An Investigation into the Effect of Air Pollution on Lichen

Aim

This investigation aims to find out the pollution levels using lichens as indicator species.

Underlying Environmental Science

Air pollution describes the presence or release of harmful gases, mainly carbon dioxide and methane, into the atmosphere, which can have a negative effect on the affected environment, often leading to environmental problems such as acid rain. The main source of air pollution appears to be caused in energy production, specifically carbon emissions derived from coal-burning power stations. Pollution levels tend to vary depending on area, with the highest levels being found in large cities and near major roads due to the pollution released by the vast amounts of vehicles.
Air pollution therefore is shown to have a negative impact on society. For example nitrogen dioxide, a major pollutant, has been proven to have a negative impact on human health as it causes lung irritation and lowers the body's ability to provide resistance against respiratory infections.

Lichens are a combination of two plant species, fungi and algae, living together as an example of a mutualistic symbiotic relationship. Indicator species are characterised by their ability to indicate the health of a particular habitat or ecosystem which they inhabit. Birds of prey tend to be excellent examples of indicator species as they are highly sensitive to environmental changes and pollution. Lichens are natural indicators of air pollution because when they absorb rainwater containing traces of dissolved gases their growth is prevented. Other uses of lichens include monitoring the effects of pollution within towns and industrial sites as well as serving as indicators of airborne fertilisers high in ammonia.
There are three types of lichen – crusty which can tolerate high levels of pollution, shrubby which cannot tolerate very much pollution and leafy which can tolerate a bit of pollution.

Field Work

Field work locations – Dalmellington Road, Castlehill Woods and Auchencruive Country Estate.

For each location lichen samples were gathered from 3 trees and the total amount of each indicator lichen cover was determined with the following key.
0 – none
1 – small overall amount
2 – medium overall amount
3 – large overall amount

Fieldwork Data

Dalmellington Road

Type of Lichen	Lichen Cover per Tree(according to key)			
	Tree 1	Tree 2	Tree 3	Average
Shrubby	0	0	0	0
Leafy	2	1	2	1.66 = 2
Crusty	3	3	3	3

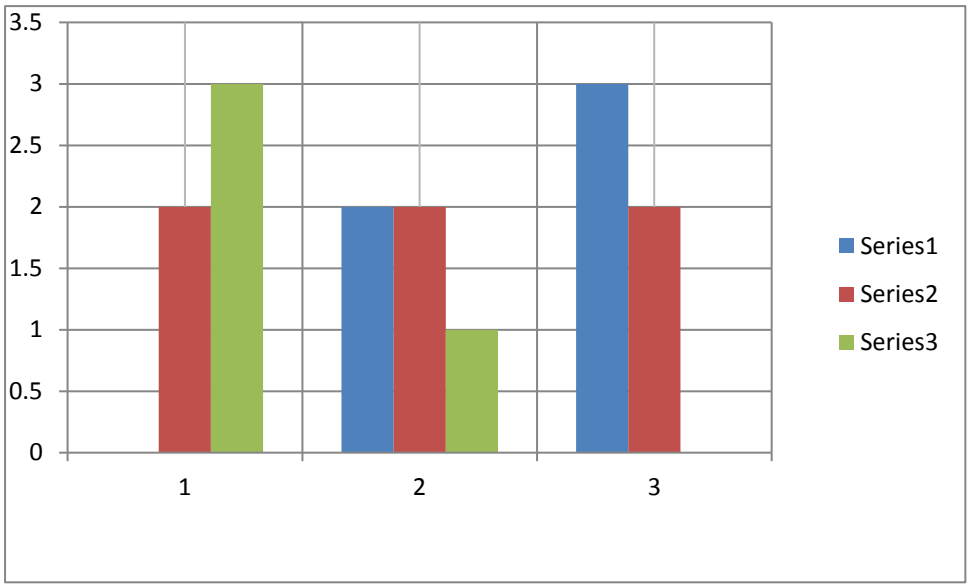
Castlehill Woods

Type of Lichen	Lichen Cover per Tree(according to key)			
	Tree 1	Tree 2	Tree 3	Average
Shrubby	1	1	2	1.66 = 2
Leafy	2	2	2	2
Crusty	0	1	1	0.66 = 1

Auchencruive

Type of Lichen	Lichen Cover per Tree(according to key)			
	Tree 1	Tree 2	Tree 3	Average
Shrubby	3	2	2	2.66 = 3
Leafy	1	2	2	1.66 = 2
Crusty	0	0	0	0

Graphical Presentation



Data from Internet

APIS (Air Pollution Information website)

http://www.apis.ac.uk/search-by-location

This site provides detailed results on pollution levels relating directly to the locations we visited.

Dalmellington Road

Air Pollutant Type	Concentration (µg per m^3)
Ammonia	3.15
Nitrogen Oxides	7.87
Sulphur Dioxide	1.00

Castlehill Woods

Air Pollutant Type	Concentration (µg per m^3)
Ammonia	2.36
Nitrogen Oxides	5.07
Sulphur Dioxide	0.84

Auchencruive Estate

Air Pollutant Type	Concentration (µg per m^3)
Ammonia	2.28
Nitrogen Oxides	4.93
Sulphur Dioxide	0.78

Analysis

According to the fieldwork Dalmellington Road shows the highest levels of air pollution, followed by Castlehill and then Auchencruive. Likely this is due to the fact that Dalmellington remains the only sample site located alongside a traffic-prone road with a constant presence of carbon emitting vehicles. This is supported by most of the lichens found here being the crusty types, which can tolerate high levels of pollution. Castlehill and Auchencruive on the other hand are more rural areas, located further away from the constant pollution emitted by vehicles and other sources, which explains their substantially lower pollution levels. This is supported by most of the lichens found here being leafy or shrubby type, which prefer cleaner air. Similarities can be drawn with these results and the results from the internet as both show that Dalmellington Road contains the highest levels of pollution due to the presence of polluting vehicles which are constantly present. Furthermore both sources show slightly lower pollution levels regarding Castlehill Woods and Auchencruive as they are located in more isolated areas with more growth.

Conclusion

In conclusion it has been shown that Dalmellington Road has the highest pollution levels followed by Castlehill Woods then Auchencruive Estate. This is proved by the types of lichen found at each place.

Evaluation

Our method of measuring how much lichen was on the trees was not very accurate. I could improve this by measuring the actual area of the lichen.