

# Mosses and Lichens



Learning about mosses and lichens  
using outdoor learning and  
interdisciplinary teaching methods



Project part-financed by the European Union

## Preface

The aim of this chapter is to introduce the many different species of mosses and lichens, and the biological diversity of these organisms. Many people think that a moss is just a moss and a lichen is just a lichen. Without further examination and discovery of the differences between species, it is difficult to understand that in fact there are many types of mosses and lichens.

When arguing for the preservation of species, it is vital to stress the importance of biological diversity. Someone who cannot tell one moss from another might not grasp how a specific moss species can be endangered when moss can be found almost everywhere in the forest.

With insight into how mosses and lichens live, how they contribute to ecosystems, and the great diversity, the importance of preservation is more easily understood. In contrast to vascular plants, mosses and lichen can be studied all year round. Viewed through a loupe, the miniature world of mosses and lichens will impress with its colours, shapes, and tiny inhabitants.

### The national curriculum Lpo 94 on...

#### ...Biology

#### Goals stated for grade five pupils

Pupils are to:

- Recognise and identify several common plants, animals and other organisms in the local environment and know their habitat requirements.
- Be able to give examples of life cycles for some plants and animals and their respective requirements during different life phases.
- Be able to participate in the ongoing discussion on the preservation of nature types and biological diversity.



### Excerpt from the Swedish Environmental Objectives

The 16:th objective: “A Rich Diversity of Plant and Animal Life”

Definition of the generational perspective according to government bill 2004/05:150:

- government and citizens alike are widely knowledgeable about and aware of the importance of biological diversity.
- traditional and local knowledge about biological diversity and its benefits is safeguarded and used appropriately.

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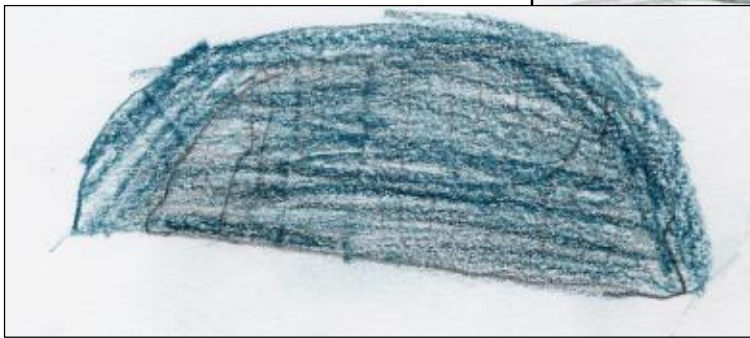
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# Preparations

## Before and after drawings

Let each pupil fold an A4 sheet of paper across the middle (making two A5 surfaces). On the back, let the pupils draw a picture of a moss. After the field trip, the pupils get to make a second drawing of a moss on the front of the folded paper. When both drawings are done, the paper is folded out showing the “before” picture on the left hand side and the “after” picture on the right. Do the same exercise for lichens.

*A moss and a lichen. The “before” pictures are usually not very detailed*



## Searching for mosses and lichens on the school yard

Let the pupils look for mosses and lichens on the school yard. They can search the asphalt, the school building, the trees, the stones, the fence, the lawn, and any other places they suspect might host mosses or lichens. Are there any spots that appear to be particularly well suited for mosses or lichens? Which is the best spot for a moss or lichen on the school yard?



## Assembly and introduction

As soon as the pupils arrive, they are divided into groups and each group is given a loupe. We gather all the pupils round by the camp fire which is lit if the weather and time of year is appropriate. As an introduction to mosses and lichens, each pupil is given a sample of a moss and a lichen. The pupils are given some time to feel the texture, take in the smell, and look at the samples using the loupe.

- Which is the moss and which is the lichen?
- How do they differ?
- What is typical for a moss?
- What is typical for a lichen?
- Where do they grow?

