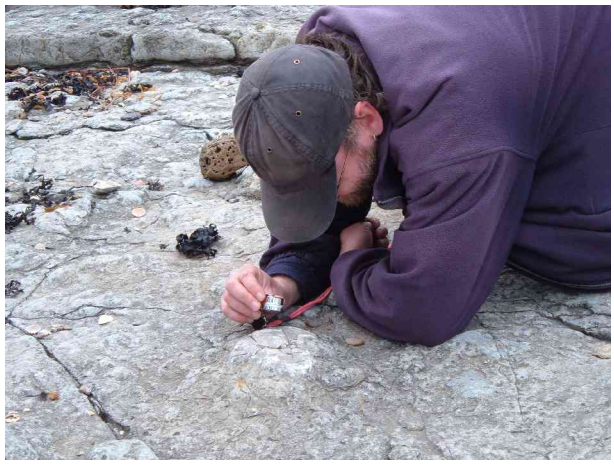
Primary Earth Science Outdoors
- Teachers' Guide -

INTRODUCTION

scottish earth science education forum



Introduction
Why outdoors? Why earth science? Curriculum for Excellence links

Suggested Activities
Activities based around five Big Questions related to the landscape

Resources
Health & safety, getting help, books, maps and rock kits

The Scottish Earth Science Education Forum (SESEF) is an association of educators and scientists established to promote understanding of planet Earth in Scottish schools and colleges.

Membership of SESEF is free – visit www.sesef.org.uk for further information.

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Introduction

Earth science is an exciting science subject for primary schools, capable of firing children's imagination and promoting relevant, accessible science. Earth science is best done out doors, where children can directly experience their local landscape, discover what has made it the way it is, how and why it changes, explore how people have used it in the past and present and speculate about how it might be used in the future. Exploring the local environment is a key component of a Curriculum for Excellence (CfE).

Using this guide

This Teachers' Guide has been produced by the **Earth Science Outdoors** project, which is developing resources to encourage and support outdoor learning within a Curriculum for Excellence. All our resources are available free from our website, and teachers are welcome to use and adapt them.

This guide is written as a resource to aid teachers in getting outdoors with pupils, exploring the local area and finding out more about the Earth. It cannot be a complete package – you'll need to do a bit of work to identify local places to visit, carry out a risk assessment and choose activities that are suitable for your group and the theme that you want to explore. You might want to prepare material for pupils.

We welcome feedback, suggestions and examples of how you have used the guide. Contact us through the SESEF website www.sesef.org.uk.

Why Outdoors?

Outdoor learning has become increasingly important within Scottish education since the development of a Curriculum for Excellence.

In our rapidly changing society, where children have increasingly indoor, sedentary lifestyles there is a need for children to experience the world beyond the four walls of the classroom or house. Many jobs rely on practical skills and involve working outdoors in a variety of different environments and conditions.

Undertaking earth science projects offers valuable opportunities to learn outdoors and develop key science skills that cannot be replicated in a laboratory or indoor environment. The flexible nature of fieldwork allows for a range of approaches that have wide appeal. For example, the use of handheld and portable data logging devices and GPS systems to collect evidence appeals to those with technological interests. Other children enjoy sketching and writing to record their observations of their local landscape. Some need the reassurance of working as part of a group. Activities such as transect work naturally fit this approach.

We are now living in a world with a rapidly changing climate and need to find ways of living sustainably and respecting our environment. Direct contact with the natural environment can inspire wonder, curiosity and awe. This helps motivate people to develop the necessary knowledge, skills and understanding to change their lifestyles. The Taking Learning Outdoors report (2007 – see references) suggests this can be achieved *"by re-engaging children and young people with their planet through learning outdoors – frequently throughout their school life and in a variety of contexts and settings."*

Several Scottish Government publications refer to outdoor learning, e.g.: *"All aspects of the curriculum can be explored outside. The sights, sounds and smells of the outdoors, the closeness to nature, the excitement most children feel, the wonder and curiosity all serve to enhance and stimulate learning."* Scottish Executive (2007) Building the Curriculum 2: Active Learning in the Early Years p18

A Curriculum for Excellence does not prescribe outdoor learning, but it is implicitly encouraged within statements about providing varied teaching and learning experiences beyond the classroom. In science, social subjects and health and wellbeing, there are experiences and outcomes that make specific reference to learning outdoors. Learning and Teaching Scotland have web pages specifically devoted to outdoor learning: http://www.ltscotland.org.uk/outdoorlearning/index.asp.

