

Land Cover Teachers' guide



Background information

This study is a great way to teach measurement and data handling in maths and still retain most of the essential geographical skills of 'place' and 'mapping' from geography. The study allows pupils to learn about living things in their environment, particularly green plants, and makes thorough use of experimental and investigative techniques.

For different ages and abilities, a shift in emphasis can highlight the way that different wavelengths of light are used to create different satellite pictures. Or the pupils might be learning about the earth in space. It is also a good way to compare two contrasting habitats.

For years, satellite images of the earth have been beamed back from space and NASA scientists have worked long and hard to interpret what they see. They can make a good guess about ground cover from the images, but their guesses need to be verified by data from the ground. It would be too great a task for individual scientists to go out and compare the images with land from around the world. This is where GLOBE students come in.

GLOBE schools from around the world can collect data and take ground level photographs of the land cover and send the data to NASA. They can use the internet to enter data about plant cover and land classification and they can send photographs. The special interactive nature of GLOBE will, of course, allow your pupils to retrieve and process images, information and data collected from your school and other schools around the UK, Europe and the world. You could even choose to compare your data with a contrasting school.

GLOBE activities

Preparation : Investigating your satellite image

This part of the project is the first stage before carrying out biological investigations. Depending on the age and ability of your pupils, you may wish to involve the children in all stages or you may wish to look at the satellite images and pinpoint the study sites yourself.

Equipment and special instructions

MultiSpec computer programme and your computer (IBM compatible, 486 or better)

GPS receiver

Land classification system (UK MUC)

Landsat image

Camera

Transparent film

About your satellite image

GLOBE uses 'Landsat' satellites. The images are taken by a 'Thematic Mapper' (TM) which takes pictures at five different wavelengths. Each wavelength gives a different mixture of colours on the picture. Having two images at different wavelengths helps you to decide where different types of land cover exist. For example, forest can look similar to open water at one wavelength but not at another.

The TM images are made up of tiny squares of colour, called pixels. Each pixel represents 30m x 30m on the ground.

A TM image covering 15km x 15km with your school in the centre will be sent to you once you have sent 250 pieces of data to GLOBE. The image will also come on a disc with software called MultiSpec to help you to show images at different wavelengths and to zoom in and out. You should familiarise yourself with the software and the image before you attempt to use them in the classroom. Further information about using MultiSpec can be found in the 'Toolkit' section of this manual.

Investigation notes

1. Either: Print out colour copies of the TM image in real colour and infra red shift.
Or: Photocopy a local map on to a transparency to fit exactly over the image or lay a transparent sheet over the image.
2. Distribute these among groups.
3. Mark areas which you think have a similar land cover, using a combination of sight, local knowledge and the MultiSpec programme (see Toolkit) to decide where areas of land cover are of one type (homogenous).
4. Use your own local knowledge and that of the class to decide as many of the land cover UK MUC classifications as possible.

Some of these (those involving woodland, forest or grassland) will be verified on site later. There are two types of land cover investigations;

Activity 1: Qualitative - describing or classifying different types of land cover

Activity 2: Quantitative - measuring natural vegetation in wooded or grassy areas.

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Activity 1: Qualitative land study

The first step is to visit some of the areas identified either from the local map or from your satellite image. You want to find areas which have homogenous (uniform) land cover in an area 90m x 90m. Visit as many of these as you can manage. Pupils visit this site and use a Global Positioning System to find out the latitude, longitude and elevation of it.

The pupils then decide where the four compass points are and take a photograph of the site in each direction. They can verify the MUC code allocated in the classroom when they looked at their satellite image.

The photographs and map can be emailed through the website or posted to the following address.

GLOBE Student Data Archive NOAA/NGDC E/GC 1 325 Broadway Boulder, CO 80305-3328 USA
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By now you should have a map with manually chosen and classified land cover and at least one site where the following have been collected:

- A name for the site
- GPS data
- Photographs
- A UK MUC classification.
- Send this data to GLOBE by defining a Qualitative Land Cover site

You can visit as many of these sites as you wish. Why not combine a site visit with another school trip?

Activity 2: Quantitative land study and your biology study site

If the land is natural or semi-natural forest or woodland, various measurements can be taken. This is known as a quantitative investigation where data is gathered on the tree or grass cover on your chosen sites.

