



**DARWIN
INSPIRED
LEARNING**

Enquire with
Darwin

KS2

Module 2: Understanding the Environment

Lesson plan

Reading the natural world

Constantly, Darwin thought about the reasons for what he saw, and asked questions. To answer these questions, he carried out many experiments in the garden and meadows, ponds and woods near his home.

As a boy, Darwin started to look closely at the natural world. By the time he was eight, he had a passion for collecting all sorts of things from shells to minerals. As a student, he spent long hours on the seashore, collecting and naming specimens. His diaries from the Beagle voyage, when he was in his 20's, show him not only collecting and trying to name all the things he saw but also keeping notebooks so that he could work with them when he returned to England. He continued to build on his collections at Down House in Kent and also spent time walking the local lanes, regularly observing the natural world, his notebook always to hand, his eyes and mind sharp to observe the unexpected.

Quotation

Darwin wrote in his Journal of Researches, 1839, about making notes in the field: *'Let the collector's motto be, "Trust nothing to the memory"; for the memory becomes a fickle guardian when one interesting object is succeeded by another still more interesting.'*

'[A naturalist] ought to acquire the habit of writing very copious notes...and no follower of science has greater need of taking precautions to attain accuracy; for the imagination is apt to run riot when dealing with masses of vast dimensions and with time during almost infinity.'

Charles Darwin Admiralty Manual 1849 p.163



Above: Ladybird on ivy collecting nectar.

Below: Toadflax was a subject of one of Darwin's experiments.

Lesson outcomes

- Recognising how Darwin looked at the natural world, using framed and focused observation, as he walked in the natural habitats across the world and at home.
- Experiencing his ways of working using hand lenses and other methods to focus attention.
- Keeping a field notebook of observations, thoughts and feelings about the natural world.
- Asking questions about the environments explored and considering ways to investigate them.

Curriculum links

- Ideas and evidence in science: investigative skills, planning, obtaining and presenting evidence, considering and evaluating evidence.
- Living things in their environment, especially adaptation.
- Human effects in the environment.

Key words

Starting from a walk, observing, focusing, paying attention, note taking, posing questions, designing investigations, thinking, theorising, feeling, thinking path, habitats, individual species, populations, communities, interdependence, variation, struggle for survival.

Resources

Field Studies Council (FSC) Tree Name Trail: a key to common trees, hand lenses, Darwin notebooks and pencils, digital cameras, leaf slides (see Notes for teachers page 09), re-sealable polythene bags and labels, map of the area the class will visit in their lesson out-of-doors.



Above: Holly with berries.

Below: Hops, a climber in hedgerows.

Lesson sequence

Pre-visit lesson

Starter activity

To develop a sense of place, ask pupils to describe one place in the environment outdoors that they like best. They could produce a picture, a poem, or a description. Collect these thoughts together and talk about the diversity of habitats; places for animals and plants to live. Pay attention to what the pupils have seen and how they feel about these special places. This sense of place is very important in developing a strong connection to the natural world.

Darwin's sense of place is shown in the PowerPoint presentation. Slide 2 introduces Darwin and slide 3 shows where he lived. Slides 4 and 5 show the Sandwalk, Darwin's thinking path, at Down House. He walked here two or three times each day and this is where he formed many of his big ideas, walking and mulling over his thoughts. Use slide 6, to prompt ways of thinking about how Darwin would have observed the plants, and slide 7 to think about how close he might get to these animals on his daily walks.



Above: The Sandwalk at Down House was Darwin's 'thinking path'.

Below: Pupils walking round Darwin's Sandwalk at Down House.

Pre-visit lesson

Main activity

Starting from a walk and paying attention. Plan a short walk as a thinking path for the pupils to experience close observation, to think and to take notes.

Before going out-of-doors, discuss what Darwin took on his walk: a hand lens, a notebook and a pencil. Slide 8 may prompt more discussion. What else would he find useful today: a digital camera, small plastic bags, labels. Darwin went out at night and in all weathers.

