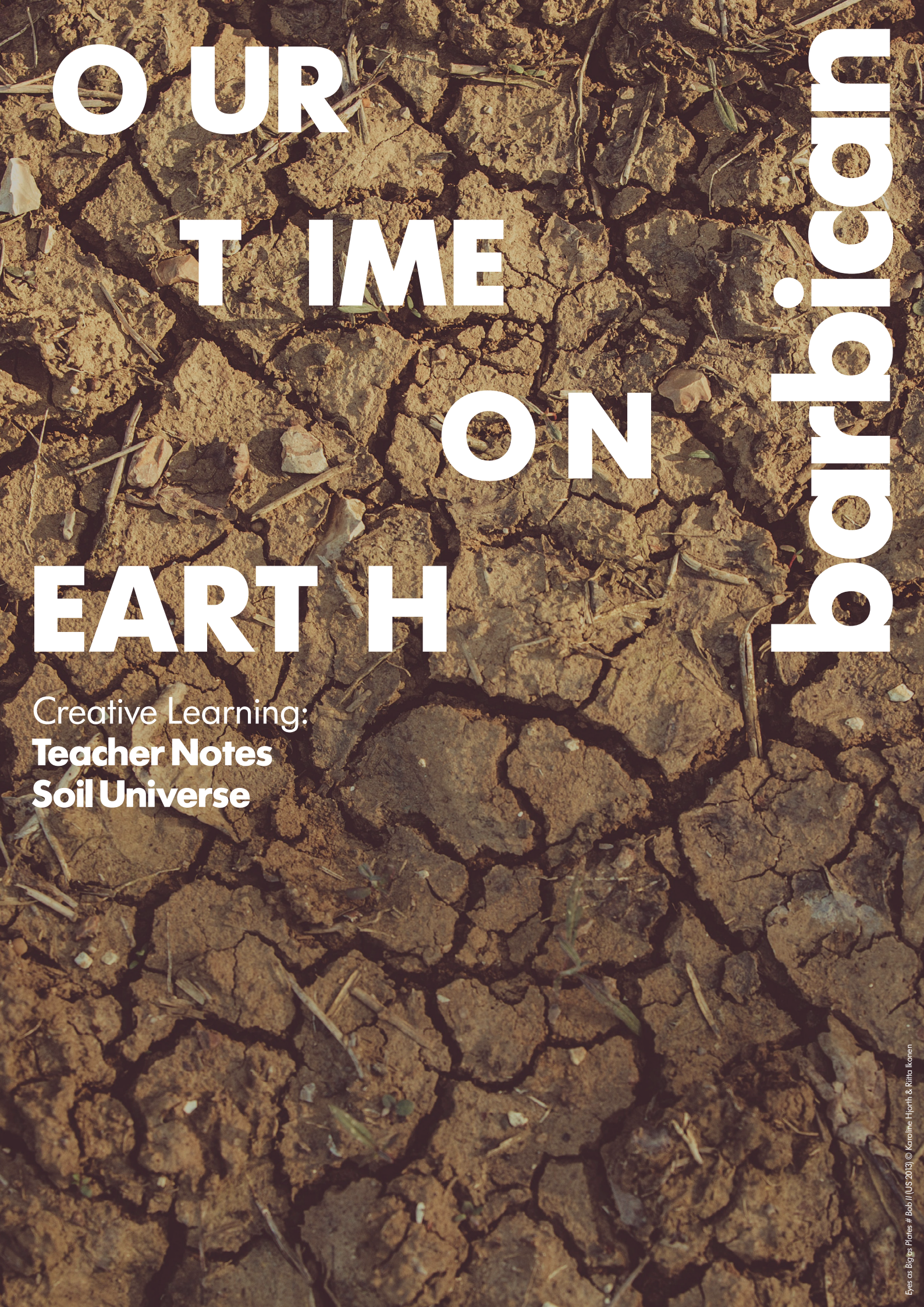
OUR TIME ON EARTH

barbican

Creative Learning:
Teacher Notes
Soil Universe



Eyes as Big as Plates # Bob II (US 2013) © Karoline Hjorth & Riitta Ikonen

Plan Your Visit

Our Time on Earth runs from 5 May – 28 August at the Barbican Centre. The exhibition takes place in the Curve, Pit Theatre and foyer. School groups can book to come any time, and we have limited slots for tours and workshops on Tuesdays at 2pm and Thursdays at 10am from 10 May – 28 July.

Please also find our digital Exhibition Guide to support your teaching.