A Definition of Outdoor Learning

The Taking Learning Outdoors Report (2007) states "...the outdoor classroom is a setting, outdoor education is a process in which educators, students and others take part, and outdoor learning is the learning which accrues as a result."

In its most simplistic form, outdoor learning is...learning outdoors. Like learning indoors, this is a complex process.

The benefits of outdoor learning have long been recognised. As schools embed the principles and purposes of a Curriculum for Excellence, staff have a great opportunity to follow this advice:

"That which ought and can best be taught inside the classroom should there be taught, and that which can best be learned through experience dealing directly with native materials and real life situations outside the school should there be learned." Julian Smith, 1943, Outside the Classroom, The Educational Forum, 7(4), 363

Being outside allows children to experience or feel:

- A greater sense of freedom: the feeling of space can be emphasised when looking at a wide landscape.
- The changing weather and temperatures: the local area will change in appearance through the seasons and the impact on the landscape can be observed.
- Whole body, multi-sensory learning: walking to a nearby site, examining the textures of different buildings, etc. Fieldwork is, by its nature, interactive.
- A different quality to the relationships with other children, adults and the environment: being outdoors and away from the classroom allows staff to observe children in different places and how they react
- Opportunities to challenge their own limits and learn about safety: preparing and going outside in almost all weathers, learning to manage uneven surfaces, practising sensible behaviours near water, roads and steep slopes are some of the many opportunities to develop responsible behaviours and safe practices.

Nicol et al (2007), found that the delivery of outdoor learning and the aims and focus of the experience make a big difference to what is learned. *"Simply 'being outdoors' is not sufficient for young people to express an ethic of care for nature or develop an understanding of natural processes. These things seem to be learned when they are an explicit aim of experiential activities and when they are mediated in appropriate ways."* (Key finding 14).

Earth Science Outdoors as part of planned approach can:

- Increase attainment in specific subjects such as science and social subjects especially in terms of developing practical skills
- Impact positively on health and well being of young people. For example, children are more physically active when undertaking fieldwork than in a classroom.
- Help develop responsible citizens and lifelong appreciation of the natural world. Children are able to connect with their environment and develop a sense of place through observing and interacting with the landscape, asking questions and thinking about the associated issues.
- Improve social and communication skills of young people through the cooperative nature of much fieldwork.
- Effectively weave together many of the strands of sustainable development education in a real world context.
- Cover a range of learning styles and intelligences.

Delivering Outdoor Learning Effectively

Earth Science Outdoors is designed to enable teachers to increase the number of local trips to study science outside. A key finding of research undertaken by Mannion et al (2006, p86) is that *"formal outdoor education needs to be more rounded in terms of its focus, more regular throughout the year and more inclusive for all pupils"*.

The Earth Science Outdoors activities focus on:

- Interdisciplinary learning across subject areas
- The use of the local neighbourhood, especially ‘greenspace’
- Several linked visits over a period of time, rather than a one-off trip
- Starting where the young person is at, in terms of their interests, knowledge and understanding
- Children involved in the planning and decision-making
- Routines that develop skills and build independence
- Teaching and learning in, through and about the natural world
- Developing skills of observation, measurement, interpretation, recording and reporting
- Building in opportunities for reflection with the children
- Sharing experiences and findings

Why earth science ?

Earth science is an exciting subject for primary school children, capable of firing children's imagination and promoting relevant, accessible science. It can be taught as an interdisciplinary project at all ages and stages and can underpin many popular science topics. Earth science may be most effectively taught outdoors with indoor activities designed to build upon and complement these place-based outdoor activities.

