Sustainable Development
Teachers' guide

So what is Sustainable Development?

There are many definitions of sustainable development, but it is basically about ensuring a better quality of life for everyone, now and for generations to come. The 1987 World Commission Report on Environment and Development described it as: "development which meets the needs of the present without compromising the ability of future generations to meet their needs".

The background issue is that our modern society is using up raw materials - and producing waste materials - at a rapid rate. This obviously cannot go on forever, so our life styles will have to change in the future. The UK government has recognised four aspects of sustainable development (find out more from www.sustainable-development.gov.uk):

- Social progress which recognises the needs of everyone
- Effective protection of the environment
- Prudent use of natural resources
- Maintenance of high and stable levels of economic growth and employment

What can the GLOBE Programme offer?

The GLOBE Programme now has new activities for sustainable development, which complement the existing GLOBE protocols. Whereas the existing GLOBE activities monitor the state of the planet, these new Sustainable Development protocols involve measuring our impact on the planet.

There are five areas of GLOBE Sustainable Development activities are:

- **Energy**
- **Waste**
- **Transport**
- **Bio-diversity**
- **Water**

Classroom activities and protocols have been developed in each area to encourage the scientific gathering of data, which can then be compared over time, between schools and between countries. With this data, class discussions and projects can look at how we might change elements of our life-styles in order to achieve real sustainable development.

As more schools contribute to the GLOBE Sustainable Development Database, so we will build up a unique resource in the world, measuring children's contribution to a better future.

Overleaf we have listed some key points from the National Curriculum's summary Education for Sustainable Development (ESD) – and the following pages give just some of the curriculum links for the GLOBE ESD Activities at Key Stage 2 and 3. The main links are with **Science**, **Geography**, **Design & Technology, Mathematics**, **ICT**, **Citizenship** and **English**.

Education for Sustainable Development

"Education for sustainable development (ESD) enables people to develop the knowledge, values and skills to participate in decisions about the way we do things individually and collectively, both locally and globally, that will improve the quality of life now without damaging the planet for the future." The National Curriculum, 1999
Government Panel for Sustainable Development Education, 1999

ESD can be defined in many ways. The Government Panel for Sustainable Development Education has described seven inter-related concepts:

- **Interdependence**
- **Citizenship and Stewardship**
- **Quality of life**
- **Sustainable Change**
- **Uncertainty and Precaution**
- **Diversity**
- **Needs and Rights of future generations**

- **Interdependence:** Understanding the connections and links between all aspects of our lives and those of other people and places at a local and global level, and that decisions taken in one place will affect what happens elsewhere.

- **Citizenship and stewardship:** Recognising that we have rights and responsibilities to participate in decision-making and that everyone should have a say in what happens in the future.

- **Needs and rights of future generations:** Learning how we can lead lives that consider the rights and needs of others, and that what we do now has implications for what life will be like in the future.

- **Diversity:** Understanding the importance and value of diversity in our lives — culturally, socially, economically and biologically — and that all our lives are impoverished without it.

- **Quality of life:** Recognising that for any development to be sustainable it must benefit people in an equitable way, it is about improving everybody's lives.

- **Sustainable change:** Understanding that there is a limit to the way in which the world, particularly the richer countries, can develop and that the consequences of unmanaged and unsustainable growth are increased poverty and hardship, and the degradation of the environment, to the disadvantage of us all.

- **Uncertainty and precaution:** Realising that as we are learning all the time and our actions may have unforeseen consequences we should adopt a cautious approach to the welfare of the planet.

You can find out more details from the National Curriculum ESD website: www.nc.uk.net/esd/index.htm and from the Government's SD website: www.sustainable-development.gov.uk

Energy: Background Information

Domestic consumption of energy accounts for almost 25% of the carbon dioxide emissions in the UK, produced by the burning of fossil fuels such as coal, oil and gas. Carbon dioxide contributes to the problem of global warming as it 'traps' energy from the sun (which would normally be dispersed into space) inside the earth's atmosphere. This 'trapped' heat acts like a blanket - or greenhouse - and is believed to be a cause of changes in our climate (called climate change or global warming).

Electricity, gas, oil and coal are being consumed at an ever-increasing rate. If we continue to use non-renewable fuels for energy at the current rate then the supplies could run out during the lifetime of children born in the 1990s.

Currently, renewable forms of energy such as wind, sun and water only supply a small percentage of our requirements. So it makes sense to:

- use as little energy as is necessary,
- get the maximum amount of energy out of every type of fuel that is used and
- ensure a minimum of energy is wasted

Energy is used in schools for lighting, cooking, heating and air conditioning. Lighting uses electricity but cooking and heating may also use gas, oil or solid fuel. All electrical goods should have a plate fixed to them showing the amount of power that they require, measured in watts (W) or Kilowatts (kW). Schools have meters recording the amount of power that is used in kilowatt-hours (kWh). Gas and oil are measured by volume, as cubic metres and litres respectively, and solid fuel is measured by weight (tonnes).

National Curriculum overview

The energy activity involves reading a variety of scales accurately and using a variety of units and so answers requirements for Science and Mathematics.

ICT (optional) common to all activities
Key Stage 2 3a Share and exchange information in a variety of forms.

Citizenship common to all activities
Key Stage 3 1i knowledge of the world as a global community, and the political, economic, environmental and social implications of this

GLOBE Energy Activities

Activity 1. Fuel for Thought

Pupils will measure the total energy use of the school, looking at the different sources of the energy used to work out an 'Energy Profile' of your school for a one-week period.

Preparation: You will need to discover where the various metres are within the school. Is there access for you and some pupils or will the information have to be collected by the caretaker?
Ensure pupils understand the different measurements used.
You will need to measure the various meters twice – at exactly one week apart.

