

Rocks and Soils



LEAF Education

Stoneleigh Park

Warwickshire CV8 2LG

Rocks and Soils



Contents

Introduction	Page 3
Have a go at making soil	Pages 4-5
Soil Profiles	Page 6
Layers of soil	Pages 7-8
Make a geological model of your farm/land	Page 9
Recipe for salt dough	Page 10
The Crop Rotation Game	Pages 11-19
Muddy Mystery	Page 20
More soil activities	Page 21
Panorama drawings using natural materials	Page 22
Useful websites	Page 23
Farming and Countryside Education (FACE)	Page 24

Rocks and Soils



Introduction

Everything that we use, build with, our food and even our transport can all be traced back ultimately to resources that come from rocks and soils.

Use the following activity to demonstrate how much soil there is on the earth.

“How much soil is there” apple analogy, <https://www.soils.org/files/about-soils/earth-science-week-2007.pdf>

There are also several demonstrations of this activity on Youtube e.g. <https://www.youtube.com/watch?v=S8cD4M9Ayg4>



Rocks and Soils



Have a go at making soil

Equipment:

Canvas bags

Mallets

Boards/ logs to put bags on for hitting

Ingredients for soil (air, water, rocks and minerals, organic materials (live and dead) and insects and organisms).

Leader's Notes:

Ask children what they think is in soil, get them to squish some soil about and see if they can work it out.

In groups ask the children to fill their bags with the ingredients of soil (NO LIVING CREATURES).

Health and safety: Brief the group about working safely with mallets (don't let go of mallet, don't stand behind/in front of someone using a mallet etc.)

Close the bags, place them on logs/boards and hit them with mallets to speed up the weathering process. As group are hitting the bags remind them of processes involved: micro organisms, mini-beasts, weather, water, etc.

Have a look at how they have done.

Of course we can only speed things up a bit, in reality it takes thousands of years for soil to form.

Several factors determine the type of soil that is formed:

Parent material

Climate

Topography

Time

Organisms

Rocks and Soils



Roughly speaking it takes 500 years to make 1 to 2cm of soil.

Soil is precious and so we must look after it!

There is an old farmer saying “Look after your soil and the crops and animals will look after themselves.”

Farmers do a number of things to protect their soil:

- Planting shelter belts to help slow down erosion

- Using special cultivation techniques

- Planting nursery crops to protect soil while main crop establishes

- Growing green manures

- Using buffer strips around fields

- Avoiding over grazing

Rocks and Soils



Soil Profiles

Dig pits in soil to show the different layers in a soil profile and how soils can vary enormously in a small area. (Showing the effects of bed rock, slope etc.)



