

UHI for KS3 Geography – Teachers' Notes

Teaching sequence

The three lessons and fieldwork session introduce urban heat islands, then move on to planning fieldwork, carrying out fieldwork and then analyzing and presenting the results.

We have provided you with:

- 30 calibrated thermometers.
- PowerPoint presentations for three lessons
- Data entry sheet
- Data display worksheet

You will also need:

An Ordnance Survey Map covering your school catchment area – preferably a class set of photocopies. These can be obtained from <http://www.ordnancesurvey.co.uk/oswebsite/getamap/>

A local weather forecast, for example from http://www.metoffice.gov.uk/weather/uk/nw/nw_forecast_weather.html

You could also use:

- Any data in or near your school catchment area/ town/ city from:
 - the Met Office http://www.metoffice.gov.uk/education/teachers/latest_weather_data_uk.html ,
 - WoW <http://wow.metoffice.gov.uk/home> ,
 - Wunderground <http://www.wunderground.com/global/UK.html> .

For lesson three, class access to computers running Google Earth and possibly <http://www.sgrillo.net/googleearth/gegraph.htm>

- 2 ice cream tubs or similar, one painted black inside
- Thick polystyrene to encase the tubs
- Cling film
- One large lamp or two identical small ones, with low energy lightbulbs

Lesson 1	Activity	Notes
Objectives	Learn about urban heat islands	A key point in this lesson is about showing the link between land use and temperature, and understanding the sources and sinks of heat in an urban environment



Entry / Settling activity	Where would you most like to live – urban or rural? Close to shops/ school/ work/ your friends/a park/ leisure centre?	
Starter	Practical demonstration showing that different surfaces absorb different amount of heat – see http://metlink.org/pdf/teenagers/experiments/how-reflective.pdf	This needs to have been set up before the lesson.
Main	PowerPoint introduction to urban heat islands	Use the PowerPoint supplied for lesson 1.
Activity	Groupwork - research	Set groups the task of researching various aspects of urban heat islands – e.g. one group could research causes, another impacts, another a case study etc.
Plenary	Whiteboard activity - match land surface type to temperature for a night in July in London.	Suggested Answers Central Business District 19°C High density residential (eg tower blocks, terraces with back yards but no gardens) 18°C City park 15°C Low density suburban housing (eg semi-detached houses with gardens) 16°C Out of town shopping/ leisure centre 17°C Large graveyard 15°C Industrial area 17°C Rural fields 14°C

Lesson 2	Activity	Notes
Objectives	Fieldwork planning	A key point in this lesson is about learning to use the thermometers correctly, practicing map skills and planning fieldwork.



Entry / Settling activity	<p>Identify the causes of Urban Heat Islands – which of the following is contributing to the urban heat island effect:</p> <ul style="list-style-type: none"> - Heating systems - Cooling systems - Urban parks and trees - Drains - Tarmac - Roof gardens - Vehicles - Buildings 	<ul style="list-style-type: none"> - yes, buildings and vehicles are not perfectly insulated - yes, although cooling systems may cool buildings and vehicles down, they pump warm air into the environment! - No, plants cool the land surface by evapotranspiration - Yes, if rainwater is quickly channelled underground, it isn't left on the surface to cool it by evaporation - Yes, most road and pavement surfaces are very dark and absorb a lot of the Sun's energy. - No, vegetation on roofs actually cools buildings and keeps rainwater out of drains. - Yes, hot car engines and exhaust gases contribute - Yes, buildings absorb heat during the day and release it during the night
Starter	<p>Explain how to use the thermometers. Ask the students to quickly go into the school grounds and put their thermometer somewhere out of the sun and remember where they have put it!</p>	<p>Care should be taken to make sure that the sensor holes are not covered. They need at least 5 minutes to adjust to a new temperature – more if the temperature is very different.</p>
Main	<p>Introduction to the fieldwork plan. What will be the fieldwork day? What 'high quality data' is available locally?</p>	<p>Use the PowerPoint for lesson 2.</p>
Practical	<p>Identify the fieldwork area. Using an OS map, mark on students homes and their routes to school. Does the area cover a variety of land use types (industrial, high density residential, low density residential, parks, retail etc.)? How can students routes to school best be used to make a temperature map of the school catchment area? Do any teachers come in from a wider area – could they be called upon to make additional measurements?.</p>	<p>Suggested investigations:</p> <ul style="list-style-type: none"> • At the simplest level, you could just ask students to record the temperature in their garden on the specified morning at a given time. Alternatively... • Give students a thermometer on the day before the measurement campaign, together with the relevant OS map. • Suggest that all students who walk or cycle to school stop every 100m or so, wait a couple of minutes and then note down the temperature, time and grid reference of where they are. • Suggest that all students who drive or take a bus or train to school spend 15 minutes before they leave making a temperature map of their road or the area