The activity:

1. Discuss the kinds of energy used in the school – can the pupils suggest other energy sources.
2. Introduce the various units used to measure energy in school – show them the data sheet.
3. Pupils will need to meet with the building officer / head teacher and accompany them to take the readings.
4. Enter the totals onto the GLOBE database.

Follow up: You can usefully carry out the activity at different times of the year, to see how climate and the seasons impact on energy use

National Curriculum

Science

Key Stage 2	Sc1.2	Pupils can use all their investigative skills in a practical, real experiment.
Key Stage 3	Sc4.5a	variety of energy resources
	Sc4.5c	electricity is generated by a variety of energy resources
	Sc4.5e	ways of storing and transferring energy
	Sc4.5g	energy may be dissipating, reducing its availability as a resource

Mathematics

Key Stage 2	Ma 3.4b	read scales with increasing accuracy
Key Stage 3	Ma3.4a	interpret scales on a range of instruments

GLOBE Energy Activities

Activity 2. An efficient school

The activity looks for any energy saving measures used by the school such as thermostats on radiators, turning off stand-by switches on TV etc.

Preparation: Get agreement from all staff (their rooms will be checked.
Copy the 'efficient school' data sheet.

The activity

1. Decide how to divide up the work – maybe assign different areas of the school to different pupils.
2. Talk about energy conservation with the pupils and elicit from them a list of actions that would save energy around the school.
3. Discuss the data collection sheet and encourage understanding about why the survey picks up on certain points. Are there any extra actions that could be taken?
4. The activity will take some time and may provide different results at different times of year.

National Curriculum

Science

Key Stage 2	Sc1.2	Pupils can use all their investigative skills in a practical, real experiment.
	Sc3.1b	some materials are better thermal insulators than others.
Key Stage 3	Sc4.5a	variety of energy resources
	Sc4.5c	electricity is generated by a variety of energy resources
	Sc4.5e	ways of storing and transferring energy
	Sc4.5g	energy may be dissipating, reducing its availability as a resource

GLOBE Energy Activities

Activity 3. How Bright is Light?

The activity looks at the energy used by lighting in each room. You could monitor every room at school or just your own classroom. Once the activity has been completed the first time it will be easy to repeat it and so monitor energy use over a school year.

Preparation:
Decide which rooms you want to monitor.
Copy the 'how bright is light' data sheet – one for each room.
Assign a room to each group of students.
Get the help and support of the school premises officer.
Acquire different types of light bulbs to show the class

The activity

1. Discuss the use of lighting in the school. Are there enough lights? Too many?
2. Look at the different type of light bulbs. How are they different?
3. How is electricity measured – what units do we use? (Kilowatt/hours)
4. Pupils will need to find the wattage of each bulb in a room and change W into kW.
   60 W = 0.06 kW 45 W = 0.045 kW
5. Pupils need to find out how long each light is on during a day. They can monitor the lights for themselves – checking in a morning, then at lunch time and again at the end of the day. Alternatively, ask someone in each classroom to monitor the lights.
6. Once they have the numbers for wattage and hours, work out the kWh and then the total for the day.

Follow up
Repeat regularly.
Work out the lighting cost per room.
Present results using line graphs.
Start a 'turn it off' campaign – posters and presentations.

National Curriculum

Science

Key Stage 2	Sc4.1	changing number/type of component in a series can make bulbs brighter or dimmer
	Sc4.3a	that light travels from a source.
	Sc4.3b	that light cannot pass through some materials
	Sc4.3c	that light is reflected from surfaces
Key Stage 3	Sc1	carry out a scientific enquiry

Mathematics

Key Stage 2	Ma3.4a	convert one unit to another eg 60 W = 0.06 kW
Key Stage 3	Ma3.4c	use compound measures eg kWh

GLOBE Energy Activities

Activity 4. Temperature Survey

Students will collect temperature data at fixed times during the day and will look at the heating use in the school in comparison.

Preparation: Decide which rooms you want to monitor.
Copy the 'temperature survey' data sheet – one for each room.
Assign a room to each group of students.
Get the help and support of the school premises officer.
Acquire and calibrate several thermometers.
Check outside thermometers to see that they are in working order and correctly installed– either use you Stevenson Screen (as for weather protocol) or use a digital thermometer with an outside probe.

The activity

1. Discuss the use of heating in the school. Are there enough radiators? Too many? What do thermostats do? Does the school use individual thermostats?
2. Talk about the need for heat to circulate freely from radiators without obstacles such as furniture in the way.
3. How might the temperature in a classroom change during the day – draw graphs to predict what you think will happen to the classroom temperature during a typical winter / summer / weekend day.
4. Make sure all pupils know how to accurately read a thermometer.
5. Calibrate the thermometers by placing the bulb in icy water for 3 minutes. The temperature must drop to 0^{o}C otherwise find a new thermometer.

Follow up Repeat the activity at different times of the year and for different rooms.
Produce graphs / displays to illustrate the findings to the rest of the school.
Find out about thermostats for individual radiators.

National Curriculum

Science

Key Stage 2	Sc4.1a	changing number/type of component in a series can make bulbs brighter or dimmer
	Sc4.3a	that light travels from a source.
	Sc4.3b	that light cannot pass through some materials
Key Stage 3	Sc1	carry out a scientific enquiry

Mathematics

Key Stage 2	Ma 3.4b	read scales with increasing accuracy
Key Stage 3	Ma3.4a	interpret scales on a range of instruments
	Ma4.1a	collect data, progress and represent, interpret and discuss data
	Ma4.4b	calculate means of small data sets

Research links and project ideas

- Discuss what we will do for energy when the oil, coal and gas begin to run out. What will happen to transport? What will we do for heating, cooking, etc. What would be the effects on travel? On sport?
- Make comparisons with other schools of the same size using the GLOBE database.
- Discuss how pupils think improvements in energy use could be made within the school.
- Research alternative sources of energy available. Are any suitable for a school environment?
- Research and discuss the possible effects of burning fossil fuels on the environment