Rocks and Soils

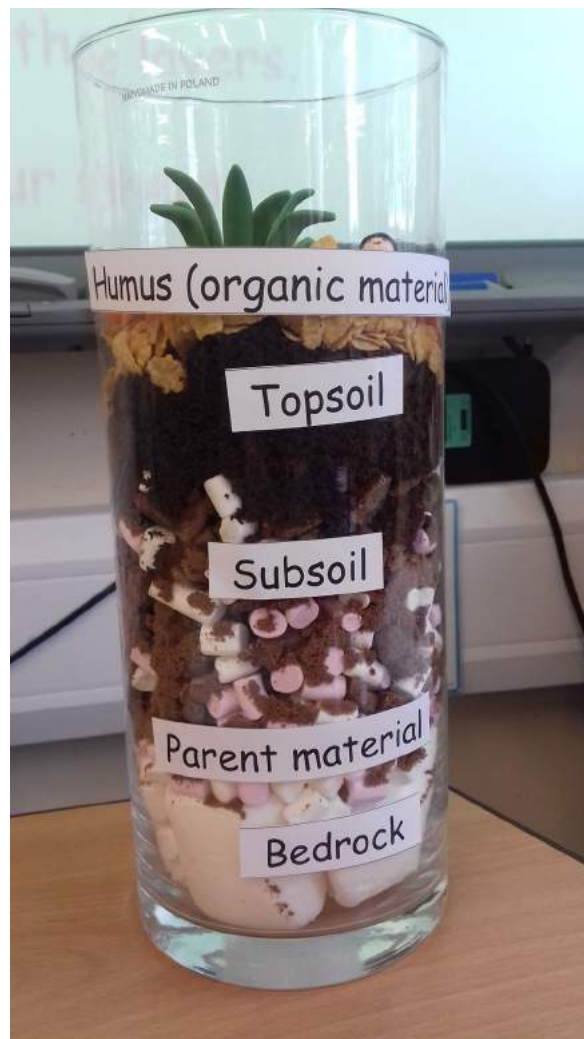


Layers of soil

A teacher introduced us to this video which explains the different layers of soils and the composition and function of each:

<https://www.youtube.com/watch?v=ysIm7lmsK6c>

After watching the video, children can create their own soil horizon using marshmallows, biscuits etc!



Rocks and Soils



Layers of soil

Soil samples are taken from two different types of soil e.g. a sandy and a clay soil. (This could either be done by the teacher/leader, or older students could be asked to collect a higher number of samples themselves from a pre-chosen areas of the school - for example, their school garden, the field, the compost, in the woods etc.)

Students need to understand the idea of 'fair testing' e.g. the soil samples must be the same size to give accurate results.

The samples are mixed with equal amounts of water and in identical jars - again to provide a fair test. The jars labelled Soil A and Soil B are shaken and allowed time to settle. Hopefully the students will then be able to see how soil is made up of various sized particles: small stones, sand, silt and clay. There will probably be tiny particles still suspended in the water, making it cloudy, and they may also find there is organic matter floating on the top of the water - all this can be discussed with the students.



The next stage is to measure the different layers to find out which is the 'sandy soil' and which is the 'clay soil.' They should discover that both soils have elements of both, but the sandy soil will have a larger sand layer. It is quite hard for younger students to measure the layers using a ruler, so get them to use strips of paper to mark where the layers are, and then measure their marks using a ruler. They can then record their results onto a data table, and feed back to the class to determine which soil was which.

Rocks and Soils



Collecting soil samples

When we want to compare soils from different areas, what should we do to make it a fair test?

(Dig to same depth; Collect the same amount of soil;)

Collect a soil sample using a trowel.

(You should dig down, ideally to about a foot depth and include some leaf litter from the surface)

Place each soil sample in a labelled bucket or bowl.

(You will need to carry out a risk assessment for this, the details of which will depend on where you are collecting your soil from).

Appearance

Describe the appearance of the soil. Explore its texture by rubbing some between fingers and record its colour by smearing a small amount onto a piece of white paper. When the smear has dried a coloured stain will be left behind when you brush away any loose soil.



Teachers trying out the activities at ASE Conference 2017

Rocks and Soils



Make a geological model of your farm/land

(With thanks to Peak District National Park)

Equipment:

- Time capsules containing items that represent different geological time periods.
- Pictures of landscapes in different time period
- Tray to make model of rock stratigraphy on.
- Salt dough in different colours to represent each rock type.

Leader's Notes:

The children hunt for hidden time capsules, starting with the oldest.

When they have found the time capsule, use the items inside to work out what the world might have been like then. Using this information they build a model of the local geology.

Our oldest capsule represented the formation of Jurassic Limestone 165 million years ago (shells, dinosaurs etc.) Using the items from the time capsule and pictures of a Jurassic sea, the group makes model creatures and plants using the salt dough. The models are placed on the tray and the class discusses how rocks are formed by compression and how fossils can help us find out what lived millions of years ago.

The group then count steps forward in time. (Each step represents 1 million years) until you reach the area where the next time capsule is hidden.

The process is repeated for each time capsule, making a new layer of rock each time, until you have a layer cake of rock types. Now the layers can be bent, tilted, folded, weathered etc. to give a model of what is exposed on the surface in the present day.

Rocks and Soils



Recipe for Salt Dough:

2 cups water

2 cups salt

2 cups flour

1 table spoon cooking oil

1 tablespoon cream of tartar

Food colouring

Put all ingredients in large pan and heat, stirring continuously. The mixture will go lumpy but if you keep stirring eventually it will form a dough. The dough will keep for a couple of weeks in the fridge.