Using this resource

This resource is for the classroom, and complements the exhibition *Our Time on Earth*, but you might use it even if you have not attended with your students.

Aimed at Key Stage 2.

In here you will find...

- An introduction to the artwork *The World Beneath Our Feet* by George Monbiot and *Holition* and its premise to be used as a provocation to begin a discussion
- Teacher notes on **food webs, soils, biodiversity and climate change**
- Discussion points and questions
- New vocabulary
- Activities to get your hands dirty and get creative
- Further links to resources, notes and activities to develop the session

"Life Forces" by Tin&Ed, 2021

Curriculum Links

Our Time on Earth brings together indigenous thinkers, artists, scientists, activists, architects and more. Our resources reflect the interdisciplinary, collaborative ambition of the project, as we acknowledge the climate emergency affects every realm of life and every subject on the curriculum. We aim to provide opportunities for teachers to engage students with climate action in a holistic way. Below is some guidance for where the subject matter links to the curriculum.

Key Stage 2 Science –

- Plants: explore the requirements of plants for life and growth (air, light, water, nutrients from soil, and room to grow) and how they vary from plant to plant
- Animals: identify that animals, including humans, need the right types and amount of nutrition, and that they cannot make their own food – they get nutrition from what they eat
- Rocks: recognise that soils are made from rocks and organic matter.
- Living things and their habitats:
  - recognise that living things can be grouped in a variety of ways
  - explore and use classification keys to help group, identify and name a variety of living things in their local and wider environment – (invertebrates and vertebrates)
  - recognise that environments can change and that this can sometimes pose dangers to living things
  - describe how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including microorganisms, plants and animals
  - give reasons for classifying plants and animals based on specific characteristics
- Animals, including humans: construct and interpret a variety of food chains, identifying producers, predators and prey

Key Stage 2 Art –

- to improve their mastery of art and design techniques, including drawing, painting and sculpture with a range of materials [for example, pencil, charcoal, paint, clay]

Key Stage 2 Geography –

- physical geography, including: climate zones, biomes and vegetation belts, rivers, mountains, volcanoes and earthquakes, and the water cycle
- human geography, including: types of settlement and land use, economic activity including trade links, and the distribution of natural resources including energy, food, minerals and water

Key Stage 2 Citizenship –

- that resources can be allocated in different ways and that these economic choices affect individuals, communities and the sustainability of the environment

The Ground Beneath Our Feet

Beneath our feet is an ecosystem so astonishing that it tests the limits of our imagination. Soil. For years we have treated it like dirt. But it turns out to be one of the most diverse and fascinating of all the world's living systems.

Rather than the lumpen mass people once assumed it was, soil is an extremely complex biological structure, built by the tiny creatures that inhabit it. In collaboration with environmental and political writer and activist George Monbiot, digital agency Holition have created an immersive experience for *Our Time on Earth* that evidences the interconnectivity of the nutrients, organisms and plants that live in our soil, highlighting their relevance in keeping our world alive.

Courtesy of Holition

This is a little known but essential area of work in the effort against climate change. For too long exploitative human activities have had a detrimental impact on the health of our soil. The artists here are aiming to develop a renewed respect for this hugely important ecosystem, telling the incredible story of the hidden beauty and complexity of the living systems beneath our feet.

New Vocabulary

You may want to introduce your class to this new vocabulary at the beginning of the lesson

Organic Matter – dead living things in the process of breaking down, forming a large source of carbon-based compounds found in environments such as soil

Humus – dark, organic matter that forms in soil when plant and animal matter decays

Decomposer – an organism, especially soil bacterium, fungus, or invertebrate (spineless creature), that decomposes organic material

Consumer – an organism that needs to consume other organisms for energy - it derives organic compounds and energy as it consumes

Translocation – the movement of something from one place to another

Soil

What is in soil?