Our planet Earth exists through the interactions of the components illustrated in Figure 1. By considering each component separately and through their relationships to and with each other, and their interdependence, children can develop an understanding of the natural world in which we live. In each component there are chemical, physical and biological processes taking place.

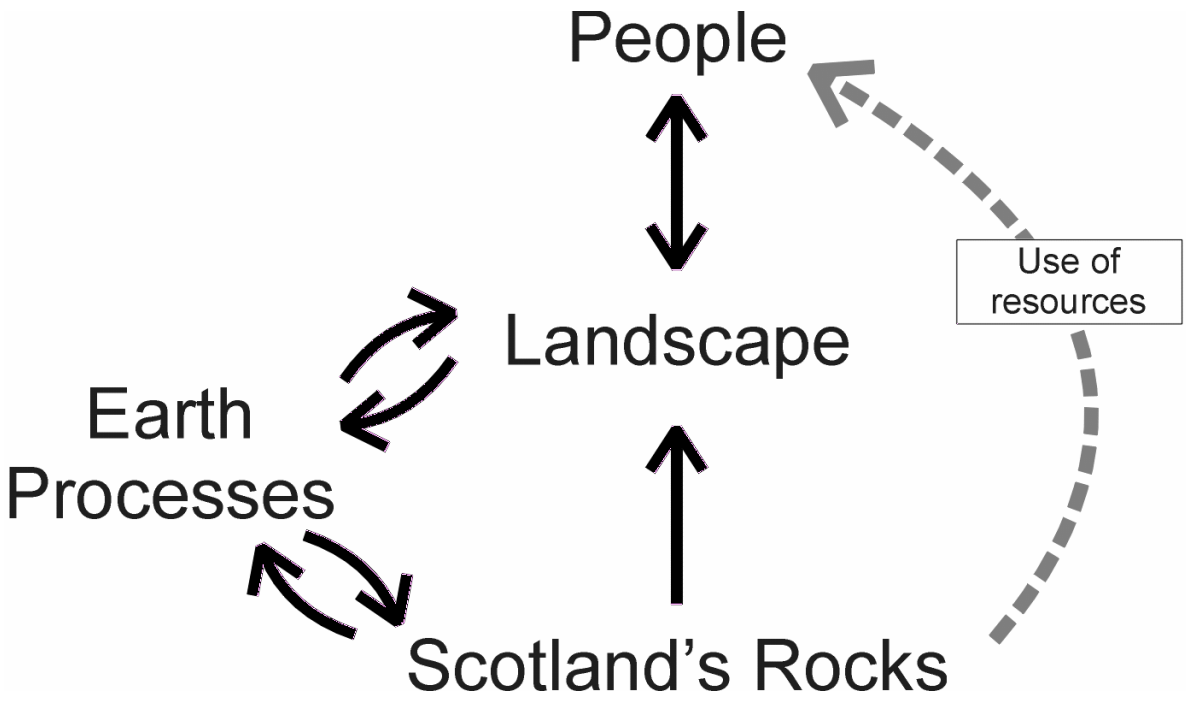

Figure 1: Earth Science Outdoors – relationships between key components.

Earth processes include:

- The impact of weather, climate and movement of water
- Formation of soils
- Movements of the earth’s crust, e.g. plate tectonics, volcanoes and earthquakes

Earth science within a Curriculum for Excellence

The sciences and social studies frameworks provides a range of different contexts for learning which draw on important aspects of everyday life and work.