Useful contacts

CREATE
CREATE is a charity promoting the sustainable use of energy, with activities for children in schools as well as the general public.
http://www.create.org.uk

Energy Saving Trust
A government funded trust that runs promotions and discounts on buying energy efficient goods and services.
http://www.est.org.uk

The Centre for Alternative Technology
The Centre for Alternative Technology at Machynlleth in Mid-Wales provides a wide range of alternative options for energy – and other sustainability issues. You can visit them in real life – or on the web at http://www.cat.org.uk

Eco-Schools
Eco-Schools provides a whole-school environmental management and certification system, based upon a simple methodology with energy as one of its components.
http://www.eco-schools.org

Global Action Plan
Global Action Plan is an independent charity that provides practical solutions to environmental and social problems. Schools can choose to tackle water, waste, energy or transport projects over three terms.
http:www.globalactionplan.org.uk

You can also work out your carbon balance using the web-based carbon calculator
http://www.carboncalculator.org

Waste: Background Information

Modern western society produces huge amounts of waste in solid forms. These are disposed of in many ways: by burying in landfill; by burning in incinerators; by treating in sewage systems. The amount of solid waste produced is not sustainable.

Each of us produces waste that goes into landfill. Landfill is the burying of untreated waste in holes in the ground. These holes may be old quarries where sand, gravel or other minerals have been removed. As the rubbish decomposes, 'greenhouse gases' such as carbon dioxide and methane are produced.

An alternative is to burn or incinerate rubbish, however this also results in the production of carbon dioxide and other polluting gases that are released into the atmosphere.

More sustainable methods of dealing with waste are:
- Minimising waste at source e.g. providing less packaging.
- Recovering waste materials, which can then be reused, recycled or composted.

What can be recycled?

Most products can be recycled, but the local authority will be able to tell you what services are provided in your area (Local Agenda 21 officer).
Common materials for recycling include paper, clothing, plastic, glass and cans.
Schemes may also be in operation locally that collect, computers, furniture, fridges and cookers. Green waste can be successfully composted at home or school.

Many things that you throw away can often be recycled. Taking a close look at the contents of your bin is an important part of sustainable living.

The three key words are **REDUCE, REUSE, RECYCLE**

National Curriculum overview

The activities can be used across all schools as citizenship exercises to raise awareness of students' environment and their responsibility for it.
They work well in Geography curriculum for Year 4 Unit 8 Improving the environment.
The data handling and weighing elements fit into the Mathematics curriculum, AT 2 and 4 for both Key Stage 2 and 3.

ICT (optional) common to all activities
Key Stage 2 3a Share and exchange information in a variety of forms.

Citizenship common to all activities
Key Stage 3 1i knowledge of the world as a global community, and the political, economic, environmental and social implications of this

GLOBE Waste Activities

Activity 1. Waste Not Want Not

Pupils measure the amount of waste their classroom produces during a one-week period. Waste can be measured at the end of each day and the weekly amounts calculated and entered onto the database. For this activity waste is classified into paper, metals, glass, plastics and items that are biodegradable (e.g. orange peel), waste batteries and 'other'. The activity will be easier if there are separate containers for each of the types of waste that the children can use throughout the day. Each component is weighed in grams.

Preparation:

Weigh the boxes when empty so that their weight can be taken from the total weight and not included. Alternatively, place the rubbish into a thin bin liner which will weigh virtually nothing

A recording sheet has been provided but older children should be encouraged to create their own

Required knowledge Ensure pupils know the meaning of the words biodegradable and sustainability

The activity:

1. Pupils weigh the contents of each box at the end of the school day and record the results onto the data sheet.
2. At the end of the week they work out the total weight for each type of waste and the average number of children in the class that week.
3. Enter the results onto the GLOBE Sustainable Development database.

Follow up: Encourage other classes to weigh their waste and compare the results. Compare your schools results with other schools in the country of similar size or within the same LEA via the GLOBE database. Why do some people produce more rubbish than others?

Discuss with the pupils what they could do to reduce the amount of waste they produce. See if pupils can reduce their waste by recycling / composting.

National Curriculum

Geography Unit 8 Year 4: Improving the Environment

Children should learn	1b	to collect and record evidence to answer questions
	2b	fieldwork skills
	5b	how/why people seek to manage and sustain the environment

Mathematics

Key Stage 2	Ma2-1g	use notation diagrams and symbols correctly
	Ma3-4b	read scales with increasing accuracy.
	Ma4-1f	decide how best to organise and present findings.
	Ma4-2c	Represent discrete data using graphs and diagrams.

GLOBE Waste Activities

Activity 2. The Litter Pick

Pupils will examine the litter in the playground and decide which kind of recycling bins would help to improve the litter situation issue around the school and grounds.

Preparation: You will need gloves, bins, data collection sheets, scales and recycling bins.
Prepare a large class map/plan of the school grounds, either with the children's help or before the lesson.
Make sure that **you** know where the litter bins are.

Required knowledge How to use weighing scales

The activity:

1. Using a plan of the school grounds, areas are allocated to groups, each area should have a litter bin in it.
2. After lunch the groups weigh the bin bags from their litter bin and record the weight in grams on the data collections sheet.
3. The group then do a litter pick in their area. You could organise it so members of the group pick up different kinds of litter (cans or wrappers or plastic). They then weigh their litter and record the results onto the data collection sheet.
4. Enter the totals for each form of the results onto the GLOBE database.

Follow up: Discuss as a class what could be done to improve the litter problem, if you have one or what could be done to reduce the amount of rubbish thrown away.
Discuss recycling and find out what experiences the pupils have had of recycling at home. Where are the closest recycling points? Do their parents recycle?
Children present their findings using graphs or table and write about what they found out about different areas of the school.
Decide what kind of recycling bins would be useful in each area and put a recycling bin near to the litterbin.