(Tip: don't clean pan between colours just add next batch of ingredients. Leave pan to soak before attempting to wash up.)



Rocks and Soils



The Crop Rotation Game

This game was devised by Rushall Farm, an organic farm in West Berkshire. It is a decision-making game based on a 6-year rotation in one field. The aim of the game is to see who can maximise output from the field while maintaining the fertility of the soil. The game is intended for KS3/4 students and community groups. The resources, which are shown below, may be printed and laminated. The field cards can be attached to display boards to show the completed results.

The following downloads are required for the game: (saved separately – fact cards, years, arrows, joker card, oak tree field).



Rocks and Soils



Resources needed per Group:

Five Factfile sheets: Wheat; Oats; Beans; Fallow; Grass and Clover.

Field cards (2 of each); arrows (2), year cards and a 'joker' card.

Instructions:

1. Divide the participants into groups of 4 or 5 and explain the aim of the game: You have one field (see picture of Oak Tree Field) and over a period of 6 years you will grow grass & clover, oats, beans & wheat. The option of remaining fallow is also available.

The aim of the game is to see who can make the most out of the field by planting carefully using a six year rotation while retaining the soil fertility.

2. Issue the five Factfile sheets and explain the information given. The Factfiles need to be read carefully to see what the crop takes out, or puts into, the soil by way of nutrients.

3. Issue the six year cards, arrows, field cards and the 'joker' card to each group. Explain how the 'joker' card (dung heap) can be put wherever the group likes during the six year rotation as it provides more 'free' nutrients to boost soil fertility.

4. Each group sets up its numbered year cards and arrows in sequence.

5. Each group discusses all the information made available and then starts to work out the type and order of rotation which it believes will maximise output while maintaining soil fertility over the six years.

6. Each group reports back explaining and justifying the rotation it has decided is best.

7. Follow up and extension ideas:

a) The nitrogen cycle and the definition of nitrogen cycle terms

b) This game is based on just one field. A discussion about the strategy for the whole farm, i.e. multiple fields, to see how rotation works in practice could be held. Issues about organic versus conventional farming can be raised.

Rocks and Soils



Fallow



Fallow Factfile

Name: Fallow

Planted: -

Harvested:-

Uses: Break from crops

Main pests and diseases:-

Advantages: Gives the soil a break from pest, diseases & nutrient-drain from crops. Crops after a fallow year show that the soil benefits from the break

Disadvantages: No crop to sell

Soil nutrients:

Nitrogen Input	No change
Nitrogen Output	No change
Storage in soil	No change

Rocks and Soils



Wheat



Wheat Factfile

Name: Winter wheat

Planted: October

Harvested: August

Uses: 1. Flour for making bread, cakes and biscuits
2. Animal feed

Main pests and diseases: barley yellow dwarf virus, yellow rust, powdery mildew

Advantages: Highest energy content of all the cereals so receives a higher price

Disadvantages: Most demanding in terms of soil nutrients

Soil nutrients:

Nitrogen Input	30kg/ha
Nitrogen Output	132kg/ha
Storage in soil	-102kg/ha

Rocks and Soils



Oats



Oats Factfile

Name: Oats

Planted: October

Harvested: August

Uses: 1. Breakfast cereals
2. Animal feed

Main pests and diseases: powdery mildew, take-all, oat smuts

Advantages: Grows well on less fertile soils

Disadvantages: Poor financial return

Soil nutrients:

Nitrogen Input	30kg/ha
Nitrogen Output	133kg/ha
Storage in soil	-103kg/ha

Rocks and Soils



Grass and Clover



Grass and Clover Factfile

Name: Grass and Clover

Planted: March

Harvested: June

Uses: Animal feed - Summer grazing (white clover)
- Winter hay & silage (red clover)

Main pests and diseases: Clover rot, clover stem eelworm

Advantages:

1. Breaks disease and pest cycles of other crops
2. Improves soil fertility
3. Helps to control spread of weeds

Disadvantages: 1. Higher clover content is essential as grass alone is of limited value

2. Clover needs relatively wet weather
3. Needs two years to establish properly

Soil nutrients:

Nitrogen Input	185kg/ha
Nitrogen Output	55kg/ha
Storage in soil	130kg/ha

Rocks and Soils



Beans



Beans Factfile

Name: Beans

Planted: October

Harvested: September

Uses: High protein animal feed

Main pests and diseases: chocolate spot, black bean aphid, bean weevil

Advantages: Good break crop between cereals because it is not affected by many of the pests and diseases which affect cereals





Disadvantages: Sensitive to drought

Soil nutrients:

Nitrogen Input	330kg/ha
Nitrogen Output	311kg/ha
Storage in soil	19kg/ha

Rocks and Soils



<p>Fallow</p>  <p>A photograph of a lush green field with a line of trees in the background under a blue sky.</p>	<p>Wheat</p>  <p>A close-up photograph of golden wheat stalks with long awns against a bright blue sky with light clouds.</p>
<p>→ ← → ←</p> <p>NUTRIENTS IN BALANCE</p>	<p>↑ ↑ ↑ ↑</p> <p>NUTRIENTS OUT</p>
<p>Beans</p>  <p>A photograph of a green bean plant with large leaves and clusters of small white flowers.</p>	<p>Oats</p>  <p>A photograph of oat stalks with long, thin awns against a clear blue sky.</p>
<p>→ ← → ←</p> <p>NUTRIENTS IN BALANCE</p>	<p>↑ ↑ ↑ ↑</p> <p>NUTRIENTS OUT</p>

Rocks and Soils



Grass & Clover



NUTRIENTS IN BALANCE

Rocks and Soils



Muddy Mystery

This is another soil activity originally devised at Horton Kirby Environmental Centre. It needs to be adapted to match your location/surroundings.

Someone has stolen the lunch and left a muddy footprint behind! Can we use the mystery mud to discover who the thief is? The day includes testing the mystery mud and comparing it to other soil samples.

Muddy Mystery story - The class are told a story about going for a picnic in the woods and having some food stolen. The person that stole that lunch has left behind a big muddy footprint. The mud from the footprint has been collected for the class to use in their role as crime investigators to help them discover who stole the lunch!

The class begin their investigation by asking the question 'what is soil?'

Go outside and dig up soil onto trays - Touch and feel session (optional depending on time). Make recipe on whiteboard of what the class found.

The class are then introduced to the 'Mystery soils' that have been collected from the picnic blanket. They are asked to make observations and perform various tests on the soil and record their findings. These findings will be used in the afternoon session.

The class visit the woods and visit 3 different soil areas (Sandy, Chalky and Loam). At each area the students perform the same tests & observations as they did in the morning session. They then compare their results to the mystery soil to determine which person committed the crime.



Rocks and Soils



More soil activities

You can find further soil activities in FACE's Biodiversity Project which is available online at <http://www.countrysideclassroom.org.uk/resources/1141>