Learning in the sciences will enable me to: (taken from CfE Sciences Experiences and Outcomes)	**Learning *in, through and about* earth science can relate to these Experiences and Outcomes:**
Develop curiosity and understanding of the environment and my place in the living, material and physical world	The beauty of earth science lies in its ability to be as complex or as simple as necessary. It can be studied at all scales from a micro or a macro level. For primary schools, this means that any earth science project can be taught at any age to almost all abilities in a way which starts where the learner is at.
Demonstrate a secure knowledge and understanding of the big ideas and concepts of the sciences	Earth science concepts include time, long term change and large-scale processes (e.g. through the “rock cycle”). Studying earth science poses several big questions: Why does the planet Earth look like this? Where can we find active processes that show change is happening now? Has the planet Earth always been like this? How has the planet Earth influenced people?
Develop skills for learning, life and work	Earth science is accessible – pupils can experiment and gain confidence in undertaking practical tasks using safe, everyday materials. They can learn to question, to try things out, to build on their existing experiences.
Develop the skills of scientific inquiry and investigation using practical techniques	Fieldwork is an essential component within earth science. This includes learning to use digital and traditional equipment. Being able to observe the landscape, weather, stars, etc., allows children to ask questions, hypothesise, test ideas and explore their local natural and built environment.
Develop skills in the accurate use of scientific language, formulae and equations	Pupils can progress from experimenting with their own ways of describing rocks and landscape features to learning some scientific terminology – and more importantly appreciate why scientists develop standard terminology and classifications to help communicate with each other. Maths is the language of science. Pupils can enhance their numeracy skills by recording and measuring things in the outdoors, and displaying their results.
Apply safety measures and take necessary actions to control risk and hazards	Learn how to be and work outdoors safely and the preparation required. This includes working in all weathers and many different environments.
Recognise the impact the sciences make on my life, the lives of others, the environment and on society	Earth science is very relevant to everyone. For example, the weather and climate impacts on our choice of clothing. Houses are built from the earth’s resources and situated in accordance with the surrounding landscape. Hazards such as tsunamis and earthquakes can cause significant impact the economy and progress of a country or region.
Recognise the role of creativity and inventiveness in the development of the sciences	The history of earth science and the development of ideas about plate tectonics, climate and landscape change are good examples here.
Develop an understanding of the Earth’s resources and the need for responsible use of them	Through understanding the processes taking place within and on the Earth’s surface and atmosphere, young people can understand that water, air, plants and animals are vital resources as well as minerals, rocks, oil and gas.
Express opinions and make decisions on social, moral, ethical, economic and environmental issues based upon sound understanding	Earth science can develop young people’s understanding of the science behind climate change, the greenhouse effect and other environmental issues including land use and local human impacts. This in turn aids discussion and promotes taking action.
Develop as a scientifically-literate	Earth science is about the world in which we live. A high tech laboratory or

citizen with a lifelong interest in the sciences	equipment is not needed to observe, explore and understand processes.
Establish the foundation for more advanced learning and future careers in the sciences and the technologies.	Prepares young people for related careers in engineering, oil and gas industry, surveying, sciences, outdoor and environmental professions

CfE Outcomes relevant to Earth Science Outdoors

Earth science is relevant to a range of Curriculum for Excellence Outcomes in Early, First and Second Levels.