National Curriculum

Geography Unit 8 Year 4: Improving the Environment
Children should learn 1b 2b 5a 5b

Mathematics

Key Stage 2	Ma2–1f	organise work and refine ways of recording.
	Ma2-1g	use notation diagrams and symbols correctly
	Ma3-4b	read scales with increasing accuracy.
	Ma4-1a	select and use handling data skills.
	Ma4-1f	decide how best to organise and present findings.
	Ma4-2c	Represent discrete data using graphs and diagrams.

GLOBE Waste Activities

Activity 3. Packed lunches

Pupils will collect the non organic waste packaging from their packed lunches and categorise the items. They will weigh the waste at the end of the week and record totals on the database.

Preparation: You will need gloves, collection bins, data collection sheets, and scales.

Required knowledge How to use weighing scales

The activity:

1. Ask pupils to wash and keep any pots / wrappers / bags that the pupils bring with their packed lunches. They then sort the packaging into relevant containers.
2. At the end of the week, weigh all the items and work out the average weight of waste / student.
3. Enter the results onto the GLOBE database.

Follow up: Discuss the results and what can be done to reduce the amount of packaging involved in bringing a packed lunch**.**

Reuse bottles for squash.
Have a handful of crisps from a larger family size bag (cheaper too)
Reuse or recycle foil
Use yoghurt pots as planters

Pupils could produce a graph of their own individual results.

National Curriculum

Geography Unit 8 Year 4: Improving the Environment
Children should learn 1b 2b 5a 5b

Mathematics

Key Stage 2	Ma2–1f	organise work and refine ways of recording.
	Ma2-1g	use notation diagrams and symbols correctly
	Ma4-1a	select and use handling data skills.
	Ma4-1f	decide how best to organise and present findings.
	Ma4-2c	represent discrete data using graphs and diagrams.
Key Stage 3	Ma3.4a	interpret scales on a range of measuring instruments
	Ma4.1a	collect data, progress and represent, interpret and discuss data
	Ma4.4b	calculate means of small data sets

GLOBE Waste Activities

Activity 4. Reuse

Pupils monitor the use of shopping bags at home for a week. They record how many plastic / paper and reusable bags are used for a full weeks worth of shopping.

Preparation: You will need data collection sheets – one for each member of the class.

The activity:

1. Ask pupils to monitor all the shopping that comes into the house and record all the bags used on the tally chart.
2. Enter the results onto the GLOBE database.

Follow up: Discuss the results
what can be done by individuals to reduce waste?
What is being done and could still be done by shops and supermarkets to reduce waste?
Pupils could produce a graph of their own individual results.
Produce a display for the school to highlight the issues.

National Curriculum

Geography Unit 8 Year 4: Improving the Environment
Children should learn 1b 2b 5a 5b

Research links and project ideas

- Discuss the harm litter can do to wildlife, e.g. plastic can holders can strangle hedgehogs and birds, plastic bags can suffocate, glass can trap small mammals and tins may cut.
- Discuss the problems associated with landfill. What will people do when the landfill sites are full?
- Discuss the alternative of burning or incinerate rubbish and the resulting production of carbon dioxide and other polluting gases. What are 'greenhouse gases' and their effects?
- Pupils could design and carry out a survey into other people's views and ideas about recycling.
- Pupils could plan a scheme for waste reduction within the school and implement it.
- Make a display to show what can be recycled, reused or composted.
- Discuss packaging, how can we ensure that we use less? Collect the wrappers used for snacks during the week and work out ways to use less packaging for those products.
- Visit landfill sites. Talk to the waste companies about their policies.

Useful contacts

Waste Watch
Waste Watch Is a charity promoting action on waste reduction, reuse and recycling, with a number of activities for schools and children as well as lots of information.
http://www.wastewatch.org.uk

Education for Sustainability (E4S)
There are waste projects for schools – and other sustainability activities – on the E4S website at http://www.e4s.org.uk

Environment Agency
The Environment Agency's huge website has a mass of information on all sorts of environmental issues – including waste.
http://www.environment-agency.gov.uk/subjects/waste

Council for Environmental Education
You can find out about many organisations and activities at the Council for Environmental Education's website http:/www.cee.org.uk

Transport: Background Information

To many people the word 'transport' means the same as 'traffic'. However, 'transport' actually covers a wide range of issues from local to global. One key concern is the growth over the last few decades in numbers and use of private cars.

The private car has many benefits in terms of personal mobility for those people that own them, but also has several side effects. In many towns and cities across the world car use is influencing the design of towns, with more 'edge of town' shopping centres designed to suit the car owner. Growth in car numbers is an important factor in the increased air pollution-affecting people's health.

In the UK there has been a trend for more children to be driven to school, making the roads around the school congested with traffic and the air around the school more polluted.

Road transport is the single largest source of air pollution in the UK.

Ninety percent of the carbon dioxide (CO_2) emissions in the UK come from road transport. CO_2 is one of the main greenhouse gases. Greenhouse gases trap heat and stop it radiating back into space. Over time the trapped heat can raise the temperature of the planet and could change the weather, global water circulation, local ecosystems, and even the shape of our country as water levels rise.

Nitrogen oxides (NO_x) and carbon monoxide (CO), which are released as we burn fuel in our cars, also increase air pollution. Road transport contributes 49% of the nitrogen dioxide emissions in the UK.

Nitrogen oxides and sulphur oxides also contribute to 'acid rain'. Rain becomes abnormally acidic when it absorbs gases such as sulphur dioxide and nitrogen oxides. Acid rain alters the pH balance of watercourses like lakes and rivers. It upsets the natural populations living in the water. Acid rain can also dissolve harmful metals, such as aluminium, lead and mercury from soil, this polluted water then joins watercourses and causes further problems. For example, aluminium dissolved in acidic water can affect the gills of fish and stop them absorbing oxygen. In the soil the increased acidity and aluminium ions may attack tree roots causing the trees to die back.