		<p>immediately around their homes, similarly recording the time and grid reference of each temperature measurement.</p> <ul style="list-style-type: none"> • Areas that are particularly interesting include local parks – students could walk through the park, making measurements as they go, and waterways (is the temperature cooler closer to the water?) • Alternatively, you might suggest that students could come to school earlier than normal, and investigate the area around the school in a similar way. <p>If students are only going to be making measurements at home, the thermometers can be left out overnight. They should be at least 3m from any building and about 1m from the ground, maybe on top of a garden fence.</p> <p>If students are going to make readings on their way to school, if walking, they need to be careful to hold the thermometer such that the sensor holes are not covered, and hold the thermometers well away from themselves. They need to record where they are when they make measurements.</p> <p>Car thermometers can be used for additional measurements, but the car needs to have been moving for at least 5 minutes before you make the first reading. Thermometers can also be attached to car aerials (taking care not to cover the sensor holes with sellotape!) if it is safe to stop on route and make readings.</p> <p>In addition to recording the temperature, place and time, the students could record a word describing the type of environment they are in e.g. rural, low density residential, high density residential, industrial, retail, urban park etc.</p> <p>Do you need to supply students with letters to parents explaining the fieldwork? Are there any health and safety factors to consider?</p>
Plenary part 1	Identifying risks – why may the fieldwork not give good results? Give students one post-it note each and ask them to write a reason why the fieldwork may fail.	Risks include <ul style="list-style-type: none"> - changeable weather, if the weather is changing rapidly through the time measurements are being made you wont see the UHI



		<ul style="list-style-type: none"> - wind – any wind will destroy the UHI - clouds – the cloudier it is, the more insulated the area and the smaller the UHI will be - not enough data - thermometers used incorrectly - time of year
Plenary 2	Collect thermometers from outside, asking students to make a note of their temperature before they move the thermometer. Adjust readings according to the factor given in the Excel spreadsheet. See who found the coldest/ warmest spot.	Consider distance from buildings, surface material
		Supply students with maps/ data collection sheets/ letters to parents. Make sure they really know what to do with the thermometers and what to record.

Lesson 3	Activity	Notes
Objectives	Practice data handling and GIS skills.	A key point in this lesson is about data handling and display.
Entry / Settling activity	Who got the most readings? Did anyone notice differences in temperatures on their way in to school? What was the weather like?	
Starter	Data entry onto spreadsheet – temperatures, calibrations and locations.	If using the spreadsheet, enter both the thermometer readings and the calibration appropriate for that thermometer. The spreadsheet will automatically calibrate the data. Use http://www.streetmap.co.uk/streetmap.dll?GridConvert to convert postcodes to grid references where required Do you need to correct for time – do any of the local weather stations show that the temperature was changing significantly during the fieldwork period?
Main	Using Google Earth to visualise the results	You can use the supplied worksheet for this, which gives a range of options for displaying the data.
Plenary part 1	Ask students to line up across room as a continuum. Students should stand at the left if they think their experiment does	PowerPoint 3



	provide evidence for an urban heat island, and the right if they think it does not, or somewhere in between.	
Extension	Students could be asked to write up their findings for the local press, or the school or MetLink website.	

Please ensure that all the thermometers have been returned to the Royal Meteorological Society by the agreed date.

