

Where on Earth is no soil found? A 'deep question' discussion about soil-formation

There is no soil on the Moon because, although the normal soil-forming processes of weathering and erosion happen there, there is no life – and organic material is one of the key components of soil.

So, to help your class to understand what soil is and how it forms, ask them the deep question of 'Where on Earth is no soil found?' It may be helpful to put a small bag or pot of soil in front of them to prompt their discussion.

To respond to this question, they need to know that soil is a mixture of:

- rock and mineral fragments produced by weathering and erosion;
- decomposing organic matter (humus) including leaf litter (fallen leaves);
- living organisms (plants, animals, fungi and microbes);
- water and air.

By understanding this, they will realise the soil cannot usually be found:

- in deep water (where there is no air) [However, soil can be found underwater at the shallow ocean margins during high tides, in coastal swamps (such as mangrove swamps), and during freshwater floods on land];
- in sandy and rocky coastal areas (where sediment is constantly moving due to waves and tidal currents);
- in regions permanently covered by ice and snow, such as polar regions and high mountain tops (where there is no life);
- within shifting sand dunes (where sediment is moving and any organic matter decomposes completely);
- in rocky deserts (which are too dry);
- on smooth flat surfaces that are sloping or vertical, such as walls or roofs (where there are no hollows to contain mineral or organic material);
- indoors, unless it is brought in in plant pots, etc. (rock and mineral fragments do not usually accumulate indoors).

One of the purposes of this exercise is to show that it is more amazing where on Earth soil is found than where it is not found. It is very unusual for a natural surface above water to have no soil or vegetation cover.



Rocky desert with limited soil and vegetation, Lara, Venezuela.
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The ice cap covering Saunders Island, Greenland, where there is no soil.
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Sea wall and beach with no soil, Acre, Israel.
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The back up

Title: Where on Earth is no soil found?

Subtitle: A 'deep question' discussion about soil-formation.

Topic: A class discussion to consolidate learning about soil-forming processes.

Age range of pupils: 8 years upwards

Time needed to complete activity: 10 minutes

Pupil learning outcomes: Pupils can:

- describe the conditions necessary for soils to form;
- explain where on Earth such conditions are found.

Context:

It is helpful for pupils to know how soil normally develops on bare rocky surfaces, such as rock exposures and walls.

- First lichens grow on the bare rock, their rootlets grow into the gaps between minerals and weaken them; whilst wetting and drying of the lichen, causing expansion and contraction, speeds up this process.
- Moss begins to grow in hollows produced by lichen activity, accumulating more mineral fragments.
- Seeds of plants, particularly of pioneer, or first-colonising plants, grow in the moss.
- The humus produced by these plants aids soil development, as the soil becomes colonised by more varieties of plants and animals.

A huge variety of soils is possible, depending on different mixtures of soil ‘ingredients’.

Following up the activity:

Ask the class whether they would expect soil to be found:

- on the school buildings (*yes, in gutters and hollows*);
- on areas covered by tarmac (asphalt) (*yes, in sheltered, little-used tarmacked areas*);
- on roads (*yes, along the centres of little-used roads, between car wheel tracks*);
- on mountain tops not covered by snow and ice (*yes, in hollows between rock exposures*);
- in old mine and quarry areas (*yes, unless the surface sediment has been poisoned by the minerals mined there*);
- in old industrial areas (*yes, unless the sediment has been polluted by oils or chemicals*).



View near Queenstown, Tasmania, Australia, where much of the soil in the distance has been polluted by old mining and smelting (industrial) activity.

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Underlying principles:

- The ‘ingredients’ for soil-formation include: rock and mineral fragments; decaying organic material (humus), living organisms (plants and animals), water and air.
- All these ingredients can be found together in most places on Earth’s land surface – which is why soil and vegetation can be found almost everywhere.

Thinking skill development:

Pupils have to construct a pattern of the requirements for soil formation before applying that pattern to ‘real world’ circumstances through bridging. Their discussions are likely to involve cognitive conflict and metacognition.

Resource list:

- (optional) a small bag or pot of soil

Useful links:

A useful animation about soil-formation can be found at: <https://www.sciencelearn.org.nz/resources/955-soil-formation>

Try downloading the free ‘My soil’ app to your phone in the UK to find out more about your local soils.

See the list of other Earthlearningideas for teaching about soils at: https://www.earthlearningidea.com/home/Teaching_strategies.html#soils, including how Charles Darwin ‘discovered’ how soil forms.



The field in Shropshire, England, where Charles Darwin ‘discovered’ how soil forms (see the ‘Darwin’s ‘big soil idea’ Earthlearningidea) (Chris King).

Source: Chris King of the Earthlearningidea Team. Many thanks to Susie Lydon for comments on an earlier version of this activity.

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