and six molecules of water (6H2O) are produced.

**In which part of the plant does the photosynthesis take place?**

In plants, photosynthesis occurs mainly within the leaves. As we already learned, photosynthesis requires carbon dioxide, water, and sunlight. All of these ingredients must be obtained by or transported to the leaves. Carbon dioxide is captured through tiny pores in plant leaves called stomata. Oxygen is also re-leased through the stomata



# *Water Transport*

## *The pathway of water and nutrient transport against gravity*

The plants we discuss will be vascular plants (such as ferns and seed-bearing plants) that have systems of tubes (xylem and phloem) for the transport of nutrients and water. The phloem transports sugar and the xylem transports water as well as salts.

The xylem vessels are tiny, each only several microns in diameter, made up of dead cells that have holes at either ends that are joined together to make hollow tubes that water can flow through.

Water is sucked up through the xylem. When they die, their cell walls are still intact and continue to serve as a water transport pipeline.

The keyword defining the trees anti-gravity process is transpiration. It's a mechanism by which water that is absorbed by plants, as already explained through the roots, is evaporated into the atmosphere from the plants surface openings (stomata). There the moisture changes to vapor and is released to the air.

# *The Root System*

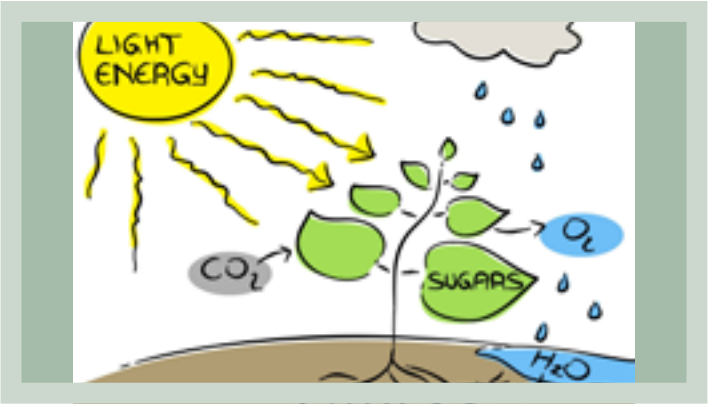
## *The trees‘ store-house and anchor*

Roots grow along with the plant and are the plants lifelong companion.

**How do roots grow below the surface without any sunlight?**

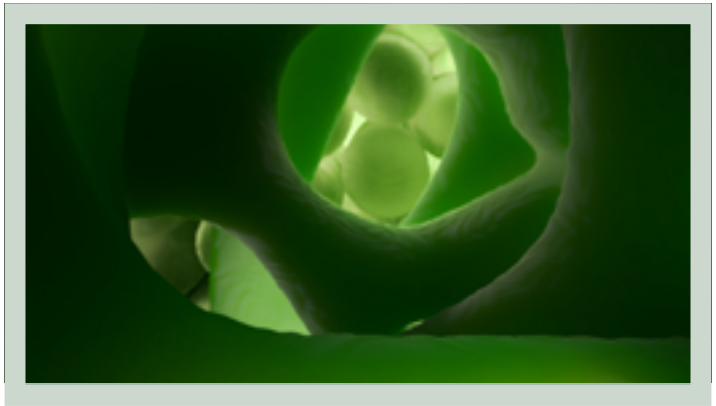
It’s very easy: they grow longer from the tip, the so called root cap, which actually is the most ro-bust part of the root pushing its way through the soil. All the root needs to grow are cells which are being added to the end of each root. No sunlight is required as roots do not have chloroplasts (remember? The tiny organelles containing the green molecule chlorophyll that enables them to absorb light)

Roots are structures designed to pull water and minerals from whatever material the plant sits on. For water plants, the roots may be in the water. For traditional trees, the roots go deep into the soil. Some roots can do as deep as 60 m below the surface. Root systems also provide support for plants working as an anchor in the soil. If the wind blows hard, those roots keep the plant from fall-ing over. Some plant species, like mangrove trees, have roots above the ground that pro-vide support for the entire plant. Those kinds of roots are known as aerial roots and exchange gases with the atmo-sphere just like leaves.




Did you know?

Humans profit from the roots of plants for food: Carrots and turnips are just very big edible roots.



# *Reproduction*

## *Moving pollen from one flower to another*

Most of the plants have their own way of sexually reproducing. Plants that rely on flowers for reproduction are also very dependent on outside help such as insects and animals and have different methods to attract pollinators: color, scent, heat, nectar glands, eatable pollen and flower shape. There are 20.000 varieties of pollinators, mainly insects, which move pollen from one plant to another. Flowers generate attraction strategies as well as functional strategies used to produce the next generation of plants. Pollinators and plants have coevolved, often to some extraordinary degrees, very often rendering mutual benefit.

## *How does pollination work?*

A butterfly might go to one flower and get a little pollen on its back. If it goes to another flower of the same species, that pollen can land on the stigma (the part of a pistil that receives the pollen). From that point, one haploid male nucleus, having only one complete set of chromosomes, combines with a female nucleus, also pertaining to a single set of chromosomes. If successful, an embryo and seed fruit develop respectively and in a couple of decades a plant, maybe even a tree, will flourish.

Did you know?

Bees, wasps, flies, ants, beetles, moths and butterflies are known as nature's number one pollinators. But they are not the only ones carrying pollen from plant to plant: There are vertebrates such as birds and bats. Humans do it, dogs and cats do it. The wind does it.