Outside, ask pupils what they see; just the green of the playing field? Look closer; help everyone to focus on small parts of the habitat. Framing aids may be useful here (see Notes for teachers page 09).

Walk slowly and quietly round the route you have planned. Encourage everyone to make notes of what they see, hear, smell, or of a thought, a question or a feeling. Ensure everyone focuses, frames and collects one item to bring inside.

Plenary

Indoors, use the hand lenses to look closely at the items collected. Make sure everyone knows how to use the hand lens and how much they magnify (see Notes for teachers page 08).

Make a display of the items brought inside. Name this habitat, for example grassland, brick wall, tarmac path, hedgerow, pond so everyone knows where it is.

Ask each pupil to share a special observation and a question about this habitat.

Vote for the most interesting question and everyone writes it in their notebook.

Encourage everyone to write down one question they would like to investigate about the habitat they will be visiting next, and make sure they put their name on their Darwin notebook ready to use in this lesson out-of-doors.



Downe bank (Darwin's 'orchis bank')
now a Kent Wildlife Trust site.

Extension activities

Differentiation

- Show slide 6. Ask pupils to take up the position needed for them to photograph each of the examples. They will point their camera upwards, downwards, lie on the ground, get close to a branch or trunk of a tree, crouch, avoid prickles or tip-toe between the bluebells and wood anemones. Also, or alternatively, use slide 7 to think about how the animals move and how they react when someone comes near to take their photograph. Discuss why they move away.
- Leaf/tree identification: Collect different-shaped leaves and use the leaf slides (see Notes for teachers page 09) to look closely at them. Pupils each describe their own leaf and then discuss why leaves are so varied. The FSC charts will help pupils identify and name the trees each leaf comes from. Tree identification experts will be needed on the visits and in the post-visit lesson.
- Those who walk to school could look for different plants on one day, animals on another. They could listen for bird song or smell flowers, pick (but not eat!) berries they see and show them to the class. The sightings, smells, sounds and fruits observed can be marked on a local map and any questions, thoughts, and feelings added on post-it notes. They can also make a note of changes in each season.
- Play some environmental games (see website links).



Above: Primroses and bluebells growing on woodland floor.

Below: Ash leaves.

Visit

Visit a park, local nature reserve or, if possible, Down House.

Looking at different levels: On the visit use the same Darwin Inspired methods of framing and focusing, using the notebooks and hand lenses and collecting small specimens. Plan the visit to a habitat that is unlike the school grounds, for example, a woodland or meadow, a park, nature reserve or garden.

Use the thinking path method to start an exploration of the habitat. Encourage and help pupils to focus on the plants and animals present, identify them and raise questions.

To move thinking from the species level to thinking about populations of animals and plants, divide the class into pairs and each pair identifies and counts the number of a single tree species, sycamores, oaks, ash, birch, beech, yew, holly trees, and the number of a single animal species, woodlice, spiders, squirrels, bees, pigeons they can see.

Ask each pair to write down their ideas on how each individual, in their two counts, struggles with others of the same species, to survive. How do 3 or 4 sycamore trees growing close together struggle with each other to survive?

Match pairs that have counted different species. They discuss and write down any ways in which they think their species might interact (a pigeon perches in a sycamore tree, a spider makes a web in a yew tree). The whole habitat is made up of a community of living things that depend on each other in some way (see Notes for teachers page 10). Ask some pairs to take photographs of evidence that shows how one species interacts with another (spiders webs, holes in leaves, bird nests, plants climbing up other plants). Ask other pairs to take photographs of food supply for animals in the habitat (leaves, seeds, flowers) and the competitors for this food (birds and squirrels).

Everyone writes down one example of how they think humans fit into this habitat. Do gardeners work here? Are there any buildings here? Do people drop litter?



Above: Grey squirrel on an oak tree.
Below: Hawthorn berries.

Post-visit lesson

On a map of the habitat visited, drawn on a large piece of paper or projected on a whiteboard, each pair marks, with a coloured pen or post-it note, the most interesting observation they made in their notebook. Print or upload some of the images to add to the map.

