SCIENCE learning springboards

Pappus

Pollution investigations – SO$_2$ and particulates

Using lichen to investigate SO$_2$ and looking at the effect of plants on particulate pollution in school grounds

Aim: Use specific species of nitrogen tolerant and intolerant Lichens as indicators of air pollution, identify places in your locality which have higher levels of air pollution compared to others.
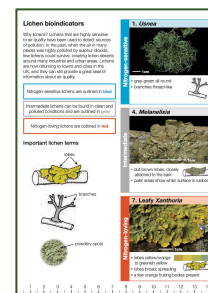
Lichens do not have any roots and so only receive nutrients from the atmosphere, making them the perfect bio-indicator of air pollution. They grow on a variety of surfaces such as walls, trees, rocks, churchyard gravestones etc. They are extremely sensitive to atmospheric pollutants such as sulphur dioxide (SO$_2$) and nitrogen (N) from traffic exhaust fumes, factories, power stations and pesticide spraying. Air pollution contains N which harms the ability of some lichens to produce sugars that enable it to feed so it will not grow in that locality. Other species can cope and are thus more tolerant of SO$_2$ and N than others and will therefore tend to exist at increased frequencies in these higher polluting environments.

Activity 1: Lichen survey

Look for increased numbers of pollution tolerant lichens the further you travel into built-up areas or toward locations where there is more pollution activity, for example areas of the school grounds such as carpark and drop off zones, or along a transect from school to city centre or countryside. Use the British Lichen Society OPAL project lichen ID resource – download it from the Pappus resource library or from the OPAL citizen science website.

- Map your survey area and the planned route you will take to find, identify and measure lichen growth on a variety of surfaces - trees, large rocks and walls etc.
- As you walk, annotate the map with the sampling points you use and the features you find the lichens growing upon.
- Gather 'presence and absence' data of pollution tolerant and non-tolerant lichens shown on the ID sheets.
- Measure the abundance of each species at each sampling point by using the 10cm plastic sheet quadrat and assess their coverage within the grid: each square represents 4% amounting to 100% in total.
- Enter the data into a table that has two properties that you have chosen to compare, for example where the *y* axis = abundance/coverage and the *x* axis = distance along the transect followed.

Discuss the environmental factors that might affect the types and distribution of the lichens you found.

Activity 2: Particulate pollution survey

Very small airborne particles known as PM10 and PM2.5 are produced by diesel vehicles, tyre and brake dust and other sources; they can be measured indoors and outdoors. They can be tested for with a simple sticky tape activity.

- Map a survey area and decide where to place the double-sided sticky test strips. Find locations that are exposed to traffic and some that are protected from traffic.
- Annotate the map to mark where the test strips are placed and be sure to mark each strip with a code that relates to its location on the map.
- Attach the test strips to structures such as fences and trees, avoiding places where they will be easily seen and tampered with.
- Leave for two weeks then return to collect the strips.
- Look at the density of particulates in each location and discuss the results.

Think about how hedges and shrubs can 'collect or trap' particulates thus removing them from adjacent areas – such as playgrounds!

Resources:

- British Lichen Society OPAL citizen science ID sheet
- FSC Lichen Id. Sheet
- Graph Paper to plot frequencies
- 10cm^2 clear plastic quadrat divided into 1cm squares
- Clear plastic freezer bags to place lichen samples into
- Double sided sticky tape strips on pieces of recycled plastic, with string loop attached.

More springboards:

- History Learning Springboard: Lichenography

Key vocabulary:

Bio-indicator - bio-indicator species is a biological species that indicates a trait or characteristic of the environment that it is associated with.

Particulates (fine dust)

Success criteria:

- ✓ I can plan and conduct a fair test
- ✓ I can interpret information and data gathered from my test
- ✓ I can use scientific language and my analysed data set to explain my findings
- ✓ I understand and can explain how lichens react to air pollution