A key concern over the last few decades has been the growth in the number of private cars being used. The private car has many benefits in terms of personal mobility but it has many side effects. In addition to the environmental effects described above there may be a link between vehicle emissions and higher levels of asthma.

Transport can also have a physical impact on wildlife. Frogs, toads and newts are particularly vulnerable as they cross roads to get to their breeding grounds in the spring.

National Curriculum Overview

Activity 1 Mainly a Maths project but also part of a Geography module about the local area.

Activity 2 can be used to look at metric conversion skills (Maths), map reading skills (Geography) or as part of the Year 3 QCA Unit 6: Investigating our local area in Geography. The activity looks at our impact on the environment and addresses several issues in Key Stage 3 Geography.

Activity 3 can be used as part of the Numeracy Strategy in Year 6. It can also be used as part of Handling Data projects.

GLOBE Transport Activities

Activity 1. Getting to School 1

Pupils survey their classmates and find out the mode of transport that each person used to come to school. This starts pupils thinking about their travel and encourages them to talk to each other. The activity would work well with a new class at the start of the school year. Pupils can compare their journeys and work out if there are parts of the trip they could make together.

Preparation: Decide whether the group will work together or separately.
Copy the 'Getting to School' Activity 1 data sheet.

The activity:

1. Pupils choose the one type of transport they use for the longest part of their journey.
2. Complete the survey sheet and work out the totals for each type of transport.
3. Enter the results onto the GLOBE sustainable development database.

Follow up: Draw graphs to display the data.
Discuss sustainable forms of transport and find out if any pupils can travel together.
Survey the rest of the school and add their results to your graphs.
Repeat the activity at the end of the year and see if anything has changed.
Do the 'Getting to School 2' activity.

National Curriculum

Mathematics

Key Stage 2	Ma4.1a	Select and use handling data skills.
	Ma4.1f	Decide how best to organise and present findings.
	Ma4.2c	Represent and interpret discrete data.
Key Stage 3	Ma4.1a.ii	Collect data from surveys.
	Ma4.1f	Communicate mathematically, use diagrams and text.
	Ma4.2a	Collect discrete data, using observation and controlled experiments.
	Ma4.2c	Design and use two way tables.
	Ma4 Level 3	Construct bar charts and pictograms to communicate info they have gathered.
	Ma4 Level 4	Collect and record discrete data. Use mode.

GLOBE Transport Activities

Activity 2. Getting to School 2

Pupils work out the distances travelled using each mode of transport in meters.

Preparation: You will need local maps and pieces of string or access to the Internet.
Copy the 'Getting to School 2' data sheet.

The activity:

1. First pupils work out every form of transport they use to get to school.
2. Next they need to work out how far they came using each form. There are several ways to do this… (pupils may need extra support to complete this activity)
3. Using large scale local maps and a piece of string pupils lay out the string along their route and then use the scale conversion to work out the distance they travelled.
4. If children come by car or by bus, they can ask the driver to note the distance from the mileometer and then convert into meters.
5. Pupils can use a route finder programme or web sites like www.mapquest .co.uk and search for driving directions, the site will give them their distance travelled.

Follow up: Who travels the furthest?
What is the average distance travelled by pupils in the group?
Repeat later in the year and check if things have improved.
Encourage pupils to talk about sustainable methods of getting to school.
Can some pupils travel together?
Draw a map of the area and mark on the routes and methods taken to get to school.

National Curriculum

Mathematics

Key Stage 2	Ma4.1a	Select and use handling data skills.
	Ma4.1f	Decide how best to organise and present findings.
	Ma4.2c	Represent and interpret discrete data.
Key Stage 3	Ma2.4a	Use a range of measures and convert between units
	Ma3.4a	Convert measurements from one unit to another
	Ma4.1a.ii	Collect data from surveys.
	Ma4.1f	Communicate mathematically, use diagrams and text.
	Ma4.2a	Collect discrete data, using observation
	Ma4.2c	Design and use two way tables.

Geography:

Key Stage 2	Year 3 QCA Unit 6: Investigating our local area.	
	2c	Use maps and plans at a range of scales.
Key Stage 3	2c	Use OS maps including 1:25,000 and 1:50,000
	2e	Draw maps and plans using a variety of scales.
	3e	explain how places are interdependent and explore global citizenship.
	4b	Identify, describe explain human processes and impact on the environment.
	5b	explore the idea of sustainable living, recognise implications for their lives.

Activity 3. Traffic Survey

Pupils carry out a traffic survey around the school or local area. It gives them an idea of how many vehicles there are on our roads and how much we rely on them. Pupils can present their findings and compare them with those of other schools.

Preparation: You will need Traffic Survey Data Collection Sheets (optional)
Local map and GPS

Decide whether you want your pupils to use the data collection sheet provided Look at the local area map and choose observation points on different roads if possible so that the data can be compared. Alternatively make observations from one point at different times of day.
Take GPS readings at the observation point(s).

Required knowledge: Pupils need to know how to draw and fill in a tally chart**.**

The activity:

1. Discuss as a class how the frequency of traffic might change at the different observation points or at different times of day. Ask pupils to write predictions/hypotheses for the general results they expect from their survey. Talk about the categories of traffic pupils might see: car, bicycle, motorbike, van, lorry, pedestrian, etc, etc.
2. Break the class into groups and assign observation points/observation times.
3. Hand out the data collection sheet or get pupils to design their own.
4. Carry out the survey using tally charts.
5. Collate the data from all the surveys into a simple class database on the board.

Examples of simple databases:

	Point 1	Point 2	Point 3
Bicycle			
Car			
Lorry			

	08:30	12:00	15:00
Bicycle			
Car			
Lorry			

6. Discuss the results. Are there any surprises? Review the predictions.
7. Present the results using a bar chart or line chart and explain what was done.
8. Find the modal type of traffic for each point
9. Enter the data onto the GLOBE website at www. globe.org.uk

National Curriculum

Numeracy Strategy Year 6: Handling Data: Traffic Survey.
Pupils should learn to solve problems by collecting, organising, representing, extracting and interpreting data in tables, graphs and charts.