Match up pairs that noted different aspects of the habitat. As they write about the habitat, encourage them to use the words population (numbers from their count), struggle to survive (how individuals struggle with each other) and communities (how species interact with each other) as they compare what they noticed about each species.

Join pairs to make mixed ability groups to prepare a presentation by, for example, drawing graphs of their counts or using their images to compare findings. Each group makes its presentation and the rest of the class make notes in their notebook of what other groups have discovered.

Plenary

Investigating like Darwin: one of the questions Darwin thought about as he walked the Sandwalk was: How do plants reach a woodland habitat?

Use the page from Darwin's notebook (See Resource materials page 13 and slide 9), that explains the experiment Darwin planned to help him answer this question. Discuss whether Darwin designed the investigation well. Suggest how it could be improved.

Ask everyone to find the question they wrote down before their visit and discuss whether they found the answer or what they could do to investigate it now.

Assessment of progression

Each pair creates a poster of the class findings with a reminder that encourages continued use of their Darwin notebook in the centre.

Take in the notebooks and read them for evidence of progression in understanding the natural world. The notebooks may also show how far pupils have progressed in terms of Darwin Inspired learning criteria (see KS2 Introduction).



Above: Caterpillars on stinging nettles.

Below: Sweet chestnuts on woodland floor.

Notes for teachers

Pre-visit lesson

Introduce Darwin using PowerPoint slide 2 and the places he knew well (slides 3, 4 and 5). For a 360° view of the beginning of the Sandwalk near the house, go to <http://www.english-heritage.org.uk/daysout/properties/home-of-charles-darwin-down-house/history-and-research/> The Sandwalk took Darwin around a copse of trees.

The tools of the scientific field naturalist are very simple but it is worth spending time training pupils to use notebooks and hand lenses and to frame and focus their observations. An important tip about selecting a hand lens is to get a quality lens. Unfortunately many low quality hand lenses are on sale. 7X magnification is a good choice for teaching proper hand lens use because the larger diameter makes it easier for the object to get enough light to view easily. Just like a microscope, the eye should be close to one side of the lens and the object will be close to the other side of the lens. Practice manipulating the object and hand lens to get things into focus. If used like a reading-glass magnifier, the hand lens held away from the body, it works up to a point, but close observation is ideal. Getting the right light on the object is important. Move the lens around to find a position where the object is in the sunlight. Watch the Youtube video (see websites)

What pupils see and how they feel about a place is very important if they are to develop a strong connection to the natural world, what Darwin's biographer Janet Brown, calls '*a sense of place*'.

Risk Assessment needed. Plan a short walk outdoors using the local environment available.

The experience of being out-of-doors and paying close attention to the natural world may well be something new for some pupils. They need to learn how to look, where to look and how to interpret what they see. Much research supports this view (see references).



Above: Correct use of a hand lens.

Below: Cracks between paving stones are a microhabitat.

Pre-visit lesson

Differentiation

Movement and dance. Use the positions pupils would need to adopt to record the images shown in the montage slides to create a dance or set of movements in gymnastics.

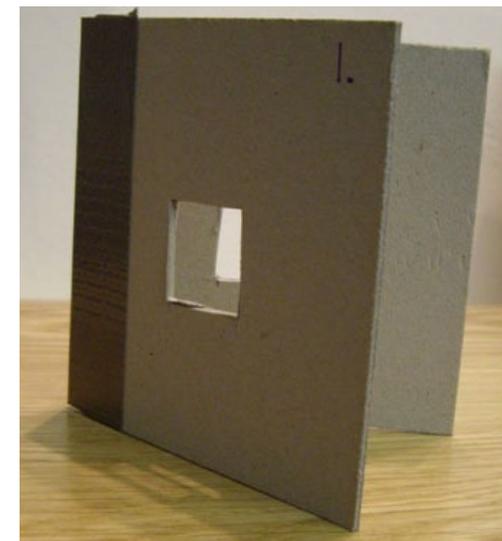
Leaf slides

Small 10-centimetre frames cut from card, or cardboard tubes can be useful and dental mirrors can be good for looking under leaves or into crevices without disturbing them.

