

ACTIVITY 2

Does air quality vary within the Squares?

Introduction

Gordon and Woburn Squares are tightly locked between small side streets leading from one of the busiest highways in London - the Euston Road. Lying to the north of the Euston Road are three of the capital's main commuter gateways: Euston, King's Cross and St. Pancras railway stations. The pollution monitoring station located on the Euston Road has recorded some of the highest levels of air pollutants to be found in London. The source of most of these pollutants is from vehicle emissions.



Figure 9. Aerial photograph of Gordon and Woburn Squares.

Learning outcomes

Through this activity pupils will:

- investigate the most suitable site for a café in the Squares by collecting and analysing the deposition of airborne particulates on trees
- evaluate the method used to collect the primary data

Resources

Worksheets

- 1. Collecting evidence of air pollution
- 2. Recording evidence of air pollution
- 3. Analysis of results
- 4. Evaluation

Accompanying CD

- PowerPoint 'Sense of Place'
- PowerPoint 'Argument'
- All photos from this section

Apparatus needed

Clipboard
Sticky tape
Long measuring tapes
Graph paper copied onto acetates
Noise sensor (optional)

Microscopes
Hand lens
Trundle wheel
The Tree Name Trail key
Key to lichens (optional)

Lesson sequence

1. Before fieldwork

Pupils need a basic understanding of the key pollutants prior to the investigation. An introduction to the area and an outline of the history of the squares should precede the visit to the site. This research could be carried out and presented by pupils as a preparatory task or delivered by the teacher using the 'Sense of Place' PowerPoint (see accompanying CD) and site history.

The investigation looks at whether the levels of particulates vary with distance away from the Euston Road into the squares. The issue of where the most suitable place to situate a café in the Squares could be investigated with consideration of air and noise pollution. The 'argument' PowerPoint (see CD) could be used to set up the scenario.

2. Fieldwork

If pupils are provided with knowledge of the basic techniques (choosing their sample sites and sampling using sticky tape) the detailed planning of the investigation could be left to them. This would allow for a variety of methods to be discussed and evaluated later.

Points for discussion during planning

Choosing the transect: what factors are changing along the transect (independent variable), and which factors are being kept the same as far as possible (controlled variables)? What will be measured (dependent variable)?

Sampling: How will you make sure your data is valid? Are the data accurate and reliable? In this case the discussion about validity could start with 'do particles on the sticky tape actually indicate air pollution?' Repetition and standard procedures are important, e.g. taking measurements at the same height from the ground each time, and either always from the same aspect or from all round the circumference of the tree. Using the same type of tape and technique for applying the same pressure each time is important.

Site position

On the west and east sides of the squares rows of trees run the length of the fencing. The trees at the north end of Gordon Square are closest to the Euston Road. A transect which is used to analyse changes along an environmental gradient could start here, the point nearest to the Euston Road, and run to the south of Woburn Square. The distance from the Euston Road to the first tree in Gordon Square can be measured using a trundle wheel. Alternatively, the first tree could be noted as 0m, and the distances to other trees measured from here.

A line transect can be used and the distance measured between each tree (sample site) using a tape measure / trundle wheel. The dominant tree species are London plane (*Platanus x hispanica*) and limes (*Tilia x europaea*). Refer to *The Tree Name Trail* for help with identification.

Collecting data at each site

(a) Air pollution

Take two samples (repetition) of particles at site one at 1m from the base of the tree. Place a 2cm length of sticky tape firmly onto the bark of the tree, leave for 10 seconds, and then remove it. Soot and other particles from the air will have adhered to the tape, along with debris such as loose bark and moss from the tree (Fig. 10).

Stick the samples onto the individual results sheet (Sheet 1) for the correct site. If there is time, a third sample can be taken and placed onto a labelled microscope slide, so that the samples can be studied in much greater detail in the laboratory.



Figure 10. Use of sticky tape for sampling.

(b) Tree girth and species

Taking girth measurements of the trees allows an estimation of tree age. Consideration of this variable alongside the variable 'tree species' during analysis will aid discussion. Measure the diameter of the tree trunk using a tape measure held at shoulder height. Observe and record the presence of lichens in the results table. A data logger / sensor may be used to record noise levels at each site along the transect.

(c) Alternative method using lichens

An alternative method for investigating levels of air pollution by using lichens as indicators has been developed by the Natural History Museum. See

<http://www.nhm.ac.uk/jdsml/nature-online/lichen-id-guide/twig/pollution.html>

3. After fieldwork

Analysing the raw data

The sticky tape on the slides can be examined under the microscope. Make mini-quadrats by photocopying graph paper onto acetates. Lay an acetate grid over the pollution sample (sticky tape). Use random co-ordinates to locate a quadrat. Estimate and record the percentage frequency of black particulates in the chosen quadrat. (Fig. 11). Repeat this estimation of particulates between 15-20 times for different quadrats, and calculate an average percentage cover of particulates for the sample site.