The pupils help each other in answering these questions and we teachers wrap up and add to their statements. After this comes a small test: we bring out an advent candle holder and ask the children what has been stuffed between the candles for decoration. A lot of the pupils answer peat moss. We then explain that it is actually a star-tipped reindeer lichen and show what peat moss really looks like. There are no similarities between peat moss and reindeer lichen except that they both have antibacterial properties. A bog consists of different species of peat moss. Over time, the bottom part containing dead peat moss matter will turn into peat.



*Historically, star-tipped reindeer lichen was put between windows to absorb any moisture and prevent water from soaking into the wood*

## Suggested schedule

08:30	Assembly and introduction
09:00	Walk
09:30	Snack break
10:00	Activities and gathering of mosses and lichens
11:15	Reassembly
11:30	Lunch
12:15	Moss and lichen figurines
13:00	Summary and learning points
13:30	End of day and evaluation



*If one finds a moss with rasta braids, one can be sure it is a peat moss*

## The walk

Many pupils are unaware of the great number of different moss and lichen species. During the walk we show the children a few of the about 1000 species common in Sweden. To discover the differences between mosses and lichens, one must get close to the organisms and use both a loupe and all of one's senses.

We start by showing the step-moss where each annual shoot will emerge from the previous years. The annual shoots can be used to investigate the fallout of heavy metal particles. At the same location we also find hair-cap moss and broom moss, which gives us an opportunity to tell the story of *Aunt Moss*.

After the story, we investigate a mountain wall and a couple of stone blocks upon which both mosses and lichen grows. Using the loupe, the pupils experience a whole new world, and a lot of creative ideas come forward when one asks them what they have seen.

We stop by some oaks where some bitter wart lichen (*Pertusaria amara*) grows. This is a good spot to tell the children the story of *Lenny Lichen*.

Lenny Lichen has apparently been baking a Swedish cream bun (traditionally eaten during lent) and he has clumsily spilled icing sugar all over the place. We let the pupils taste the "icing sugar" to find out what a real lichen cream bun tastes like.

Further along the path we find some moist lichen, grind it, and let the pupils smell the substance and tell us what it reminds them of; a lot of the children say mushrooms. This is a good time to tell the children what lichen is, and its relationship with mushrooms. A *lichen story* can help the younger pupils understand.



- Look at the rock using a loupe. What do you see?
- I see a forest and a cave!



- Smell the lichen! What does it smell like?
- It smells like mushrooms.



- Taste the white powder on the tree!
- What does it taste like?
- disgusting yuck!!





## Gathering of mosses and lichens

After the snack break it is time to gather some mosses and lichens. It is important to clarify to the children that they are only allowed to take a small specimen. Since we are trying to teach the children the importance of preservation we are to take only just as much as we need. To emphasize that they do not need to take a large amount, we show them how little is actually needed in order to identify a species. A practical way of limiting the amount gathered is using egg cartons. A twelve pack carton is perfect for gathering six mosses and six lichens.



*Find the moss in the picture! The pupils are given a couple of pictures of typical mosses and lichens*



*To prevent the children from taking too large specimens of mosses and lichens, one can use egg cartons. The amount is then adjusted to the size of the egg carton*



*Sort the mosses and lichens by colour, size, or using your own system*

## The story of Aunt Moss

Once upon a time there was a strange lady who lived in the forest. She was called Aunt Moss because her house and all her belongings were made of moss. The steps leading up to her house were made of *step-moss*. A new step would grow each year which is why Aunt Moss had the tallest house in the forest. Since Aunt Moss was an old lady, she also made some banisters for her stair-case using *red stem moss*.

One day Aunt Moss' children and grandchildren were coming for a visit. "I'll have to clean this place up", she thought, "the floor is practically covered in pine needles". Aunt Moss fixed this problem using her *broom moss* and soon you could see her sweeping away. She also wanted to look nice so she carefully combed her *hair-cap moss* and decorated her hair with some *plume moss*. To warm up the house, Aunt Moss made a fire in the fireplace using old decomposed *peat moss*—peat is a great fuel! However, Aunt Moss knew many other uses for peat moss, e.g. in diapers for her grand children.