- Use picture frame mounting card as it is very thick and durable.
- For each slide cut 2 10cms squares. Take care when using a Stanley knife to cut the card carefully.
- In the exact centre of each card cut a square 2 centimetres square.
- Put pairs of cards together and bind one edge with elephant tape
- Number the cards.

To use the leaf slides, slip a leaf between the squares and hold it up to a bright part of the sky (not the sun). The structure of the leaf will become visible. The process of framing helps naturalists to concentrate and pay attention, to look for patterns and anomalies which raise interesting questions but also 'extract the signal from the overwhelming noise of nature' (see Canfield's *Field Notes* reference page 12).

Encourage children to do this activity in walk-to-school week or during a science/environment week. Parents could be asked to assist especially in collecting berries and with smelling flowers. A local map will be needed to record the sightings and other findings. Showing the interaction of species can be achieved using environmental games (see websites).



Above: Leaf slide.

Below: Using a leaf slide in the field.

Visit

A risk assessment will be needed and a preliminary visit if possible. Plan a visit to a different habitat from the local environment; a woodland, meadow, garden, park or nature reserve or an area Darwin worked in if possible. (See websites)

The purpose of the visit is to learn to look at the environment at different levels (individuals, populations and communities) and to start to think about how the animals and plants interact.

Pupils will explore the struggle for existence, one of Darwin's big ideas. He had read Malthus and his theories about what happens when populations increase rapidly.

Interdependence was also a major Darwin theme. He finished his great work, *On the Origin of Species* (1859) with this quotation:

'It is interesting to contemplate an entangled bank clothed with many plants of many kinds with birds singing on the bushes with various insects flitting about and with worms crawling through the damp earth and to reflect on these elaborately constructed forms so different from each other and dependent on each other in so complex a manner have all been produced by laws acting around us.'

Looking at how humans become part of the habitat equation is also important on the visit.



Above: Honeysuckle.

Below: Park Environment

Post-visit lesson

Plenary

This activity takes one of the questions that occurred to Darwin as he walked the Sandwalk and how he investigated it with an experiment (Page 13 and slide 09). Pupils could try this experiment for themselves or investigate their own questions about the natural world and their visit.

The natural world is just one step outside the classroom. Darwin's inspiration came from his close observation of the natural world on his doorstep. Virtual tours of the landscape that inspired him are available (see websites). Creating a virtual tour video of habitats locally could be a project to follow this unit.

Assessment of progression

The introduction to KS2 has a list of Darwin Inspired learning criteria. Use these in conjunction with the Darwin notebooks, displays and graphs.

Website links, videos, interactives, references

Websites

How to use a hand lens or magnifier

http://www.youtube.com/watch?v=dtVv_IFiU8I

Virtual tours of Darwin's countryside and house

<http://www.bromley.org/ciswebpl/darwin2/virtualtours.asp>

Finding the Sandwalk

<http://www.darwinlandscape.co.uk/theme.asp?navid=60>

Find the magnifier in Darwin's bag

<http://www.sedgwickmuseum.org/exhibits/darwin.html>

Play, learn and have fun environmental games

http://www.naturedetectives.org.uk/play/group_games.htm

Down House – contact for visits

<http://www.english-heritage.org.uk/daysout/properties/home-of-charles-darwin-down-house>

For research on woodlands

http://www.plantlife.org.uk/wild_plants/celebrating_our_woodlands/

<http://naturedetectives.org.uk/packs/trees.html>

Visiting woodlands

http://www.woodlandtrust.org.uk/en/our-woods/Pages/woodland-trust-woods.aspx#.TxBQa_16LcM