- Minerals (pieces of rock or sand)
- Organic material or "humus" (dead plants and animals)
- Water
- Air (gases)

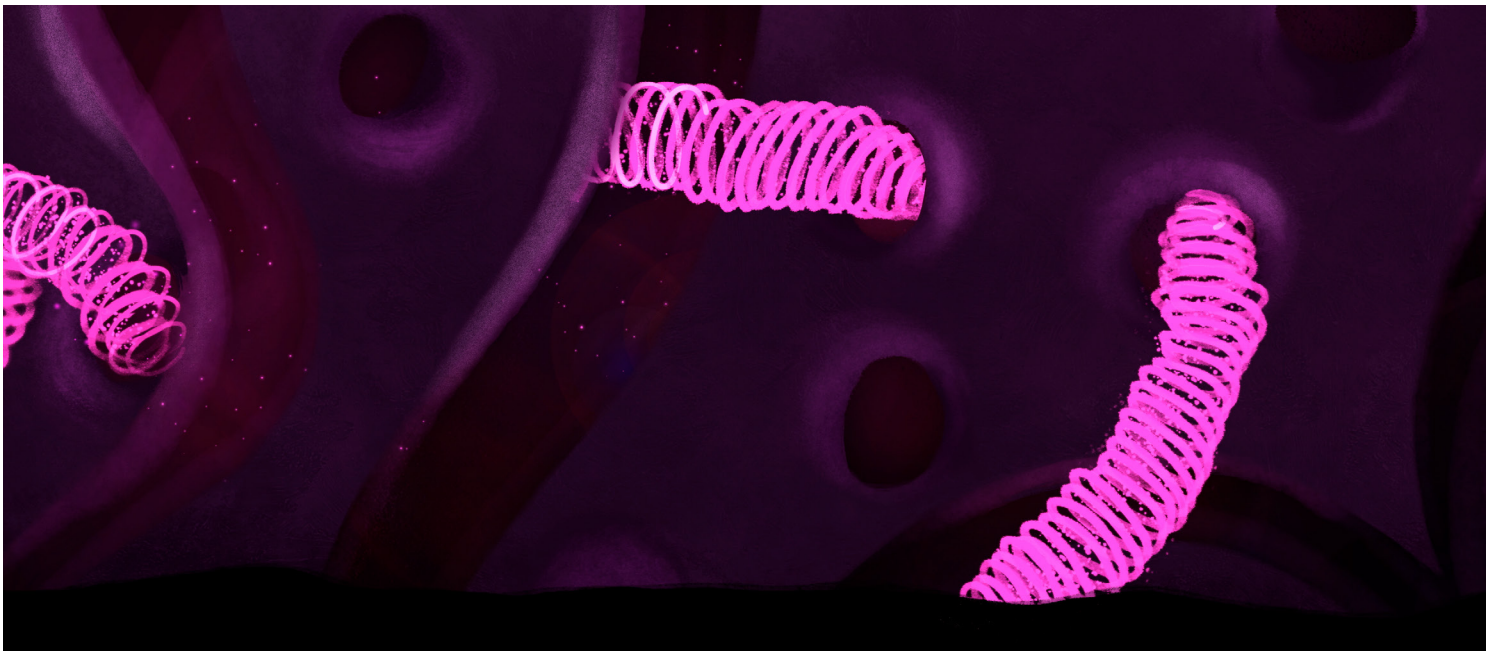
Do

Match the organism to the group as you learn what lives in soil

Ask

Who lives in soil?

- **Fungi e.g. –**
  - **Zygomycota**
  - **Ascomycota**
- **Bacteria: e.g. –**
  - **Azotobacter**
  - **Azospirillum**
  - **Clostridium**
- **Invertebrates you can see:**
  - **Centipedes**
  - **Earthworms**
  - **Ants**
  - **Woodlice**
  - **Dipluran**
- **Invertebrates you can't see:**
  - **Nematodes**



Courtesy of Holition

What are they doing?

These living creatures, both invisible and visible to the human eye, are **consumers** and **decomposers**.