## The story of Lenny Lichen

Once upon a time there was a strange old man called Lenny Lichen. He lived in a little hole which a wood pecker had pecked for him in the oldest tree in the forest. The floor of his house was coated with *horsehair lichen*. It is similar to a horse's mane, and it is nice and warm for your feet. The walls were covered with *common orange lichen*, which Lenny thought brought a nice, cosy, warm colour to the place. In his windows, Lenny had placed some *reindeer lichen* to keep the wood in the window frames dry.

One day Lenny Lichen wanted to go and visit Aunt Moss. First he freshened up by shaving using some shaving cream he had made from *tree moss*. The shaving cream had a faint smell of pike which Lenny thought was a good thing because he liked fish and pike in particular. After this, Lenny went out to find some *map lichen* so that he would not get lost on his way to Aunt Moss. While walking through the forest, Lenny had the idea that maybe he should play a joke on Aunt Moss by disguising himself with some *beard lichen*. But then he remembered that pollution from all the cars had made beard lichen extinct and he felt a little sad.

As a gift for Aunt Moss, Lenny had baked some cream buns with icing sugar on top. As usual when Lenny Lichen was baking, there was a terrible mess and he managed to get icing not only on the cream buns but everywhere else as well. To this day, you can still find Lenny Lichen's icing sugar on a lot of deciduous trees.

### **Bitter wart lichen** (*Pertusaria amara*)

Bitter wart lichen is one of the most common lichens of the *Pertusariaceae* family found on deciduous trees in southern and middle Sweden. It is easily recognized by its white powder and bitter taste.

## Making Aunt Moss and Lenny Lichen figurines

After gathering mosses and lichens, we bring the class indoors; it is time to make moss and lichen figurines. This is yet another exercise where the pupils practice distinguishing mosses from lichens, and discovering the differences between species in terms of colours and shapes.

For this exercise, we provide the pupils with pieces of hazel wood: 10 cm long and with diameter of about 3–4 cm. The wood chips must be cut beforehand and left to dry for a few weeks in order for glue to stick. Using mosses, lichens, plastic eyes, and their own creativity, the pupils can make very artistic figurines



*While making the figurines, the pupils must distinguish between mosses and lichens, and different species, by carefully studying colours and shapes*

## Summary and learning points

At the end of the day, we evaluate the field trip and let the children discuss what they have learned. We also talk about how mosses and lichen reproduce. The pupils have already come in touch with one reproductive system, the bitter wart lichen's white powder. The powder is actually small mushroom threads filled with spores called soredia.

A good way to introduce the concept of spores to the pupils is doing some tricks with club-moss (lycopodium) spores. Place a pinch of these spores in your palm and hold a lit match between your index and middle finger. With a swift hand movement, throw the spores across the burning match to create a magnificent flame. Club-moss spores are rich in oil and have been used in theatres and magic shows. Chemists also used to roll tablets in club-moss to make them easier to swallow.



# Follow-up activities

## Before and after drawings continued

Take the folded A4 papers from the preparations work. On the unused side of the papers, draw a moss and a lichen respectively. Unfold the papers and compare the before and after drawings. How do they differ?



*The "after" drawings are typically much more detailed than the "before" drawings*

## Finding five mosses

Let the pupils search for mosses on the school yard. Can they find five different types of mosses and lichens?

## Visit a moss

A nearby moss is always worth a short outing. Find a peat moss specimen and let your hand follow it as far down as possible in the moss before pulling it up for observation. Study the peat moss and test the pH level on the spot where you found it. Observe which plants (trees, bushes, herbs) grow on the moss. Are there any animals or traces of animals?

# Additional activities

## Outdoor activities and games

### Little trolls go looking for a lantern

If one studies mosses very thoroughly one can find what looks like small lanterns on tall stems. These are the mosses' spore capsules.

Let the pupils make their own small trolls and then let the trolls search for the magic lanterns which are to be found somewhere outdoors. The pupils can use a digital camera to take pictures of the trolls' adventures. How many different kinds of mosses and lichens do they encounter on their way? How many different "lanterns" do they find?



