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TROPICAL RAIN FOREST IN THE BOTANICAL GARDEN









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SOLUTION OF THE WORKSHEET No. 7



The tropical rainforests (TRF) are written and spoken about very often, especially because it is disappearing fast. That is why everybody has an idea of what tropical forests look like but only a few people here have seen it with their own eyes. In the greenhouse Fata Morgana you can see and observe some of the major species of TRF from different corners of the world. They are arranged to reflect their diversity and variety as well as their relationships. This worksheet will enable you to learn about the distinctive features of vegetation in the lowland tropical rainforests

1. In the legend: circle the symbol used in the map for tropical rain forests.

2. Using your knowledge and the map complete the following text:

Most of the TRF's are situated near the equator, between 10° (-25°) of northern latitudes and 15° (-20°) of the southern latitudes. The main areas of its occurrence are:

- 1. Amazonia (South America)
- 2. Western Central Africa
- 3. Southeastern Asia (Indonesia, PNG, Malaysia...)
- 4. Central America (Guatemala, Belize and others)



There are no TRF's in Eastern <u>Africa</u>. The climate of tropical rain forest is equally humid and warm during the whole year, the total rainfall is between <u>2 000 and 12 000</u> millimetres, the average 24-hour temperature fluctuates between <u>25</u> and <u>27</u>°C. The microclimates in the different layers of TRF can be very different: on the forest floor the temperature and humidity fluctuate just slightly, in the emergent layer there is direct sunshine which heats and dries it. Climatic conditions are also different in lowland forests (up to 1000 m a.s.l.), mountain ones (1000–2000 m a. s. l.) and cloud forest (2000–3000 m a. s. l).

3. During the tour in Fata Morgana find the climate figures on the information stands in the exposition of lowland tropical rainforest and complete the exact figures of temperature and humidity.

<u>The temperature stays above 22°C, sometimes it exceeds 30°C.</u> <u>The air humidity stays over 80%.</u>

4. What is characteristic for plants in the TRF? State as many specific features as possible, not less than 3. Layers of plants, trunks and roots of trees with various adaptations, presence of many epiphytes, lianas etc. (see <u>next tasks</u>)

5. On the area of 1 ha of TRF there grows a few hundred tree species (the well-known maximum is 400) which can be as tall as 70 meters. The green house's height does not allow planting such giant trees, that is why the understory and canopy layers consist of lower wood plants. We can encounter for example avocado (*Persea americana*), kapok tree (*Ceiba pentandra*) or pachira (*Pachira macrocarpa*). The teacher will help you with their identification as there are no labels which can be seen from the path. But he or she will need descriptions and drawings as detailed as possible. **Choose one of the three pictured wood plants, find it and try to describe it using botanic terminology.**



<u>1. Persea americana</u>

<u>Avocado – up to 30 meters tall, ever-</u> <u>green tree, original location – tropical</u> <u>areas of Central and South America</u>





2. Ceiba pentandra

Kapok tree – up to 70 meters tall, original location – tropical areas of America, fibre from ripe capsules is used as cotton wool in upholstery, insulation, manufacturing of paper or life jackets (it has waxed surface), the seeds are used for oil pressing

3. Pachira macrocarpa

Pachira – up to 20 meters tall, original location – tropical South America, it has beautiful (at most 10 centimetres in size) blossoms and edible seeds

No 3. can be incorrectly identified as *Cecropia* growing in the curve of the path leading to the footbridge but its leaves grow from the trunk individually

6. The trunk and root formations of TRF trees are very conspicuous. **On your own choice, do at least two of the tasks marked with a–c. Pick another two form the ones marked with d–f.**



a/ How deep do you think do the roots of trees in TRF's reach? Give evidence for your opinion. Very shallow – as the most of the nutrients released by litter decomposition are found in the upper 10 centimetres of soil.



b/ What adjustment could improve the stability of trees in TRF's? Write down all your ideas.

Adjustment of trunks (so called pillars). Adjustment of roots (supportive, stiltlike).



pillars <u>1 – vertical columns</u>

supportive roots <u>3 – they make system of support</u>

stiltlike roots 2 - they resemble stilt



Note: It is more important to notice the adaptation than to give them the correct name.



d/ Find a wood plant with the stiltlike roots and another one with the supportive roots, draw them and write down their names.





e/ The soil is often very wet in TRF. Lots of trees have adapted themselves to these conditions by creating unusual types of roots.



What do you think these roots serve for? Exchanging of breathing gases.

What would you call this type of roots? Breathing.

Is there a tree with such roots near the lake? YES NO



Ficus trichopoda, F. cyathistipula and others – ask students to show if need be



7. We can identify particular adjustment to the conditions of TRF on the leaves, blossoms and fruits. On your own choice, do at least one of the tasks marked with a-c.



a/ Leaves of the plants in TRF's are very miscellaneous. They can be found with stalks with joints, that enable the leaf to follow the sunshine, or blades with so called drip tips, which make water draining from the leaf's surface easier.

Find a tree that has leaves with drip tips (i.e. lengthened to noticeable tip) put down its name and draw the leaf.

e.g. Ficus religiosa, F. cyathistipula and others – ask students to show if need be



There is one example on the rear wall, if you go past the waterfall.







Trumpet flower contains some reward – nectar – deep inside the blossom which can be reached by pollinators with long proboscis or beak. Theoretically, such a blossom could be pollinated by a butterfly too.

Try to find one more plant with similarly shaped blossoms like *Kohleria*'s (in the picture) and write down its name:

e.g. Gesneria ventricosa but also others, ask students to show if need be



c/ Fruits are variously coloured up, which makes them adjusted to dispersion by animals (zoochory). Look around and add up how many plants bearing fruit you can see around. What can be the reasons for absence of fruits? Put down all your ideas.