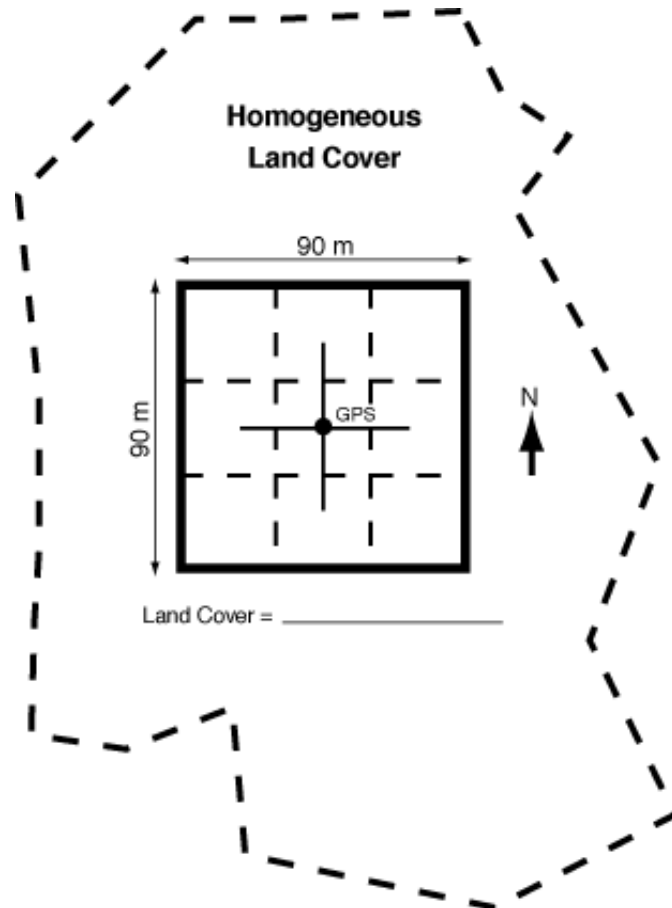
You can have several quantitative study sites.

In the centre of your 90m x 90m land cover site there is an area 30m x 30m which represents the middle of the nine pixels. This is your quantitative study site. In most cases, you will take measurements at the site just once.

Biology Study Site

Choose just one of the quantitative study sites to be your biology study site.

GLOBE asks that you take the biometry measurements twice a year at your biology study site. If possible take them in summer and mid-winter, although this is not necessary. You are free to choose which measurements you wish to make. The measurements are all very simple. It is, however, always necessary to find out the GPS data and dominant and co-dominant vegetation.



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Biometry Measurements

A range of measurements can be taken at each quantitative land cover site...

Dominant and co-dominant vegetation. Students will identify the species of trees in their study site and figure out which ones are dominant and co-dominant. It helps to imagine the area from above – if a bird flew over which tree would it see most of?

Ground cover and canopy cover.

The aim is to quantify the ground and canopy cover of the study site, using a densiometer to provide numerical data.

- The densiometer can easily be made in the classroom and is a useful exercise for pupils in following explicit instructions (see Toolkit).
- Both canopy cover and ground cover readings are taken at the same time.
- Report to the GLOBE database the total number of (+) and (-) measurements.
- To find out the percentage canopy and ground cover, divide the number of (+) by the total number of measurements and multiply the answer by 100. You will not need to report percentage cover to GLOBE, only the number of (+) and (-).

Tree height and circumference.

The aim is for pupils to use an appropriate method to measure the height and circumference of the trees in the study area. These measurements are particularly useful in giving scientists information they need to model natural processes, such as the water, carbon or nitrogen cycles. They also help further with interpretation of satellite images.

- A simple clinometer can be made following the instructions from the Toolkit.
- Ensure that the trees are marked so that the height and circumference readings are taken from the same trees.
- The pupils will need to practice the techniques before carrying out the field measurements.

Students can use a range of techniques to measure tree height. The trigonometry method is obviously for older students but the isosceles triangle method can be used with younger children. The method relies on the fact that if they look at the top of the tree from an angle of 45° then their distance from the tree plus their own height will be the same as the height of the tree.

An alternative (fun) method is to ask the children to walk away from their tree and with their back towards it, bend over and look between their legs until they can just see the top of the tree. At this point they are looking at the tree at an angle of about 45° so their distance from the tree is the height of the tree.

Maybe you could compare methods and see which is the most accurate and useful.

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GLOBE equipment

- Camera (standard colour film or digital)
- Transparent film
- Compass
- Flags or markers for marking out the site
- 50m tape measure in 1cm or smaller units
- Keys to identify local flowering plants and trees
- Canopy cover measuring tube 'Densiometer' (see pupil worksheet)
- 'Clinometer' (see pupil worksheet)
- Weather proof paint, bright plastic ties or aluminium tags

Available from your GLOBE centre:

- MultiSpec computer programme
- Landsat image
- GPS receiver
- Land classification system (UK MUC)

Further Land Cover Investigations

World Land Cover

Look at the GLOBE database, how many different classifications of land cover have been studied by GLOBE students. Find schools studying the same land cover type / MUC code as you. Can you compare climate between the two sites?