*The little trolls, made of thimbles, are searching for the magic lanterns. Here they can be seen travelling through the grey and yellow-white reindeer moss. Spore capsules (lanterns) can be found on different types of moss. Below we can see hair moss.*



### Moss memory

This variety of the memory game is a good way of learning to identify different moss species. Use two pieces each of 5 different mosses (total of 10 pieces). Hide each piece of moss under a mug or a white paper plate. Now let the pupils take turns turning over two mugs/paper plates. If the pupil on turn uncovers two pieces of moss from the same species, he/she may continue. Otherwise, it is the next pupil's turn. Add more moss species to increase the level of difficulty. Naturally, this game can also be played with lichens.

### Moss and lichen trail

Make name tags for different moss and lichen species. Place the tags along a nature trail where the pupils can walk and practice the names of different species.

### Plant your own moss garden

Try growing mosses. Plant some moss in a flower bed or pot. Can you get the mosses to grow? Under which conditions do mosses thrive?

## Experiment – erosion 1

For this experiment you will need a two metre drain pipe. Take an old gutter, build one from three pieces of wood, or cut a pipe in half. Place the drain on the ground with an angle of elevation of 20°. Put sand in the lowest half meter of the drain. Carefully pour water in the drain and watch what happens with the sand. Now fill the upper part of the drain with moss and pour the water again. How does the moss affect what happens with the sand?

## Experiment – erosion 2

Make two mounds of sand. Using a watering can, pour water on one of the mounds. Observe how the water moves and forms textures in the sand. Place a towel, or any other thick fabric, on the other mound and pour water on it. What happened to the sand in this mound? Compare the two mounds and discuss which role mosses have in protecting the underlying soil.

## Experiment – water absorption

Place a piece of moss in a glass of water and place another piece of moss in a dry glass. Place the glass without water in a plastic bag together with another glass that is filled with water and close the bag tightly. Compare the two mosses over the next couple of days. Which one of the mosses dries out?

## Handicraft

### Braiding a mat or a hat

Pick some hair moss with a length of about 20-30 cm. Only pick a small amount of moss from any one place so that the moss can recover and cover the hole quickly. Start braiding using three pieces of moss. Tie a string around the green part of the moss and continue braiding in new pieces. The green living part of the moss should be facing upwards and the brown dead part downwards. Make the braid as long as is needed for a small mat, and tie a string at the end. Turn the braid so that the brown part is facing upwards and roll it into a spiral shape. Fix the moss in the spiral shape using a string or by pushing sticks in from the sides. Making a hat is very similar but the spiral must be made somewhat cupped.



### Making a broom

Tie a handful of hair moss tightly together with a piece of string. Make three handfuls in the same way and then tie all of these together with a piece of string or a ribbon



*The moss hat and mat are both made in the same way*



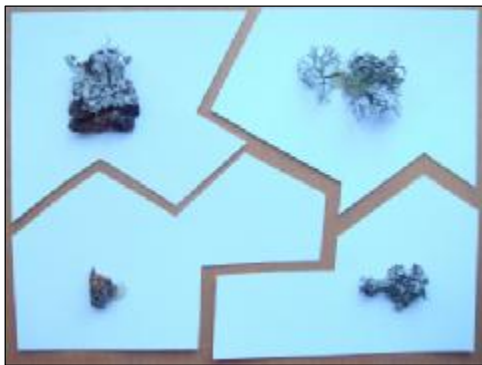


## Purifying water

Cut off the bottom of a plastic bottle and fill it with bog moss. Hold the bottle upside down and over a bucket and pour dirty water onto the moss. See how the moss filters and cleans the water that passes through. Using a white bucket makes it easier to determine the purity of the filtered water.

## Moss and lichen puzzles

Make two puzzles of the same size from pieces of wood or sheets of paper. Glue or laminate mosses onto the pieces of one of the puzzles (one species per piece). Attach lichens to the pieces of the other puzzle. Mix the pieces of both puzzles and let the pupils try to lay them. This exercise helps the children to see the difference between mosses and lichens. Knowing which pieces are mosses and which are lichens makes laying the puzzles much easier.