Did you know?

California is home to several record-busting trees, including the tallest tree in the world: Hyperion, a 379.1-foot-tall coast redwood located somewhere in Redwood National Park (the exact location is a secret, due to concerns over vandalism) The oldest tree in the world is a bristlecone pine tree and its 4,844 years old. You can find it in the Inyo National Forest in California, whereas the largest tree in the world, also known as monster tree, is the giant sequoia called General Sherman with 52,508 cubic feet. t.

# *Biodiversity*

# *The magic of our planet*

What is the product of four billion years of evolution? Many millions of distinct species, many of them yet undiscovered. Life, the world, the variation of life for the entire globe, that is what Biodiversity is made for.

**Why is biodiversity such a big issue?**

Recently the world has begun to be exhausted by human uncontrolled resource exploits. As a consequence we are sacrificing millions of species and habitats at an ever-increasing and alarming rate. As we don't exactly know how many species are there on earth, it is hard to say how much we are losing. The estimated extinction rate is about 0.01% per year. Imagine:

If there are 100,000,000 different species on earth, at least 10, 000 species go extinct every year.

**How does Biodiversity loss affect me and everyone else?**

"Biological diversity is the resource upon which families, communities, nations and future generations depend. It is the link between all organisms on earth, binding each into an interdependent ecosystem, in which all species have their role. It is the web of life."

Mother Nature features plants, animals, land, water, the atmosphere AND humans! Therefore it is imperative for us to learn how to constructively co-exist as we are all part of one big ecosystem. If we are facing a biodiversity crisis, our health and livelihoods are seriously endangered.

Did you know?

Scientists have a better understanding of how many stars there are in the galaxy than how many species there are on earth

# *Year of the Forest*

## *The planet's lungs. Home to people and wildlife. Engines of green economies. Forests are essential to life on Earth.*

The United Nations have declared 2011 the International Year of Forests. "Evolving over millennia, tropical forests are one of the greatest storehouses of nature's diversity on Earth; of all of the world's land spe-cies, around two thirds live in forests. Many of these rare creatures - orangutans, tigers, jaguars, forest elephants and rhinos - are increasingly threatened by extinction." (Greenpeace.org)

Forests in Numbers:

- Forests cover 31% of total land area.
- The livelihoods of 1.6 billion people depend on forests.
- Forests provide a home to more than 300 million people worldwide.
- The total global trade in forest products was valued at around $379 billion in 2005.
- Forests are home to 80% of terrestrial biodiversity.

## Why are forests so important for people?

Just think of how forests have affected your life today: Have you had your meals? Read a book? Switched on a light? Travelled to school by bus or car? Did your homework in your exercise book? Blown your nose into a tissue? Forests have a variety of uses to humans, including wood from trees, nutrition from animals, grazing, recreation, medicinal plants and so on. Forest products are used in our daily lives. Some are easy to figure out - fruits, paper and wood from trees, and so on. Others are less obvious - by-products that go into the manufacture of other everyday items like medicines, cosmetics and detergents. Additionally, forests function as climate-regulators as they store up to 300 billion tons of carbon in their living plants and herewith provide us with clean, fresh air and help balancing water flow as well as rainfall needed to grow crops and food.

## What are we losing?

Over the past 50 years, about half the world's original forest cover has been lost, the most significant cause for that being humans beings' unsystematic use of its resources, unsustainable agriculture, logging for timber, mining and climate change. Deforestation and rising global temperatures make our ecosystem fall apart with unimaginable consequences for all of us.

Greenpeace facts and numbers:

• Every two seconds, an area of forest the size of a football pitch is lost due to logging or destructive practices

• 72% of Indonesia's intact forest landscapes are lost forever

• 15% of the Amazon is gone for good

• Increasing temperatures kill trees, dying trees release more carbon, carbon enhances global temperature

**Did you know?**

The five most forest-rich countries are the Russian Federation, Brazil, Canada, the USA and China.

# *Sustainability*

# *An approach toward improving our way of life*

Take a long-term view of how your actions affect future generations by living within our planets resources without damaging the environment. Global players should merge ecology and economy into one system, resources shouldn't be depleted at a faster rate than the earth is capable of renewing them.

**What you can do ?**

Just add some green thinking to your everyday life! Try to save as much energy and water as possible by switching off the lights when you don't need them (or even replace your conventional light bulbs with eco-friendly ones), invest a little extra money in eco-friendly organic cleansing agents, make-up, toilet paper, shower gel, etc. Buy your fruit and vegetables from local farmers and be aware to purchase as much fair trade food as possible.

Fish is a very healthy choice but pay attention not to eat the species that are at risk for extinction, such

as the Atlantic Halibut or the Bluefin Tuna. Separation of waste may be helpful, too. Cloth bags are

more persistent and more eco-friendly than plastic bags.

The list is endless, so no excuses.

# Recommended Books

*The Tremendous Tree Book by May Garelick and Barbara Brenner (ages 3-9) The Giving Tree by Shel Silverstein (ages 4-8)*

*Red Leaf, Yellow Leaf by Lois Ehlert (ages 2+)*

*The Tree Book: For Kids and Their Grown-ups by Gina Ingoglia.(ages 8+) 1,001 Ways To Save The Earth by Joanna Yarrow (adults)*

*The Green Book: The Everyday Guide to Saving the Planet One Simple Step at a Time by Elizabeth George and Thomas M. Kostingen*

# Internet Sources

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