

What Planet is This?

Created by Susan B. Palmer
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Lichen and Air Quality

In 1866 the leading Finnish lichenologist William Nylander noticed that some lichens growing in the Jardin du Luxembourg in Paris didn't occur in any other part of the city. He realised that the lack of air pollution in the gardens was enabling the lichens to grow there, and that lichens are therefore an indicator of air quality.

Lichens had already been in use for years to test acidity. Litmus paper is made from the *Ochrolechia tartarea* and *Rocella tinctoria* varieties. Though Rocella is described as early as 1599, it was Ochrolechia that was first used to make the paper, in the 16th century in Holland, where manufacture continues to this day. The exact process is still kept secret, but involves ammonia, sodium carbonate, lime, and potash in a fermentation and extraction procedure.

There are four kinds of lichen. Foliose lichens are leaf-like; Fruticose lichens are bushy or shrubby;

Squamulose lichens are scaly and may have stalks called podetia, and Crustose lichens are crusty. In general, the following table is a yardstick for measuring the local amount of sulphur dioxide (SO₂), and hence the local air quality:

- Heavily polluted air – No lichen, only green algae
- Polluted air – Crustose lichen, e.g. Lecanora
- Moderate air – Squamulose and Podetial lichen
- Clean air – Foliose and Fruticose lichen
- Very clean air – Sensitive species such as Ramalina, Usnea, and Lobaria

But to get an accurate indication of pollution you'll need to identify specific species. Doing so can even identify the kind of pollution since, for example, *Hypogymnia physodes* is tolerant of SO₂ and ozone but not fluoride, *Lobaria pulmonaria* is sensitive to SO₂ but mildly tolerant of ozone, and *Lecanora conizaeoides* is a very toxictolerant bioindicator in general. The constant ebbing and flowing of pollution levels can provide some interesting situations:

The levels of air-borne sulphurous pollution have been dropping and this has enabled many species to return to areas where they have been absent for over 100 years. Indeed the appearance on concrete paving stone in Middlesex of the grey-green lichen *Lecanora muralis* caused some consternation. It was not recognised as a lichen by many people and correspondence to the press suggested that it had come from outer space!

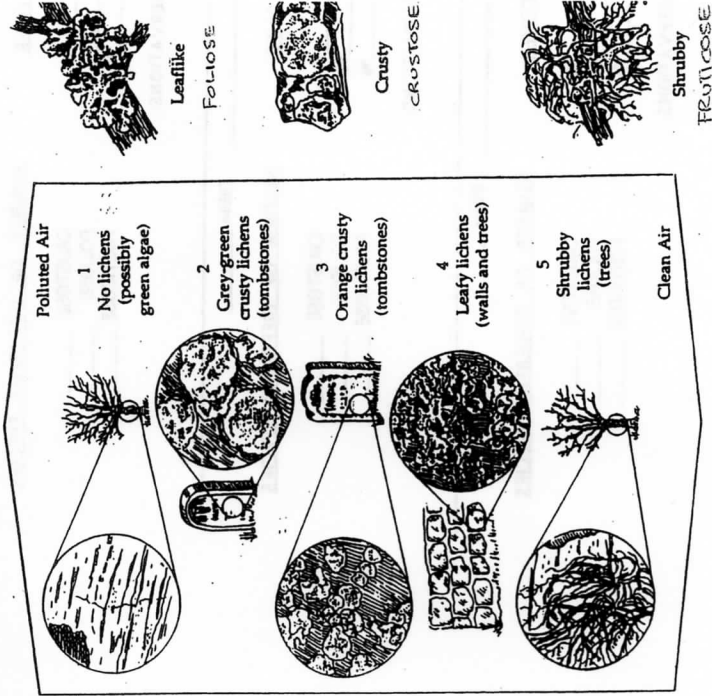
Whilst *Lecanora muralis* is said to look like mutated chewing-gum, some species of lichen are in fact edible. The tree-hair lichen, *Bryoria fremontii*, was considered by some societies to be a food for times of famine, and by others a delicacy. In Japan, *Umbilicaria esculenta* is the most famous edible lichen. And Reindeer lichen, *Cladonia rangiferina*, gets its name from being edible to reindeer, but is in fact edible to humans too when properly cooked.

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SIZE (Square Centimeters)	AIR QUALITY
10-12	Excellent
7-9	Good
4-6	Fair
0-3	Poor

LICHENS AS POLLUTION INDICATORS

Plants called lichens are sensitive to air pollution, especially the air's acidity. So, you can use their presence or absence to see how clean the air is. Shrubby and leafy lichens only survive in clean air. In the most polluted areas there are none at all. Look for lichens on walls, stones, and trees, and use this scale to rate the air quality. NOTE: Different lichen types can be found in the same area. To use this scale, decide which lichen type is most common in the study area.



LICHEN DATA SHEET



SITE _____ DATE _____
 LOCATION _____
 OBSERVERS NAME(S) _____
 COMMENTS _____

TREE 1 SPECIES= _____ DBH= _____
 PERCENT COVER NUMBER OF DIFFERENT SPECIES
 CRUSTOSE _____% CRUSTOSE _____
 FOLIOSE _____% FOLIOSE _____
 FRUTICOSE _____% FRUTICOSE _____

OTHER OBSERVATIONS:

TREE 2 SPECIES= _____ DBH= _____
 PERCENT COVER NUMBER OF DIFFERENT SPECIES
 CRUSTOSE _____% CRUSTOSE _____
 FOLIOSE _____% FOLIOSE _____
 FRUTICOSE _____% FRUTICOSE _____

OTHER OBSERVATIONS:

TREE 3 SPECIES= _____ DBH= _____
 PERCENT COVER NUMBER OF DIFFERENT SPECIES
 CRUSTOSE _____% CRUSTOSE _____
 FOLIOSE _____% FOLIOSE _____
 FRUTICOSE _____% FRUTICOSE _____

OTHER OBSERVATIONS:

TREE 4 SPECIES= _____ DBH= _____
 PERCENT COVER NUMBER OF DIFFERENT SPECIES
 CRUSTOSE _____% CRUSTOSE _____
 FOLIOSE _____% FOLIOSE _____
 FRUTICOSE _____% FRUTICOSE _____

OTHER OBSERVATIONS:

LAB QUESTIONS:

1. How long have lichens been used as indicators of air pollution?
 2. What are some other uses for lichens? Give the history and location.
 3. Name the four main types of lichens and give a description of each.
 4. Which type would we most like to find in our wetland? WHY?
- ANSWER THE FOLLOWING QUESTIONS BASED ON YOUR FIELDWORK ON LICHENS:
5. Calculate the average percent coverage of each lichen type on the trees that you observed.

6. Based on your data, how would you assess the air quality at the GHHS wetlands?