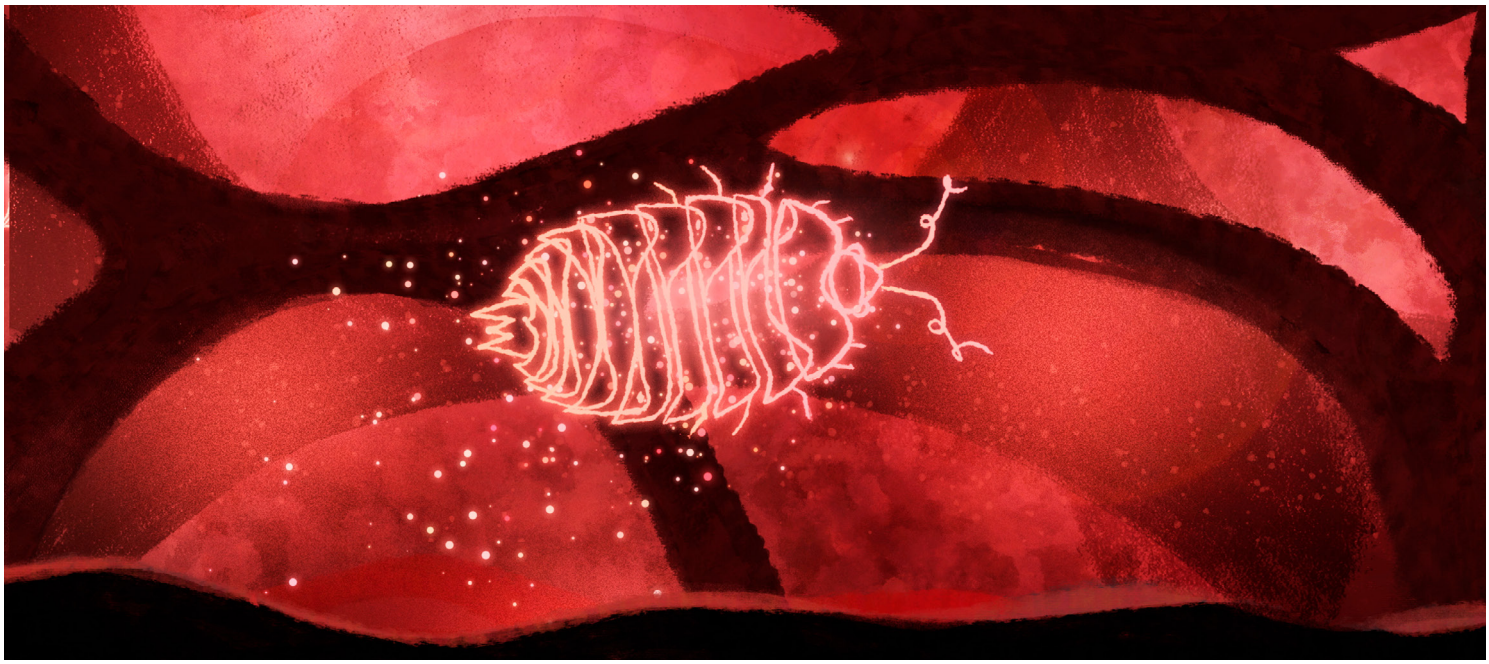
They break down the organic matter (dead plants and animals) in the soil and turn them into *humus* which is easier for plants to consume. For example, worms move up and down in the soil *translocating* broken down matter, churning up the soil making it easier for things to grow. The stuff worms excrete is a substance with readily available nutrients that the roots of a plant can absorb easily, with the help of fungi. It's like they are chewing up the food for the plants to eat.

Mycelium and mushrooms are just part of a 'fungi'. The mycelium network is a sprawling organism – the largest on earth! They are made up of hyphae, which look like threads or little roots. These hyphae can be so small you can't see them, and other times so large they carpet the floors of entire forests. The part of the fungus which is most visible is the reproductive body. This is often, but not always, the stem and hat of the mushroom. Hyphae are very important to the soil food web, because these fine threads can spread over long distances, and capture water or nutrients from far away and bring them back along the threads and close to plant roots.

As a plant grows, its root hairs pump sugars and chemicals into the ground, waking up the bacteria who then provide minerals it needs – they speak in a language we are just beginning to understand. As the bacteria multiply, minuscule creatures like springtails, mites and nematodes eat them. Other animals, such as earthworms and ants, build passages through the soil and create their own structures, like coral reefs in the sea. Predators such as centipedes can then gather and eat the bacteria. As the plant root moves on, the frenzy of activity quietens down, leaving just the remains of the insects the predators have killed. These animals create the soil: the thin cushion between rock and air on which our survival depends.

The four key processes:
Additions: dead plants and animals (organic matter) rot into the soil
Losses: plants take nutrients and water out of the soil
Transformation: organic compounds form
Translocation: matter and nutrients move about the soil with the help of soil creatures

The Soil Food Web



Courtesy of Holition

Ask

Start with a food chain — ask the class to recall any prior knowledge of how a food chain works. Introduce the concept of an ecosystem, in which living things depend on each other for survival.

What is the **soil food web**? This is a concept to support understanding of the "biome" in the soil, going beyond our ideas of a "food chain".

Ask

Tell the class to look out for the benefits of a healthy soil food web when watching the video.