*Lichen puzzle with four pieces. The lichen species have been glued onto regular cardboard paper*



*A moss puzzle with four pieces. Made the same way as the lichen puzzle*



*The lichen puzzle and the moss puzzle pieces are mixed and the task is to lay the two puzzles. It will be easier if one stacks the pieces in two heaps, one for each puzzle*

## Species switchboard

Choose five to ten species of mosses or lichens which you wish to learn the names of. Glue a sample of each species on a piece of paper. To avoid mixing up the samples, write the names of the species on the back of the papers.

For the actual switchboard, use a piece of cardboard with folded sides. Place tags with the names of the different species on the left side of the board. Put a metal terminal next to each name tag. Now attach the sheets of paper with the mosses and lichens to the board. Add a metal terminal for each species.

On the back of the board, attach sockets for two 1.5 volt batteries, and a socket for a small lamp. Now connect the battery and the lamp but let two wires hang out on the front of the switchboard so that the circuit isn't closed. Also connect the terminal of each moss and the corresponding name tag terminal on the back of the switchboard.

Now the switchboard is complete. When you connect one of the wires to the name tag terminal and the other to the correct species terminal, the circuit will be closed and the light will shine.



*The species switchboard is a good way of practising the names of mosses and lichens. Building the switchboard is also an instructive and fun technical exercise*



## Visual Art

### Projecting mosses

Place different species of moss on a projector. Project onto a sheet of paper on a wall and draw the silhouette.

### Copy and scan mosses

Place mosses, thoroughly cleaned from dirt, in the copier machine. Copy and use the pictures in art projects or to learn the names of different species.

Scanning mosses and lichen gives you very high quality pictures. Use a flatbed scanner and place a couple of erasers on the glass so that the mosses and lichens are not crushed by the lid.



### Moss and lichen collage

Create paintings by gluing mosses and lichens—of different species, colours, and shapes—on a piece of wood or cardboard.

### Colour schemes on a white canvas

Collect different kinds of mosses and lichens. Put them in a colour scheme on a white canvas. Do this with both wet and dry samples.

### An ant's perspective

Let the pupils use a camera to take nature photographs as seen from an ant's perspective (or the little trolls'). They should try to take photos that give the observer a sense of what it would be like to be an ant. In an ant's world mosses are as big as trees.



*Spore capsules on moss. The moss has been growing on bare earth in a flower pot*



## ***Moss and lichen Swedish***

### **The little troll estate agent**

This is a role play done in pairs. One person takes on the role as a little troll estate agent and the other the role of a bug of some sort, e.g. a sloe bug. The estate agent's task is to sell a plot to the sloe bug who wants to build a house for himself and his family.

First, the estate agent searches for the best plot of land and erects a fence around it. He then invites the bug for a showing of the plot and tries to sell it using persuasive argumentation. Once the transaction is completed, the roles change. Enhance the characters by using figurines.

In this game, the estate agent exercises phrasing his own ideas, putting himself in someone else's shoes, and adapting to the needs of others. The bug will also need to be able to define his needs from a bug's perspective and be critical towards the estate agent's sales pitch.

### **The algae and the mushroom—a lichen story**

Write the story of how the algae and the mushroom met, how the algae moved in with the mushroom, and how they became a lichen together.

## ***Moss and lichen mathematics***

### **Cotton and bog moss' ability to absorb moisture**

Pick bog moss and let it dry. Weigh the bog moss and put it in a can. Place cotton of the same weight in another can. Pour water over the bog moss and the cotton until they are saturated. Weigh the two substances again and compare their weights. How much water could the bog moss hold and how much could the cotton hold?

### **The age of crustose lichens**

Lichens grow slowly; crustose lichens grow on stones and mountains and grow about 1 mm a year. Since lichens grow from a single point outwards, you can calculate the age of a crustose lichen by measuring its radius.

### **Sorting lichens**

Let the pupils work in groups or pairs. Collect different species of mosses and lichens (a small amount will suffice). Sort the species on a white table cloth using your own criteria. For example you could sort them according to colour or shape. Let the pupils showcase their sorting methods and defend their ideas. How many sorting methods can they come up with?



