

Lichens



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ENVI-MOBILE: Integration of mobile learning into environmental education fostering local communities' development

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Activity No. 1

Part of the lesson:
EVOCATION

The aim of the activity: Getting familiar with the theme of lichens and their relation to the environment, observations and familiarizing with the real situation in the local surroundings.

Step 1

Brief description of the activity:

Implement this step if you have the possibility to take children for a walk in the nature to do the observations. If you don't have such a possibility, start with Step 2.

Divide children into pairs. Assign them the task of observations, writing their results down into the map (choose the map according to possibilities – part of the village, town, and surroundings): the task is to find out the quantity and kinds of the lichens in various locations, concrete habitats (trees, rocks, walls ...). Children write down the information they got on a paper and into the map. The way of collecting data is not determined.

Instruction (what you need to tell the students):

Work in pairs. Do the observations and write your findings down into the maps. Find out, how many different kinds of the lichens there are and mark their concrete habitats – places, where you found them, into the map. How many different kinds of the lichens did you find? Where concretely did you find them? Could you identify these kinds? What was their quantity? Write down your findings on the paper and into the map.

Step 2

Brief description of the activity:

Ask children to write down all the information they have about lichens (and they've got through the observations). Write their ideas down on a blackboard into the mind map, where the word „LICHENS“ is placed in the centre and the terms „KINDS“, „HABITATS“, „FUNCTION“ etc. around it.

Instruction (what you need to tell the students):

Write down on a paper all the information you have about the lichens. Work individually; write down everything that comes to your mind in relation to this topic. (after about 3 minutes) Share your ideas with your classmates.

Tools for the activity (everything you need to take to the classroom): Blackboard, markers, pen and paper

Estimated time (max. 40 min.): 10 minutes

Notes: Time estimation relates to Step 2 only. Step 1 should be implemented before the lesson, on a walk in the nature or nearby surroundings. If children are clever and able to work on their own, let them write down their findings in Step 2 on the blackboard on their own and do the mind map.

Activity No. 2

The aim of the activity: To realize the importance of lichens on the Earth, their protection and importance for the maintenance of clean and healthy environment.

Step 1

Brief description of the activity:

Teacher asks children to read the text about lichens (Annex 1). While reading, children analyse the text, using the marks (INSERT method). After reading, it is necessary to summarize the key information from the text. Then short discussion and structuring of information on the blackboard follows. Teacher ensures all the key information is written on the blackboard and children have it in their notepads. If children are used to work with this method, you can let them decide on their own which information is important and which is not. Time estimation is for about 15 minutes.

Instruction (what you need to tell the students):

Read individually text about the lichens. While reading, mark the parts of the text with signs. Analyse it and underline key information. Do not underline every information, choose only the information you consider important.

Use the following system of marking the information:

1. I knew this (✓)
2. This is new for me, I did not know this (+)
3. I do not agree with this (-)
4. This is not clear to me, I would want/need more information (?)

(after about 5 minutes) Draw a table with 4 columns into your notebooks/paper. Briefly write down your notes into the table.

(after about 5 minutes) Share your ideas with your classmates.

Part of the lesson:
APPRECIATION

Activity No. 2

Step 2Brief description of the activity:

Summary of lichens' observations in the maps. If children did not take part in the nature observations, teacher prepares relevant information beforehand, providing them to children for further work. Teacher divides children into the groups and let them evaluate the lichens' habitats, different kinds and quantity. Children discuss the possibilities of lichens' decrease and the reasons of their protection. At the end teacher asks children to provide their own arguments and write them down on a blackboard.

Instruction (what you need to tell the students):

Work in the group. Think about the following questions:

- Where most of the lichens occur?
- Where, on the other hand, we find only a few of them or none?
- What do have these locations in common?
- Think about what the lichens and clean environment mean.
- What do you understand under the expression "lichens' desert"?
- What are the reasons for the decrease of the lichens?
- Why and how should the lichens be protected?
- What substances are accumulated by the lichens?
- What factors endanger lichens the most?
- Provide arguments on why lichens occur in some areas and won't occur in the others? What the quantity of lichens' kinds depends on, what is the result of their decrease?
- Write down your statements on the paper. After finished, present them to you classmates.