Outcome code	Description
SOC 0-01a	I am aware that different types of evidence can help me to find out about the past.
SOC 1-01a	I understand that evidence varies in the extent to which it can be trusted and can use this in learning about the past.
SOC 2-01a	I can use primary and secondary sources selectively to research events in the past.
SOC 1-02a	By exploring places, investigating artefacts and locating them in time, I have developed an awareness of the ways we remember and preserve Scotland's history.
SOC 2-02a	I can interpret historical evidence from a range of periods to help to build a picture of Scotland's heritage and my sense of chronology.
SOC 0-07a	I can explore and discover the interesting features of my local environment to develop an awareness of the world around me.
SOC 1-07a	I can describe and recreate the characteristics of my local environment by exploring the features of the landscape.
SOC 2-07a	**I can describe the major characteristic features of Scotland's landscape and explain how these were formed.**
SOC 2-07b	**I can describe the physical processes of a natural disaster and discuss its impact on people and the landscape.**
SOC 2-08a	I can discuss the environmental impact of human activity and suggest ways in which we can live in a more environmentally-responsible way.
SOC 2-10a	Having explored my local area, I can present information on different places to live, work and relax and interesting places to visit.
SOC 0-12a	While learning outdoors in differing weathers, I have described and recorded the weather, its effects and how it makes me feel and can relate my recordings to the seasons.
SOC 1-12a	By using a range of instruments, I can measure and record the weather and can discuss how weather affects my life.
SOC 1-13a	Having explored the landscape of my local area, I can describe the various ways in which land has been used.
SOC 1-13b	By exploring a natural environment different from my own, I can discover how the physical features influence the variety of living things.
SOC 2-13a	**I can explain how the physical environment influences the ways in which people use land by comparing my local area with a contrasting area.**
SOC 1-14a	**Through activities in my local area, I have developed my mental map and sense of place. I can create and use maps of the area.**
SOC 2-14a	**To extend my mental map and sense of place, I can interpret information from different types of maps and am beginning to locate key features within Scotland, UK, Europe or the wider world.**
SCN 0-05a / SCN 1-05	By investigating how water can change from one form to another, I can relate my findings to everyday experiences.
SCN 2-05a	I can apply my knowledge of how water changes state to help me understand the processes involved in the water cycle in nature over time.
SCN 2-01a	**I can identify and classify examples of living things, past and present, to help me appreciate their diversity. I can relate physical and behavioural characteristics to their survival or extinction.**
SCN 1-15a	Through exploring properties and sources of materials, I can choose appropriate materials to solve practical challenges.
SCN 2-15a	By contributing to investigations into familiar changes in substances to produce other substances, I can describe how their characteristics have changed.
SCN 2-16a	I have participated in practical activities to separate simple mixtures of substances and can relate my findings to my everyday experience.

SCN 2-17a	**Having explored the substances that make up Earth's surface, I can compare some of their characteristics and uses.**
SCN 0-20a	I can talk about science stories to develop my understanding of science and the world around me.
SCN 1-20a	I have contributed to discussions of current scientific news items to help develop my awareness of science.
SCN 2-20a	Through research and discussion I have an appreciation of the contribution that individuals are making to scientific discovery and invention and the impact this has made on society.
SCN 2-20b	I can report and comment on current scientific news items to develop my knowledge and understanding of topical science.
TCH 1-02a	Throughout all my learning, I take appropriate action to ensure conservation of materials and resources, considering the impact of my actions on the environment.

MNU 2-07a	I have investigated the everyday contexts in which simple fractions, percentages or decimal fractions are used and can carry out the necessary calculations to solve related problems.
MNU 2-11a	I can use my knowledge of the sizes of familiar objects or places to assist me when making an estimate of measure.
MNU 2-11b	I can use the common units of measure, convert between related units of the metric system and carry out calculations when solving problems.
MNU 2-11c	I can explain how different methods can be used to find the perimeter and area of a simple 2D shape or volume of a simple 3D object.
MNU 2-20b	I have carried out investigations and surveys, devising and using a variety of methods to gather information and have worked with others to collate, organise and communicate the results in an appropriate way.
MTH 2-17a	I have investigated angles in the environment, and can discuss, describe and classify angles using appropriate mathematical vocabulary.
MTH 2-17b	I can accurately measure and draw angles using appropriate equipment, applying my skills to problems in context.
MTH 2-17c	Through practical activities which include the use of technology, I have developed my understanding of the link between compass points and angles and can describe, follow and record directions, routes and journeys using appropriate vocabulary.
MTH 2-17d	Having investigated where, why and how scale is used and expressed, I can apply my understanding to interpret simple models, maps and plans.
MTH 2-18a / MTH 3-18a	I can use my knowledge of the coordinate system to plot and describe the location of a point on a grid.
MTH 2-21a / MTH 3-21a	I can display data in a clear way using a suitable scale, by choosing appropriately from an extended range of tables, charts, diagrams and graphs, making effective use of technology.

References

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All of nature for all of Scotland

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