Write to the school using GLOBE mail and share photos and information.

Climate and Land Cover

Choose a school that has lots of land cover data and download the data for land cover and air temperature and rainfall. Is there a link between land cover and climate?

Canopy and ground cover

Collect data from several of your own sites or from several GLOBE schools. Is there a link between canopy cover and ground cover? If a site has 100% canopy cover does it have 0% ground cover?

Budburst, Green Up and Green Down

Do the Green Up and Green Down activities from the Phenology section. They ask you to look at one or more trees in spring or autumn and monitor the growth and decline of their leaves. This is a great way to learn more about trees, seasons and climate change. The scientists are anxious to have this data so they can look at climate change and its effect on natural systems.



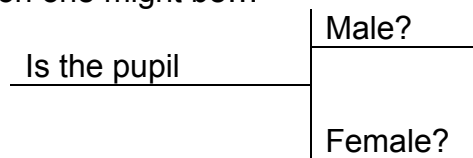
Extra Activities

Making a hierarchical key

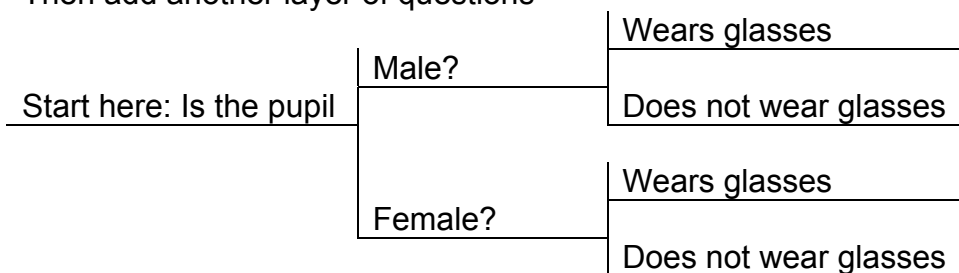
Aim: to understand how hierarchical keys are created and to make one to classify the pupils in the class.

Sit the pupils in a circle so they can see each other. Explain that the key needs to use with 'mutually exclusive' questions – the pupils should only fit into one option.

For example question one might be...



Then add another layer of questions



You could make one large key or several smaller ones using different questions. There is no right or wrong way to do this.

You could make a key for leaves or flowers. You could classify birds based on their beak shape.

Bird's Eye View

Aim: to think about land cover from an objective point of view.

Students imagine themselves as birds flying over the school grounds. When they land they make a map to show the grounds and use a key so that everyone can understand the symbols used. They will need to differentiate between different species of tree and make sure that this differentiation is obvious on their map.

Zooming in

Aim: to understand more about their biology study site, to ask questions.

Visit the biology study site and answer the following questions: What do you see? Hear? Feel? Is it wet? Dry? Warm? Cool? Is there a lot of sunlight hitting the ground? How many different plants and animals live there? How many objects are non-living? Man made? What would it look like at night? In winter? In spring?

Sketch the area. Make displays to show your site at different times.

Collect pictures of the animals and plants that you think live in your study site.

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GLOBE curriculum links

Geography Helps with understanding of locality using a range of skills and scales. A starting point for many geographical enquiries.

Key stage 2	1(a-e)	2(a-g)	3(a-g)	6(a-e)	7(a-c)
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Key stage 3	1(a-f)	2(a-g)	3(a-g)	4(a,b)	5(a,b)	6(a-e)	7(a-c)
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Science Strengthens investigative skills, encourages questioning and provides practical experience of habitat diversity and plant growth.

Key Stage 2	1.1(a,b)	1.2(a-l,m)	2.3(a)
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Key Stage 3	1.1(a,b)	1.2(a-p)	2.4 (a,b)	2.5(a)
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ICT Internet and satellite image are a source of relevant information GLOBE website is used as a tool for organising, representing and communicating data. Children's experiences of using the internet can be a basis for critical evaluation of ICT.

Key Stage 2	1(a)	1(b)	2(b)	3(a)	4(a-c)
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Key Stage 3	1(a)	1(c)	2(b)	3(a)
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Numeracy Purposeful, practical experience in measure, calculation and data handling. Provides practical understanding of distance, direction and angles.

Key stage 2	2.1(a-k)	2.2(b,f,h)	2.3l	2.4e	3.1	3.2a	3.4a,b,e
	4.1(b-h)	4.2(a-d)					

Key stage 2	2.1(g,h)	3.4a	4.1a	4.2d	4.3a-c	4.4a
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Literacy A purposeful source of non-fiction reading material, information and instructions to follow. Opportunities to communicate and publish information via e-mail and Internet. A stimulating forum for discussion.