

Lichens and pollution

A fieldwork activity using lichens as bio-indicators to assess air quality in the local area

Background

Lichens are a common, natural indicator of the health of the air quality in our environment. They are highly sensitive to subtle changes in environmental conditions, especially air pollution from sulphur dioxide and nitrous compounds.

In this module, students will compare at least two contrasting sites in their local area, identifying lichen species and using them as bio-indicators of air quality.

The study is aimed at year 9 students, although it could be adapted to suit GCSE students. There are strong cross-curricular links with science, and this could be emphasised / presented as a cross-curricular project.

The module and resources are very flexible, to allow individual schools to adapt it to suit the needs of their students and their local environment / available study sites. The resources here are based on a comparison of two contrasting sites, and lichens on the trunks and twigs of trees are studied. However more sites could be compared, and lichens on rocks / walls / gravestones could be used if this is more suited to the available study sites. A list of links and resources has been provided to allow individual schools to modify the study to suit their own individual requirements.

Aims

1. Use identification charts to identify species in the field
2. Identify lichens in at least two contrasting sites
3. Use lichen species found to make judgements and draw conclusions about the environmental conditions in each area studied

Objective

Students work in small groups to locate, identify and record lichen species found on the trunk and twigs of trees in two contrasting locations in their local area

Format

Starter

Show students the PowerPoint presentation and ask them what they think the picture on the first slide is. Introduce lichens by going through and discussing the following slides with the class. If desired, the students could complete the 'starter activity resource'.

Main

Students should be provided with a map showing the study sites. Sites should be chosen which provide good contrast, e.g.

1. An area close to heavy traffic or intensively fertilised farmland / close to slurry / silage / poultry or pig farms, or cattle sheds.
2. Areas with little disturbance e.g. the edge of woodland, parkland, churchyards

The fieldwork aims and instructions should be gone through prior to leaving - on the PowerPoint, and in the fieldwork booklet. Students should work in small groups of 4-5, and they must use the 'which tree?' resource to identify trees to survey. They must then...

1. Survey three tree trunks of the same species at each site.

2. Survey 10 twigs (3-4 cm diameter at the base) from the edge of the canopy (non-shaded). These can be from the same tree or from more than one of the same species. All data should be clearly and accurately recorded in the fieldwork booklet. Guidance has been provided in the booklet on how to fill the information into the data collection tables.

Follow-up

Students should use the information on the different tolerance levels of the lichens found in each site to complete the 'follow-up resource' sheet. There are instructions on the sheet which guide students through a set of tasks to analyse the tolerance levels of the lichens found and use the data to compare the sites and draw conclusions about environmental conditions at each site.

Differentiation / Extension

During the fieldwork - the number of sites surveyed can be adapted to suit the ability of the pupils. Low ability groups could survey one site, and then share data for other sites with other groups, or even just look at one site and assess the environmental conditions in one area only. Lower ability pupils may also survey only the trunks, whereas more able pupils could examine any difference in the lichen species found on the trunk and twigs of the trees surveyed, which may indicate recent changes in the environmental conditions.

More able pupils could be asked to take pictures / make field sketches of the land-use / activities they can identify at each site which may affect the environmental conditions.

During the follow-up, the 'follow-up resource' is simpler for less able students, although there are extension tasks to stretch the more able. More able students could write the study up as a formal scientific / geographical investigation (an 'investigation write-up' resource has been provided to give guidance). They could also use maps and their photos/ field sketches to make links between land-use / human activities and the environmental conditions. They can then explain the reasons for differences in the lichens found at different sites.

Embedding this fieldwork activity

This fieldwork activity has strong links to both geography and science, and could be presented as a cross-curricular project. Prior knowledge of pollution from different sources and how human activities can affect environmental conditions would be advantageous. Students will learn and practice important scientific and geographical skills; identifying different species using keys, recording data, and drawing comparisons and conclusions between different sets of data.

Adapting this activity for alternative sites

Due to the nature of the activity, suitable sites should be available close to most schools, without the need for complicated transport implications. Any realistic number of sites can be used, depending on the time available, the ability of the students and availability of staff. A transect from a town centre or other pollutions source, taking in several study sites could be conducted to study changes in pollution levels with distance from the source. It can also be modified to examine lichens on walls, rock or gravestones if this is more appropriate, e.g. the lichens on gravestones in different graveyards in contrasting locations could be compared. The list below gives links to identification resources.

Resources

- PowerPoint presentation
- OS map extracts of the local area, showing study sites
- Other resource sheets for starter and follow-up activities
- Field work activity booklets

- Clip boards
- Cameras / plain paper for field sketches
- Identification leaflets / cards. The following fold-out charts are available for £2.50 (£3.50 with postage!) each from the Field Studies Council...
 - Lichens and pollution (*Used to prepare this study - recommended) Has a written key and also 4 colour plates; lichens of polluted areas, lichens of moderate pollution, lichens of slight pollution, and lichens of clean air. It also gives approximate maximum levels of SO₂ tolerated by species on each plate, and indicates which species may be subject to nutrient enrichment, e.g. by fertilisers.
 - Urban lichens 1 (on trees and wood)
 - Urban lichens 2 (on stone and soil)
 - Churchyard lichens
 - Lichens on twigs

The British lichen society (<http://www.thebls.org.uk>) also produce...

- Key to lichens and air pollution
- A key to churchyard lichens

An on-line interactive guide is also available at <http://www.nhm.ac.uk/jdsml/nature-online/lichen-id-guide/index.dsml>

Links and further information

- http://www.ace.mmu.ac.uk/Resources/Fact_Sheets/Key_Stage_4/Air_Pollution/pdf/19.pdf
- http://www.ace.mmu.ac.uk/eae/Air_Quality/Older/Lichens.html
- <http://www.nhm.ac.uk/nature-online/environmental-change/lichens/lichens-env.html>
- <http://www.earthlife.net/lichens/pollution.html>
- <http://homepage.ntlworld.com/brynllloyd/EnvSci/Using%20lichens%20as%20indicators%20of%20air%20pollution.htm>