There can be a lot of reasons – it is not fruit ripening season, fruits are not noticeable, there can be shortage of pollinators

8. In TRF we can observe several similar types of plants in terms of appearance. However, they belong to different taxonomical groups (spore bearing, gymnospermous, angiospermous).

a/ From the following three tasks do one of your own choice:

• The name "palm tree" comes from the Latin "palma" (=palm) and refers to the usual shape of palm tree leaves. **Find two representatives of palm trees with palm-like leaves and put down their names.** <u>Kerriodoxa elegans, Carludovica palmata, Pritchardia hillebrandii and others – ask students to show if need be</u>

• Palm trees and dendriform buckler ferns have some features in common and some differences too. In the central part of tropical exposition right at the pathway there are the palm trees *Dypsis decaryi* and a dendriform buckler fern *Cyathea*. **Describe the similarities and differences**. **Notice the sprouting leaves among others**. <u>Similar features: leaves are arranged into a fan</u>.

Differences: new sprouting leaves of buckler ferns are rolled into a spiral, unlike at palm trees, the buckler fern leaves are several times pinnately compound leaves, at the palm trees they are not split, palm-like, only exceptionally twice pinnately compound leaves.

• Palm trees and cycases have some features similar and some different. **Take a detailed look at the cycas in the curve of the pathway leading to the montane part of the green house and describe what features it shares with palm trees.** The fact that both and coniferous trees belong to the group of gymnospermous plants can also serve as a clue.

Similar features: leaves are arranged into a fan, leaves are sometimes similar Differences: the reproductive structures of cycases are cones with seeds on the scales, the palm trees use blossoms and fruits (fruits and cones are present together only a particular part of year). The leaves of cycases are tough and leathery, the palm trees' ones are more delicate. Young leaves of cycases are rolled into a spiral, unlike the palm trees' ones.



b/ Match the appropriate names to the pictures: dendriform buckler fern (spore bearing), cycas (gymnospermous), palm tree (angiospermous). Try to find at least one not mentioned species of plant belonging to each group and put its name into the bottom line.



9. A very characteristic feature of TRF is the presence of climbing plants – lianas, epiphytes, which means that the plants do not grow from soil but hold to other plants without parasitizing them. **From the following three tasks do one of your own choice.**

a/ Lianas

Write down what advantages the strategy of climbing brings. The plant can reach the light without investing into supportive structures.

In Fata Morgana you can see a plant which creates the longest lianas in the world in the natural conditions. Its name is *Calamus rotang* and you can find it in the central part of the tropical exposition next to the dendriform buckler fern *Cyathea*. Its stalks are covered with remarkable thorns. Guess how long the liana in Fata Morgana is and what it can be used for. The generic name can help...

About 15 meters (in natural conditions up to 300 meters), it is used for making the rattan furniture.

How many other lianas can you count? More than 10.

b/ Epiphytes

Write down what advantages the epiphyte living strategy brings. <u>The plant can live in the conditions with a lot of light without investing into supportive</u> <u>structures. It often uses the nutrients and moisture collected in the branch pits.</u>

Find at least one epiphyte plant, write down its name and characteristic features. Aechmea fasciata, A. gamosepala, Platycerium and others – ask students to show if need be.

In Fata Morgana you can also see one specialized type of epiphyte plants which live in symbiosis with ants. In the central part of tropical exposition there is the species Myrmecoda growing in the height of 3 meters on the trunk of a dendriform buckler fern Cyathea (see No. 1 on the map on p. 4). Find it, write what makes the stalk of the plant unusual and try to draw it. Guess what this adaptation of stalk serves for. The stalk is broadened into the shape of a bulb, providing shelter for ants, whose droppings the plant uses for deriving minerals.

10. Write down what impressed you the most from the tour and outline some questions that come up to your mind concerning the topic:

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TROPICAL RAINFOREST IN BOTANICAL GARDEN RECOMMENDATIONS FOR TEACHERS

• The worksheet strives to evoke simple observation in groups of high school students, comparison of labels, solving problem tasks and interest in the world that the person is a part of.

• The worksheet is conceived using one major rule – choice – students can choose a task that interests them. They do not have to do all the tasks, but to keep the compulsory percentage of them. This way the students will be motivated and overcome the reluctance resulting from the "must-do-tasks".

• At the end of the tour we recommend teachers to encourage the students to ask any questions which came up during the work. The other students might know the answer, the unanswered questions can be assigned as homework. Otherwise the teacher may know or look it up.

• The worksheet is meant to be done as group work and implies cooperation and information sharing within groups.

• As the tropical climate in the greenhouse is quite difficult, the time schedule is suggested the following way:

1. the tasks 1, 2 and 4 should be done at school prior to the visit to Fata Morgana 2. the first part of the worksheet activity (25 minutes, tasks 3, 5–7)

3. a short break in the underground gallery viewing the fish or in the upper part of the green house with more pleasant climate; there is a WC in front of the entrance to the montane green house (10 minutes)

4. the second part of worksheet activity (25 minutes, tasks 8-10)

5. sharing the acquired knowledge, questions – possible to use some of the more pleasant rooms (15 minutes)

6. collective tour around the most interesting plants – students can show the teacher particular adaptations (15 minutes)

• The worksheet can be assessed by percentage of tasks which were satisfactory. Or self-assessment can be used, the rules of which the teacher can present.

References:

JENÍK, J. *Ekosystémy*. Praha: Univerzita Karlova 1995 JENÍK, J. *Kapitoly ze života v tropech. Sborník článků pro časopis Živa*. Vydáno vlastním nákladem. Praha 2009. ROHWER, J. G. *Tropické rostliny*. Praha: Knižní klub 2002