- to use, read, write and spell the vocabulary: statistics, average, distribution, mode
- to test hypothesis by drawing and discussing bar charts where discrete data are grouped, to check predictions of the most common number.

Research links and project ideas

- Discuss the pros and cons of each method of transport, for humans, wildlife and the environment.
- Encourage students to discuss why they travel to school in the way they do. What would make them choose a more sustainable method of transport? Repeat the activities at the end of the school year and examine the results; has anything changed?
- Comparisons with other countries should provide interesting results. Contact schools with very different data to find out why they choose to travel in a particular way.
- Examine the chemical changes that take place in the soil, in a food chain or in an ecosystem after input of acid rain. How do the habitats and biodiversity change?
- Work out the emissions from each student's route to school. Work out an average per Km value.

Useful contacts

Sustrans
Sustrans is a charity promoting sustainable transport. It plans, builds and maintains safe non-motor routes for walkers and cyclists. It lobbies for sustainable forms of transport.
www. sustrans.org.uk
and Sustrans second website www. saferoutestoschool.org.uk

Community car share network
This organisation helps car-clubs and car share schemes in cities and rural areas.
www. carshareclubs.org.uk

Environmental Transport Association
The ETA is a motoring organisation providing a more environmentally friendly service, and campaigning for a sound and sustainable transport system. Links to Green Transport Week (7-15th June2003) and National Car Free Day (22 September 2003)
www. eta.co.uk

Young Transnet
Collects data about how children travel to school.
www. youngtransnet.org.uk

Living Streets
A practical project creating healthy safe streets for all.
www. livingstreets.org.uk

Biodiversity: Background Information

Biodiversity is a word that summarises the wealth of wildlife - or biological diversity – all around us. It relates to habitats for wildlife, such as woodlands or wetlands, as well as to the species that live in them. Some habitats have a greater biodiversity than others – for example upland moorland in the UK supports only a small number of species, whereas grassland on limestone can have dozens of different wildflowers in only one square metre.

Measuring biodiversity of species can therefore be quite difficult, and may not tell you very much as a single measurement. In contrast it is quite easy to measure the amount of different natural habitats in an area – and generally the more that you have, the greater the biodiversity your location has.

National Curriculum overview

Activities 1 and 2
Is a geographical enquiry project and involves many skills from Key Stage 3 geography, including use of maps and a key, using evidence and undertaking geographical enquiry.

Activity 3 to 7
Look at the creatures living in the different habitats in the school grounds and fit well into Key Stage 2 and 3 science. Also make good surveys for Maths.

GLOBE Biodiversity Activities

Activity 1. My Place

This activity classifies a 3km x 3km area, with your school at the centre of it, and makes an assessment of the amounts of different habitats in it.

Preparation: You will need your GLOBE Landsat Image, If you do not have a GLOBE Landsat image of your area, you can use a detailed 1:25,000 Ordnance Survey 'Explorer' or 'Pathfinder' map instead.
GLOBE MUC system, used to classify the land.
Transparencies or tracing paper and marker pens

Set up the 3km x 3km square so that your school is in the centre of it.
Divide the 3km x 3km into equal areas so pupils can work in small groups.
Note that the results have to be presented in hectares (1 ha = 100m x 100m)

This exercise is easier if pupils are given a graduated transparency to mark each area.

The activity:

1. Pupils draw an outline of any major features such as coastline, rivers, towns etc.
2. They then use the code below to record what is present in each different area. This will take a whole lesson to complete.
   - 0 Forest (trees at least 5m tall with the crowns interlocking)
   - 1 Woodland (trees at least 5m tall with crowns not touching)

   (The difference between the above descriptions can not be discerned from an OS map. A visit or by yourself and/or the pupils will be required, in the UK most will be woodland.)
   - 2 Shrubland (woody plants 0.5-5m tall covering >40% of the ground)
   - 3 Dwarf shrubland (woody plants up to 0.5m; heathland)
   - 4 Grassland (including un-mown grasses, sedges, rushes and wildflowers)

   (There is no category on the OS map for this. A knowledge of your area is necessary.)
   - 5 Bare rocks (thin soils, sands and rocks)
   - 6 Wetland (marshes, swamps and bogs with over 40% vegetation)
   - 7 Open water (sea, lakes, ponds and rivers with < 40% vegetation)
   - 8 Cultivated land (including all farmland, crops and mown grassland)
   - 9 Urban land (including towns, houses, roads and railways)
3. A final measurement is the amount of land within your 3km x 3km square that is protected in any way – as a nature reserve or other designated site.

Follow up Pupils could make a class visit to any area that are unclear on the OS map and decide for themselves what category should be used.
Add up all the 'natural' categories (from 0 - 7) and compare that total with the agricultural and urban total (8+9). What does that tell you about your place?

National Curriculum

Geography

Key Stage 2	2b	use appropriate field work techniques (labelled field sketches)
	2e	draw plans and maps at a range of scales

GLOBE Biodiversity Activities

Activity 2. School Grounds

Pupils produce a map of the school grounds, identifying different habitats within the school grounds. They work out the rough area in m^2 of each type of habitat.

Preparation

You will need sheets of A3 plain paper
You might want to produce a template for pupils to fill in showing the outline of the school grounds so all pupils work on the same size map.
Talk about ways to estimate area.

The activity

1. Discuss the categories with the class – can they think of any more habitats that might be found in the school grounds.
2. Complete maps of the school showing as much detail as possible.
3. Estimate the average area that each habitat takes up within the school grounds.
4. Fill in results on the GLOBE database.
5. Choose the best map to send to GLOBE.

Further work

This can be done at different times to reflect any changes / improvements made to the school site.
Pupils could produce maps of their gardens and compare them.
Work can be displayed for the rest of the school and used to provoke discussion and action amongst other classes.