*This crustose lichen, has a radius of 35 mm. How old is it if it grows 1 mm per year?*

## Using a tree as a compass

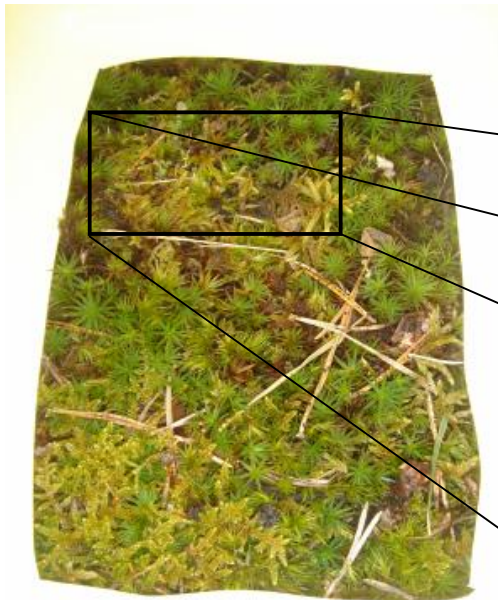
Lichens growing on trees can be used instead of a compass. Lichens need a lot of water, even though they can survive long periods without it. The north side of a tree is often more protected from sunshine and therefore more moist. Therefore, the north side of the tree will typically have a larger population of lichens than the south side. Of course, this is mainly applicable to trees where the sun shines directly on the trunk. Trees in shadowy places can have as many lichens on the south side as on the north. Let the pupils figure out which trees are the best for deciding directions.

## Inventory 1 – the ice-cream carton

Let the pupils work individually or in groups. Each person or group has an ice-cream carton with the bottom cut out. Place the carton somewhere in the surroundings and take the lid of. What can be found in the carton? How many different lichens and mosses are there? Where should one put the carton to find the highest number of different species?



*Look closely in the ice-cream carton using a loupe. There are at least three different kinds of mosses and lichens*



## Inventory 2 – the rope

Use colourful ropes of about 1-2 meters in length. Let the pupils work in groups placing a rope in the shape of a circle at any nearby place. Try to find the place which has the most species of mosses or lichens. How many species are found? Was there any difference between the place with the biggest moss population and the one with the biggest lichen population? Find out the names of some of the species.

## Inventory 3 – the circle

Push a stick into the ground. Attach a 1 metre long piece of string to the stick. The string will become the circle's radii. Use the string to mark the circle's radii with sticks or other objects. Let the pupils guess how many different mosses and lichen there are in the circle. Make an inventory of how many different species there are. Calculate how many species there are per square meter.

## Literature<sup>1</sup>

- Hallingbäck & Holmåsen (1985): *Mosses, a field guide*, Interpublishing  
Moberg & Holmåsen (1986): *Lichens, a field guide*, Interpublishing  
Holmåsen (1984): *Lichens and mosses, 52 common species*, Interpublishing  
Svensson, Rune (1998): *First book of mosses and lichens*, Almqvist & Wiksell

## Links

- [www.sbf.c.se/MV/](http://www.sbf.c.se/MV/) — The non-profit organisation *Friends of all Mosses*  
[www.sbf.c.se/slf/](http://www.sbf.c.se/slf/) — The homepage of The Swedish Lichenological Association

### Lichens' ability to reproduce

Lichens reproduce in many different ways. The most foolproof way is for the mushroom and the algae to stay together during reproduction. The lichen can either break and the pieces which have broken off can spread to other areas, or the lichen can spread using organs created specifically for reproduction.

Sureties are small lichen balls that are spread by the wind, water, or bugs (e.g bitter lichen). Isida are small out-growths from the main lichens, which easily break off and can be dispersed by wind, water, or bugs. Yet another way of reproduction is for the mushroom to release spores. The problem with this is that the spore must come in contact with suitable algae that it can live in symbiosis with.

Spores are spread by the wind and create new mosses if they land on a suitable surface. Airborne, the spores can act as condensation cores (a particle on which steam can condense and become a water drop) and thus can contribute to making rain.

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<sup>1</sup> Translated for illustrative purposes only. May not be available in English.