Section 5—soils

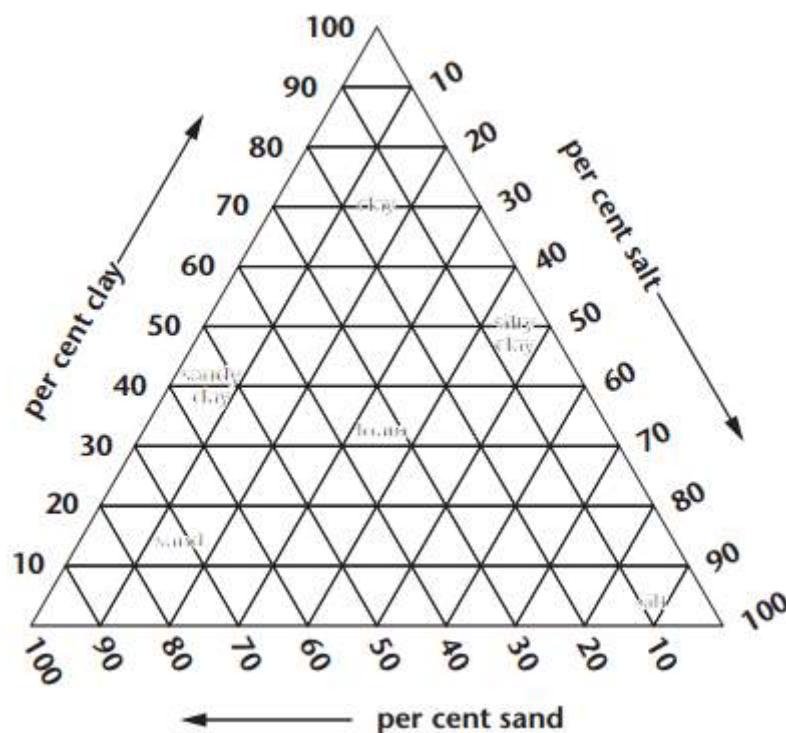
Look for investigations into:

Soil test

Soil settling and triangular graph:

Soil sample and soil map

Soil compaction



Rocks and Soils



Panorama drawings using natural materials

Resources required:

Drawing boards, artist's canvas (or any heavy weight cotton fabric), charcoal and natural materials

Space required: A site with a good view of the horizon

Instructions:

Cut your fabric into long strips and attach to the drawing board using elastic bands.

Starting with the view at one side, draw the horizon and pull the fabric through as you move around the panorama. (If you start to the left and work around to the right you will need the spare fabric by your right hand).

Use charcoal for the outlines, colour is provided by rubbing mud, grass, petals etc. onto the canvas.

If you don't want to do long drawings of the horizon, the same process works well whatever the shape of fabric.

You may need to use some "spray mount" to hold lighter weight fabrics onto drawing boards.

Comments:

Panorama drawings can be used to discuss land use, why we value certain landscapes, form the start of map making activities etc.

Not using traditional drawing materials reduces the pressure to make a representational image and allows the children to make a picture about a place using materials from the same location.



Rocks and Soils



Useful Web sites

Lesson plans for Earth Science classroom activities: <https://www.geolsoc.org.uk/lessonplans>

- British Society of Soil Science educational resources: <http://www.soils.org.uk/education>

For Joint Character Areas, descriptions of local landscapes and geology: <https://www.gov.uk/government/publications/national-character-area-profiles-data-for-local-decision-making/national-character-area-profiles>

British Geological Survey: Geological maps, time lines, education area: www.bgs.ac.uk, ask a geological question www.bgs.ac.uk/ask

Soil Net. Lots of teaching resources and activities for all key stages, links to other sites: www.soil-net.com

Earth Learning Ideas: www.earthlearningidea.com

Earth Science Teachers' Association (information for teachers and other useful resources): <http://www.esta-uk.net/>

Earth Science Education Unit (Based at Keele University, provides free in-service training to teachers across England, Scotland and Wales, through workshops for schools, teacher meetings, resources etc): <http://www.earthscienceeducation.com/>

Rockwatch: club for young geologists - <http://www.rockwatch.org.uk/>

Earthwatch Institute: <http://eu.earthwatch.org/Education>

Citizen Science projects on worms: <http://eu.earthwatch.org/get-involved/citizen-science> and <https://www.opalexplorenature.org/soilsurvey>

2015 was international year of the soil. UN web site <http://www.fao.org/soils-2015/en/> has some interesting infographics and resources .

Rocks and Soils



LEAF Education

Leaf Education (formerly Farming and Countryside Education) works with school communities to help children and young adults understand the connection between farming and their daily lives.


Farming and Countryside Education is part of [Linking Environment and Farming](#) (charity number 1045781).

Contact us

LEAF Education
Stoneleigh Park
Warwickshire
CV8 2LG

education@leafuk.org

 024 7641 3911

 @LEAF_Education

 [facebook.com/FarmingAndCountrysideEducation/](https://www.facebook.com/FarmingAndCountrysideEducation/)