National Curriculum

Mathematics

Key stage 2	3.4e	calculate areas
Key stage 3	3.3d	use and interpret scale drawings
	3.4f	find areas

Geography

Key Stage 2	2b	use appropriate field work techniques (labelled field sketches)
	2e	draw plans and maps at a range of scales

GLOBE Biodiversity Activities

Activity 3. Identifying trees

Pupils mark all trees on the school grounds map and identify them using an id key to find their Latin and common names.

Preparation You will need copies of the school grounds maps from Biodiversity activity 2 and tree identification keys / books.

The activity

1. Pupils survey the school grounds and mark that every tree is marked on the school grounds map.
2. They identify and name each tree and complete the data sheet to show how many of each type of tree they have in the school grounds.
3. Record results on the GLOBE database

Further work Use the GLOBE biometry protocols to carry out further measurements of the trees – height / circumference.
Use GLOBE Biodiversity Activity 4 to study the life on the tree.
Adopt a tree (or several trees) to monitor Green Up and Green Down.
Produce drawings of the different trees at different times of year to show changes.
Collect leaves from different trees and compare their shapes and sizes

National Curriculum

Science

Key Stage 2	2.4a	use keys
	2.4b	assigning plants to groups
	2.4c	the variety of plants make it important to identify them and assign them to groups.
Key Stage 3	2.4b	How to classify living things

Geography

Key Stage 2	2b	use appropriate field work techniques (labelled field sketches)
	2e	draw plans and maps at a range of scales
Key Stage 3	2e	draw maps and plans using symbols, keys and scales
	2f	to communicate in different ways, including ICT

GLOBE Biodiversity Activities

Activity 4. Tree Life

This task looks at one type of habitat (woodland) on a very small scale i.e. an individual tree and explores the diversity of animals that tree supports. One individual tree can support a surprising variety of animals and different trees will support different types and numbers. Native trees support more species than introduced varieties. Many of the exotic trees have only been in the UK for a relatively short time, and our native flora and fauna have not adapted to live with them. For example the native British oak has over 280 species of insect associated with it, whereas the introduced Holm oak has only two.

Preparation You will need to make a tree beater if you do not already have one. This can simply be a white sheet (visibility of creatures is best on a white background) held at the corners by the pupils whilst you shake branches above it.

The activity

1. Choose a tree to investigate. The tree should be a mature example so that it, and its associated community has had time to establish. Perhaps a tree that is common in your school grounds would be a good starting point.

Further work This can be done on a seasonal basis and a comparison of the data made. Include life cycles as one of the reasons for the changes. This can be done on another tree species e.g. a non-native such as the sycamore and a comparison made with a native species such as the oak

National Curriculum

Science

Key Stage 2	Sc2.1c	To make links between life processes in plants and animals and the environments in which they are found.
	Sc2.4a	To make and use keys.
	Sc2.4b	local animals and plants can be identified and assigned to groups.
	Sc2.5a	how living things and the environment needs protection.
	Sc2.5b	how animals and plants are found in different habitats.
	Sc2.5c	how animals in different habitats are suited to their environment
Key Stage 3	Sc2.4b	How to classify living things
	Sc2.5a	about ways living things / environment can be protected and about Sustainable Development
	Sc2.5b	habitats support a diversity of life

GLOBE Biodiversity Activities

Activity 5. Log piles

Log piles are a valuable habitat for invertebrates such as spiders, millipedes, centipedes and many insects. Logs should be placed in a pile in partial shade to prevent them drying out, as most invertebrates prefer damp conditions. Log piles are easy to create and require little, if any maintenance. You could have more than one pile in order to prevent over use for bug hunting. This activity asks pupils to carry out a bug hunt if there is a log pile in the school grounds

Preparation You will need identification keys or books, magnifying glasses, data sheets

The activity

1. Discuss with the pupils the care and consideration they should use when turning over the logs to carry out their bug hunt. You will probably want to split the class so that only a few pupils work on the log pile at any one time.
2. Ask pupils to fill in the data sheet as accurately as possible.

Further work This can be done on a seasonal basis and a comparison of the data made. Include life cycles as one of the reasons for the changes. Create a new log pile in a contrasting area of the school grounds. Draw pictures of the animals found

National Curriculum

Science

Key Stage 2	Sc2.1c	To make links between life processes in plants and animals and the environments in which they are found.
	Sc2.4a	To make and use keys.
	Sc2.4b	Local animals and plants can be identified and assigned to groups.
	Sc2.5a	How living things and the environment needs protection.
	Sc2.5b	How animals and plants are found in different habitats.
	Sc2.5c	How animals in different habitats are suited to their environment
Key Stage 3	Sc2.4b	How to classify living things
	Sc2.5a	About ways living things / environment can be protected and about Sustainable Development
	Sc2.5b	Habitats support a diversity of life

GLOBE Biodiversity Activities

Activity 6. Wet wet wet wildlife

Ponds provide a very different environment to the rest of a school site. They create a rich community of plants and animals that will be very useful for study.

Preparation You will need sheets of paper for maps, data sheets, dipping nets and bowls, and identification keys / books

The activity

1. Discuss with the pupils the care and consideration they should use when near the pond and handling animals.
2. Ask pupils to fill in the data sheet as accurately as possible.
3. Record results on the GLOBE database

Further work This can be done on a seasonal basis and a comparison of the data made. Include life cycles as one of the reasons for the changes. Compare ponds in contrasting areas – maybe gardens or parks. Draw pictures of the animals found.