Tools for the activity (everything you need to take to the classroom): Blackboard, markers/red, Annex 1, maps according the locations prepared by children or teacher, pen and paper

Estimated time (max. 40 min.): 25 minutes

Part of the lesson:
APPRECIATION

Activity No. 3

Part of the lesson:
REFLECTION

The aim of the activity: To realize the meaning of lichens for each of us.

Step 1

Brief description of the activity:

Based on the previous provided information, teacher asks children to think about the meaning of the lichens for each of us.

Instruction (what you need to tell the students):

Work in pairs, trying to think about:

- What does it mean for you that you have the lichen growing on the tree in your garden/close to your home?
- Where do the closest lichen grow in your nearby surroundings?
- What does it mean for you that there are no lichens at all in your nearby surroundings/close to your home?
- What can you personally do to support the growth of the lichens in our town?
- Write down your conclusions on your own. Than discuss them in pairs.
- At the end, those who want to, read your notes.

Tools for the activity (everything you need to take to the classroom):

pen and paper

Estimated time (max. 40 min.): 5 minutes

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Annex 1 - Lichens

Lichen is, actually, symbiotic community of a fungus and algae or cyanobacteria. The fungus provides algae with protection, keep the humidity, provide the water and minerals and protect it against damage (intense light, heat and drying up).

The fungus is called mycobiont. These mycobionts do not appear freely in nature, while the other part, algae, can live on their own. Algae provide the nutrition for the fungus, because of their photosynthesis, through which they create necessary organics. Mutual relationship of both these organisms has a symbiotic character so – called lichenized fungus. Algae contain chlorophyll and can produce carbohydrates for the fungus.

The body of the lichen is called insole. It can be of a yellow, orange, red, brown, grey, olive, greenish or even black or light green colour, when wet.

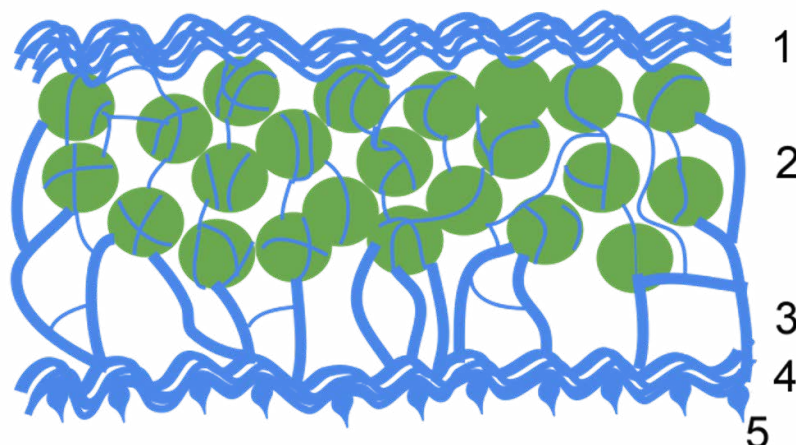
Lichens reproduce mainly vegetatively by decomposition or peeling of insole parts. Sometimes they reproduce also sexually by the spores. They create so – called isidia – growths of the insole, in the shape of narrow papule, often of different colour than insole. Isidium peel off the insole and are moved by the air or the water.

Lichens stick to the subsoil through parts sticking from the bottom layers of bark, or through bottom layers of bark they grow directly into the subsoil.

Fungus may feed by the dead cells of algae. Algae might force the fungus to protecting reactions, due to which fungal filaments and cortical layer of lichen sprawl.