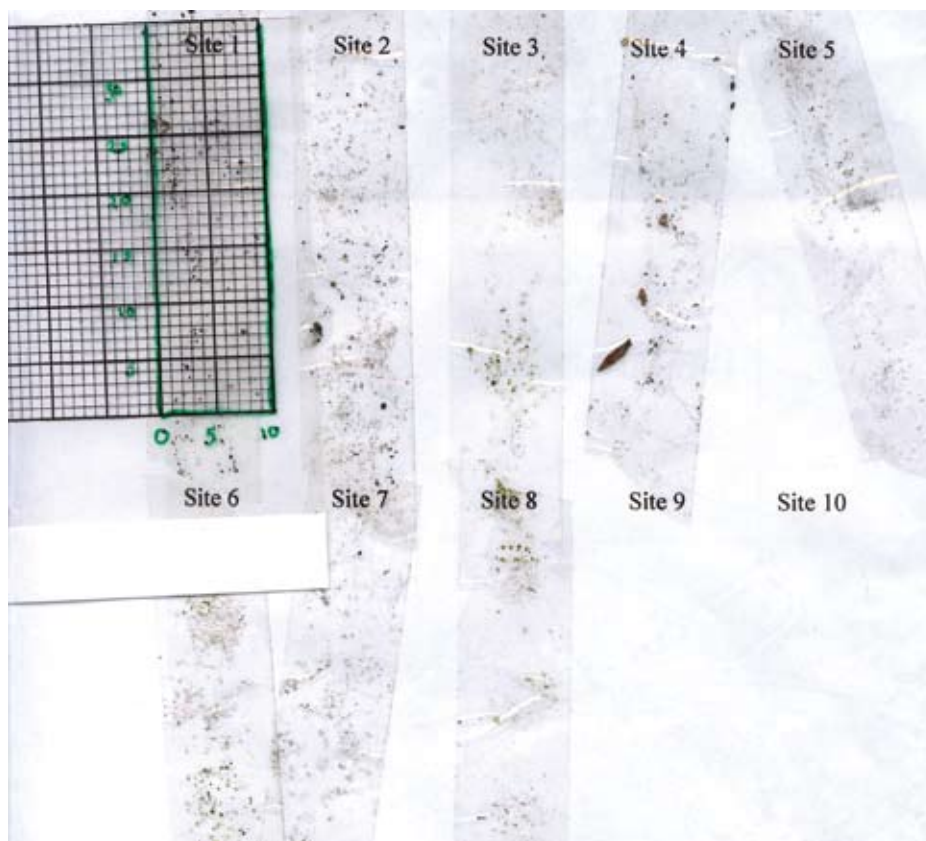


Figure 11. Mini-quadrats for use under a microscope, created by using graph paper copied onto acetates and placed over each strip of sticky tape.

Use the same technique for the second sample at the site and calculate an overall average. Record the overall average for site one on Sheet 2. Repeat this same method for all sample sites. Only soot particles should be recorded; ignore bark and moss. A hand lens may be useful.

Analysing class data

Put the data into a spreadsheet to be analysed, or alternatively plot a graph by hand, with distance from the road (either the Euston Road or from the north side of Gordon Square) along the x-axis and the average percentage cover of particulates along the y-axis. Plot the sound reading on the y-axis. Pupils can use the analysis worksheet (Sheet 3) as a prompt when analysing the data and considering the social / environmental aspects of where the café should be situated.

Evaluation of the method

The investigation has many interesting areas to consider and highlights the way scientists work in the 'real world'. Pupils can use the prompt questions (Sheet 4) to consider how appropriate the methods were and the difficulties of controlling variables out in the field. Pupils can go on to consider primary data collected by the nearby pollution monitoring stations (see www.londonair.org.uk) and observe how these data vary on a daily and seasonal basis.

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SHEET 1 - COLLECTING EVIDENCE OF AIR POLLUTION

<p>Site 1 Distance (m) -</p> <p>Tree girth (cm) -</p> <p>Tree species -</p> <p>Noise level (dB) -</p>	<p>Site 2 Distance (m) -</p> <p>Tree girth (cm) -</p> <p>Tree species -</p> <p>Noise level (dB) -</p>	<p>Site 3 Distance (m) -</p> <p>Tree girth (cm) -</p> <p>Tree species -</p> <p>Noise level (dB) -</p>
<p>Site 4 Distance (m) -</p> <p>Tree girth (cm) -</p> <p>Tree species -</p> <p>Noise level (dB) -</p>	<p>Site 5 Distance (m) -</p> <p>Tree girth (cm) -</p> <p>Tree species -</p> <p>Noise level (dB) -</p>	<p>Site 6 Distance (m) -</p> <p>Tree girth (cm) -</p> <p>Tree species -</p> <p>Noise level (dB) -</p>

<p>Site 7 Distance (m) -</p> <p>Tree girth (cm) -</p> <p>Tree species -</p> <p>Noise level (dB) -</p>	<p>Site 8 Distance (m) -</p> <p>Tree girth (cm) -</p> <p>Tree species -</p> <p>Noise level (dB) -</p>	<p>Site 9 Distance (m) -</p> <p>Tree girth (cm) -</p> <p>Tree species -</p> <p>Noise level (dB) -</p>
<p>Site 10 Distance (m) -</p> <p>Tree girth (cm) -</p> <p>Tree species -</p> <p>Noise level (dB) -</p>	<p>Site 11 Distance (m) -</p> <p>Tree girth (cm) -</p> <p>Tree species -</p> <p>Noise level (dB) -</p>	<p>Site 12 Distance (m) -</p> <p>Tree girth (cm) -</p> <p>Tree species -</p> <p>Noise level (dB) -</p>

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SHEET 2 - RECORDING EVIDENCE OF AIR POLLUTION

Complete the table for each site.