National Curriculum

Science

Key Stage 2	Sc2.1c	To make links between life processes in plants and animals and the environments in which they are found.
	Sc2.4a	To make and use keys.
	Sc2.4b	Local animals and plants can be identified and assigned to groups.
	Sc2.5a	How living things and the environment needs protection.
	Sc2.5b	How animals and plants are found in different habitats.
	Sc2.5c	How animals in different habitats are suited to their environment
Key Stage 3	Sc2.4b	How to classify living things
	Sc2.5a	About ways living things / environment can be protected and about Sustainable Development
	Sc2.5b	Habitats support a diversity of life

GLOBE Biodiversity Activities

Activity 7. Bird life

Pupils will take positions around the school and observe and identify the birds they see for half an hour.

Preparation You will need identification keys or books, magnifying glasses, data sheets.

The activity

1. Assign different observation points to different groups of students and provide each group with an id key / book.
2. Ask pupils to fill in the data sheet as accurately as possible.

Further work This can be done on a seasonal basis and a comparison of the data made. Include life cycles as one of the reasons for the changes.
Place bird tables / feeders in the school grounds.
Draw pictures of the birds seen.

National Curriculum

Science

Key Stage 2	Sc2.1c	To make links between life processes in plants and animals and the environments in which they are found.
	Sc2.4a	To make and use keys.
	Sc2.4b	Local animals and plants can be identified and assigned to groups.
	Sc2.5a	How living things and the environment needs protection.
	Sc2.5b	How animals and plants are found in different habitats.
	Sc2.5c	How animals in different habitats are suited to their environment
Key Stage 3	Sc2.4b	How to classify living things
	Sc2.5a	About ways living things / environment can be protected and about Sustainable Development
	Sc2.5b	Habitats support a diversity of life

Research links and project ideas

- Compare your school's habitat to another using the GLOBE database (try an urban school if your are in a rural setting or vice versa). Why not encourage the pupils to e-mail the other school's pupils and have a chat about the differences? What are their thoughts and opinions about where they go to school?
- Discuss biodiversity, what it is, how humans affect it, what can be done to improve it and about ways in which living things and the environment need protection
- Discuss the results on our lives if biodiversity is reduced. Make the topic a class discussion with speakers for and against retaining/ improving or even reducing biodiversity on the planet.
- What might be happening to global biodiversity in light of the use of fossil fuel usage?

Useful contacts

Lifelong learning for a sustainable future – *WWF*
Information and case studies from schools and topic briefs for environmental issues. There are also summaries of and access to the on-line debates run by our colleagues in WWF for schools: http://www.wwflearning.co.uk

Local biodiversity issues
Check with your local Wildlife Trust about any local biodiversity issues. There may be a local Biodiversity Action Plan (BAP) which highlights priorities for conservation in your area. http://www.wildlifetrusts.org

Water: Background information

The amount of water (in its various forms – vapour, liquid and ice) on the earth does not change over time and only 2% is available for human consumption. As the population grows and technology expands more of this limited resource is used, e.g. for drinking, cleaning, and in schools more water is used per pupil than any other basic resource. It is therefore important that we do not waste the water we have.

Leaking taps is common problem and the cause is usually due to a worn out washer that can easily be replaced. A dripping tap can waste enough water for a 5 minute shower each day.

National Curriculum overview

The activities make good maths / numeracy projects.

Research links and project Ideas

- Local and national newspapers can be collected and researched for articles on water use and abuse
- Research ideas on other ways of conserving water (e.g. toilet hippos and self stopping taps).

Useful contacts

'Are you doing your bit?' campaign
www.doing yourbit.org.uk

Environment Agency
www.environment-agency.gov.uk

Eco Schools
www.eco-schools.org

Global Action Plan (UK)
www.globalactionplan.org.uk

Water in Schools a resource for Key Stage 2 and 3 pupils
www.waterintheschool.co.uk

GLOBE Water Activities

Activity 1. Dripping Water Wasted

The aim of this activity is to calculate the amount of water dripping from the taps within the school by timing the number of drips over a period of one minute. Pupils are instructed to repeat this twice. They then average the three readings.

Preparation: Check the taps in the school building and note which ones are dripping when turned off.
Assign a number and location code for each one.

The activity:

1. The children can work on a tap each or in groups.
2. They will watch the tap for a minute and count and record the number of drips in that minute.
3. They then need to repeat part 2 twice more so they have 3 minute long samples to work with.
4. They will then average the readings and should enter the results onto the GLOBE Sustainable Development database.

Follow up: Work out how much water is being wasted in the school per minute, hour, each day and even over a year?

1 drip ¼ millilitre (0.25ml)
4,000 drips = 1 litre

Repeat this activity after 6 months to see if there has been an improvement
Discuss the advantage of taking three readings.

National Curriculum

Science

Key Stage 3	Sc2.5a	how living things and the environment can be protected, importance of sustainable development

Mathematics

Key Stage 2	Ma 2.2h	understand and use decimal notation for tenths and hundredths
	Ma 2.3l	multiply and divide
	Ma 3.4a	Know 1000ml = 1L
Key Stage 3	Ma2.1c	select effective techniques for numerical calculations.
	Ma2.3a	multiply any number
	Ma4.1a	solve a problem using handling data techniques

GLOBE Water Activities

Activity 2. How much do you use?

Pupils keep a record of the water they use throughout a day

Preparation: Copy data collection sheets for each member of the class.
Measuring containers

The activity:

1. Discuss and agree upon the occasions in the day when water is used – add any new options to the data sheet.
2. Encourage pupils to be honest and realistic – don't change habits – as they fill in the results for the day
3. They will then enter the results onto the GLOBE Sustainable Development database.

Follow up: Discuss steps that individuals can take to reduce water consumption.
Find out why we should be careful about wasting water.
Make a display to show the water cycle.

National Curriculum

Science

Key Stage 3	2.5a	how living things and the environment can be protected, importance of sustainable development

Mathematics

Key Stage 2	3.4a	choose suitable units for capacity and use them to make sensible estimates in everyday situations.
	3.4b	choose and use suitable measuring instruments for a task
Key Stage 3	3.4a	make sensible estimates of a range of measures