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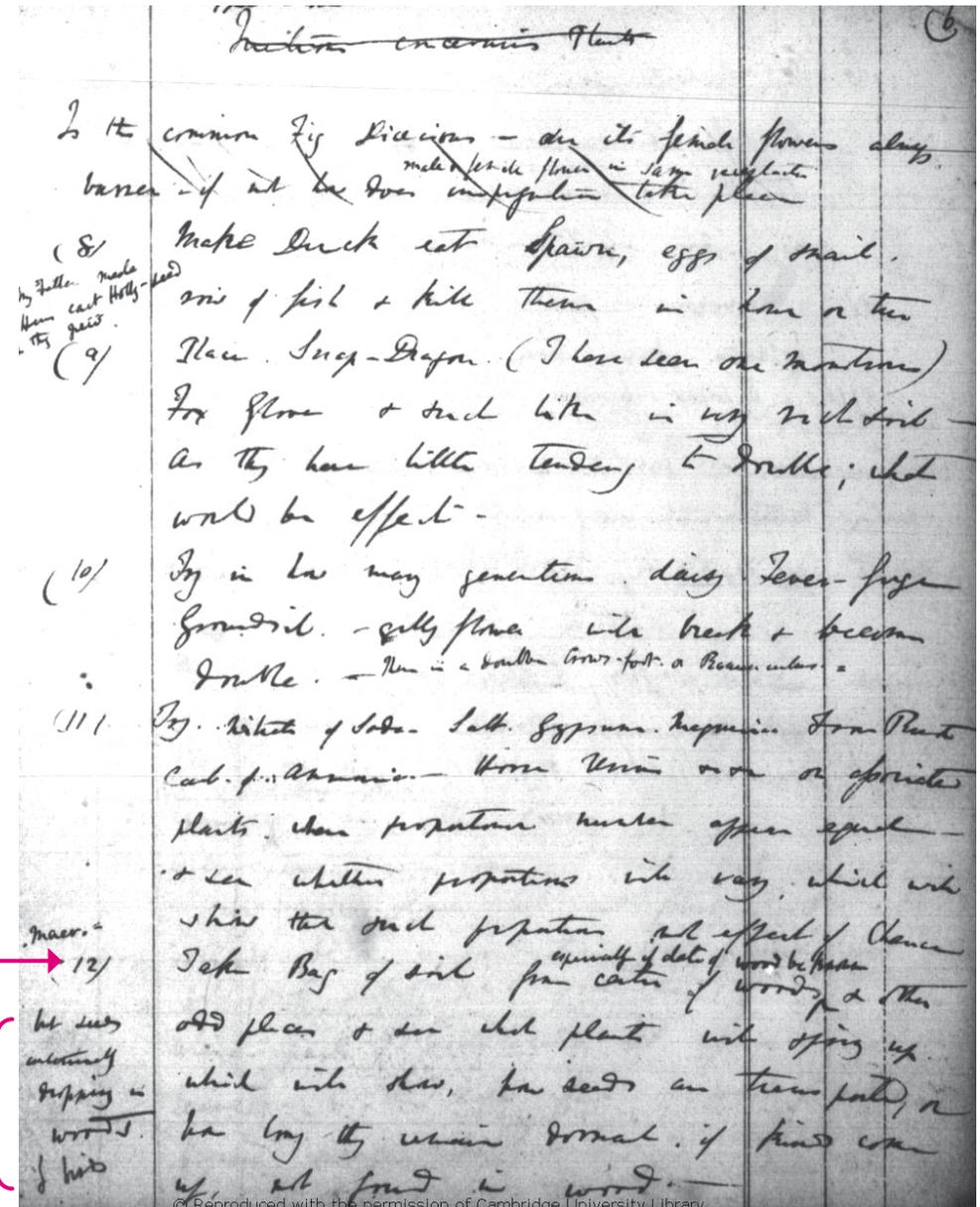
Resource materials

How do plants reach the woodland habitat?

A page from Darwin's notebook
Questions and Experiments
(1838-1844)

(12) Take Bag of soil from centre of woods especially if date of wood be known & other odd places & see what plants will spring up which will show how seeds are transported, or how long they remain dormant, if kinds come up, not found in wood.

'but seeds continually dropping in woods, by birds.'



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