Site	Distance from road along transect (m)	Noise level (dB)	Species of tree	Average % cover of particulates	Tree age = Tree girth ÷ 2.5cm	Extra Information - substrate type / position of moss / lichens present
Site 1						
Site 2						
Site 3						
Site 4						
Site 5						
Site 6						
Site 7						
Site 8						
Site 9						
Site 10						
Site 11						
Site 12						

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SHEET 3 - ANALYSIS OF RESULTS

Make sure that you use data to support your arguments.

1. Describe what the graph shows about air pollution.

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2. Describe what the graph shows about noise levels.

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3. Imagine you are explaining your results to a Year 7 pupil. What reasons can you give for the trends or patterns in the data?
(Think about the sources of pollution).

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4. Based on evidence from your data, suggest where it would be best to situate the refreshment facilities within the Squares.

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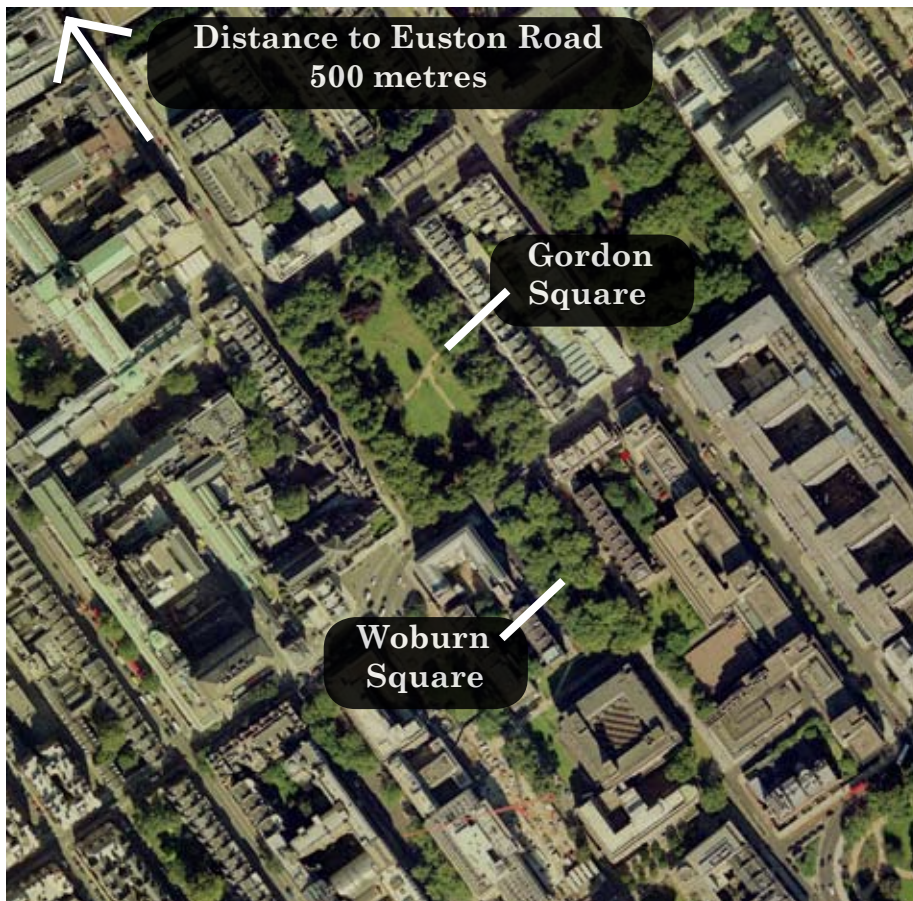
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5. Camden Council have announced that Euston Road is to be closed for 12 months for major roadworks.

Describe and explain how the distribution of particulates would be different if you took the same measurements at the same time next year.



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6. Complete the table to show reasons for and against the road closures.

Reasons for closing the road	Reasons against closing the road

I think the decision should be...

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SHEET 4 - EVALUATION

1. What were the main difficulties you found when collecting the results?

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2. Which variables were difficult to control when you went outside?

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3. Look at each site. 8 samples were taken of the data collected.
Suggest 2 reasons why data from one site may vary so much.

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4. Secondary data is available from differing monitoring stations around London.

See www.londonair.org.uk/london/asp/home.asp
and www.londonnoisemap.com

How might this information be used to assess how reliable your data is? Think about where these different sites are across London; is there a prediction you could make about London as you made about the local site? Use some data from the site to explain your answer.

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