The physique of the lichens:

1. **The upper cortical layer** - the protective layer
2. **Algal layer** - here runs the photosynthesis and the formation of organic compounds
3. **Broach layer** - water reservoir
4. **The lower cortical layer** - the protective layer, there are cracks for the gas exchange
5. **Rhizines** - anchoring hyphae, where the fungus attaches to the substrate



The benefits of lichens:

- Based on the analysis of lichen species' composition, the degree of naturalness of forests is determined.
- Lichens provide food for deer, chamois and birds.
- Speed up the process of weathering of rocks – through the action of lichens' acids or lichen ingrowths into tiny rock cracks.
- They are important soil-forming factors - lichen acids affect the soil microflora, and thus contribute to the formation of humus.
- Create a forest microclimate - wet lichens increase their weight, while the water from them evaporates very slowly, thus maintaining a constant humidity. On 1 ha lichens can gather even up to 6200 l of water in their insoles.

Thanks to lichenometry, the science of exploring the speed of growth of lichens' insoles, it is possible to determine the age of e. g. building or a rock. Lichens are considered the slowest growing organisms, despite the fact that in some conditions they grow almost all the year round (even under the freezing point). The slowest growths have the species with cortex insole, e.g. *Rhizocarpon geographicum* grows with the speed of 0,06 to 1 mm per year.

Cladonia grows faster, approx. 2,5 mm a year and some petal and bushy lichens grow 15 mm/year. On the other hand lichens live to a very old age. Epiphytic species (the kind that lives attached to the surface of live plants), live for dozens of years, epilithic kinds (growing on rocks) live for several hundreds of years. The age of *Rhizocarpon geographicum* lichens' insoles is estimated for 200 – 400 years. Some arctic lichens live for about 4000 years.

Lichens are the bio – indicators of the air quality. Simply told, the more lichens, the better air quality. The most pollution can be absorbed by lichens with cortex insole, such as *Rhizocarpon geographicum*. More sensitive for the pollution are lichens with petal insole – such as *Hypogymnia physodes*, with the shape of leaf with lobes and possibility to distinguish top and bottom part. They spread along the whole trunks and fix to the cortex through tiny fibres. The most sensitive for the pollution are bushy lichens – e. g. *Cladonia rangiferina*, creating small „bushes“ on the cortex. They can grow upwards or hang down as a beard.

Lichens might serve as bio – indicators of the pollution, as they accumulate big amounts of different pollutants, including radionuclides. Their morphology doesn't change with the change of season, accumulation process goes on throughout the year; they have significant longevity, what makes them long – term indicators of the air pollution. Lichens have the ability to accumulate the metals in the amounts much higher than are their own estimated physiological needs.

Lichens live, for example, in deserts or freezing arctic, or on the mountain peaks. Their sensitivity towards the pollution and acidification of the environment leads to the necessity of protection of some lichen species. We are unable to grow lichens artificially. In addition to their natural tasks the lichens provide also other benefits due to their possibility of their use in the medicine or cosmetic industry.

Vulnerability factors and their consequences:

- Air pollution: death of insoles – lichens' deserts with high air pollution, characteristic by the absence of epiphytic lichens or eventually with dying or dead cortex lichens
- Erosion of high mountain areas: destruction of the areas where lichens occur
- Emissions from the local and moderately distant sources, and distant sources: increase of SO_x, NO_x concentrations in the atmosphere
- Agriculture: eutrophication and hyper- eutrophication of the substrates by nitrogen and phosphate fertilizers, animal faeces from large – scale livestock
- Forestry: destruction of substrates (clearcuts, solitaires and alleys destruction, disposal of tufts)

The reasons of lichens' endangerment:

- Lichens are not protected by impermeable protective layer, unfiltered water and gases from the air are absorbed by their entire body surface.
- Insoles accumulate big amounts of pollutants that the lichens are unable to get rid of.
- Lichens have little regenerative capacity because they grow very slowly.
- Assimilation is the most active during the period from autumn to spring, when there is the highest humidity, but also the highest concentration of sulphur dioxide in the air.
- Epiphytes growing on the tree trunks are threatened by air pollutants from giant leaf areas of the tree.
- Most serious is the imbalance between algal and fungal component of the lichens, caused by pollution. It prevents mutual exchange of substances between these components and in the end leads to death of the algae and the destruction of the whole organism.

Sources:

gis.tpn.pl/uczniowie/SK/html/prezentacje/10.pps

<https://sk.wikipedia.org/wiki/Li%C5%A1aj%C3%ADk>