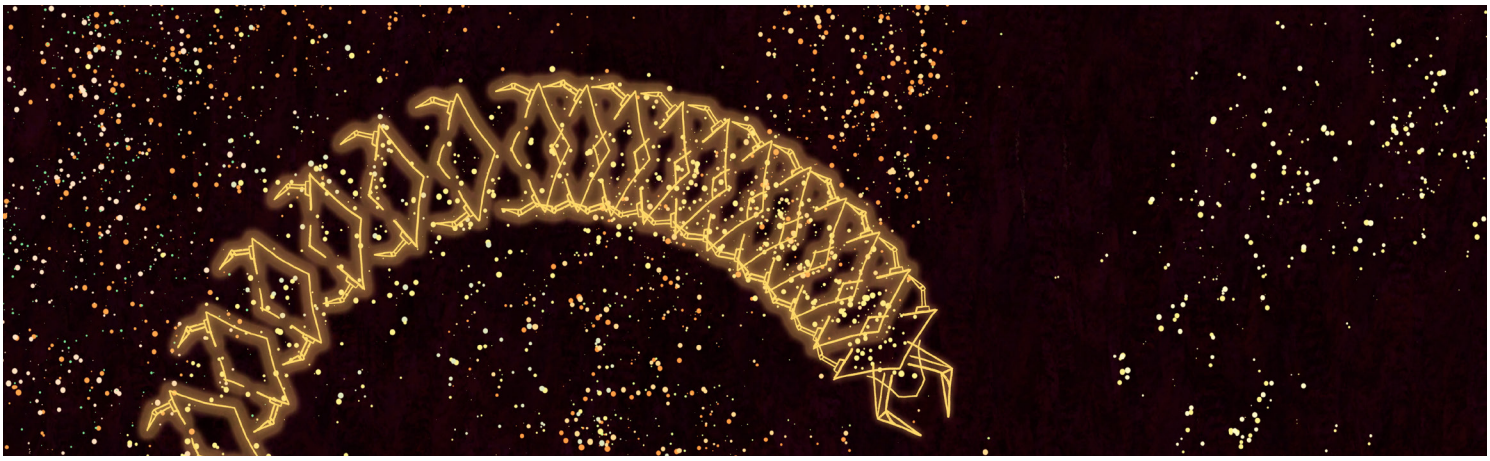
Watch this video to learn more.

Do

Throw a bean bag around the class. Catch the bag and say one benefit or property of healthy soil food webs from the video. Then reverse it. What goes wrong if we don't have a healthy soil food web?

Points to look out for:

- **Stop floods and extreme weather**
- **Give plants nutrients**
- **Improves our quality of food**
- **Improves our health**
- **Absorb water**
- **Create habitats for life**
- **Contributes to a healthy ecosystem**



Courtesy of Holition

Soil Types

What does soil look like?

Do

Look at soil samples you have collected. If you can, have different examples and textures to explore. What colour is it? Does it look healthy? Does it have anything visible in it? What does it feel like to touch? You could also put some in a funnel and see how fast it drains, or spread some on paper and see how big the lumps and particles are.

Different soils have different properties depending on what they are made out of.

- **Sandy soil** is paler, it has large bits in it and water can drain through it much easier.
- **Clay soil** has tiny particles, it is stickier and darker, and it can hold much more water and nutrients, but it can dry and become very solid too, because there aren't bigger particles to trap any air in
- **Loam soil** has a mixture of sandy and clay particles, making it good for drainage, but also rich in nutrients

Do

Soil separation.

- **Take a sample of soil and put it into a clean, clear jar, or measuring cylinder or beaker.**
- **Add water to cover the soil. Mix and then leave the sample to settle.**
- **The heaviest, biggest particles sink first (sand).**
- **The smallest, lightest sink last (clay).**
- **Floating on top might be organic matter.**

Tip: Settling can take a while so this might best be done as a demonstration using a sample left to settle the day before. Students could measure the different layers and make conclusions from these observations.

Further Activities

Ask

What is the difference between "soil" and "dirt"?

Why is soil important to the fight against climate change?

Why might some people forget to think about soil as an important area for wildlife?

Some farmers in the UK are taking up "No dig" policies on their land, rather than the traditional methods of ploughing and digging up the field in between planting crops. Why might they not want to disturb the soil?

Do

Hold up your hand and try and count five different soil creatures for each finger.

Choose one: how does it move? A worm burrows up and down, ants build tunnels, nematodes float in the water particles, and hyphae break through cell walls. Show how they might move with your hands.

Have a go at collecting earth worms outside or study a picture of a worm. What can you see?

How does it move? How might a worm reproduce? How and what does it eat? Can it see? Smell?

What creatures can you see when you look at soil? What creatures can you not see?

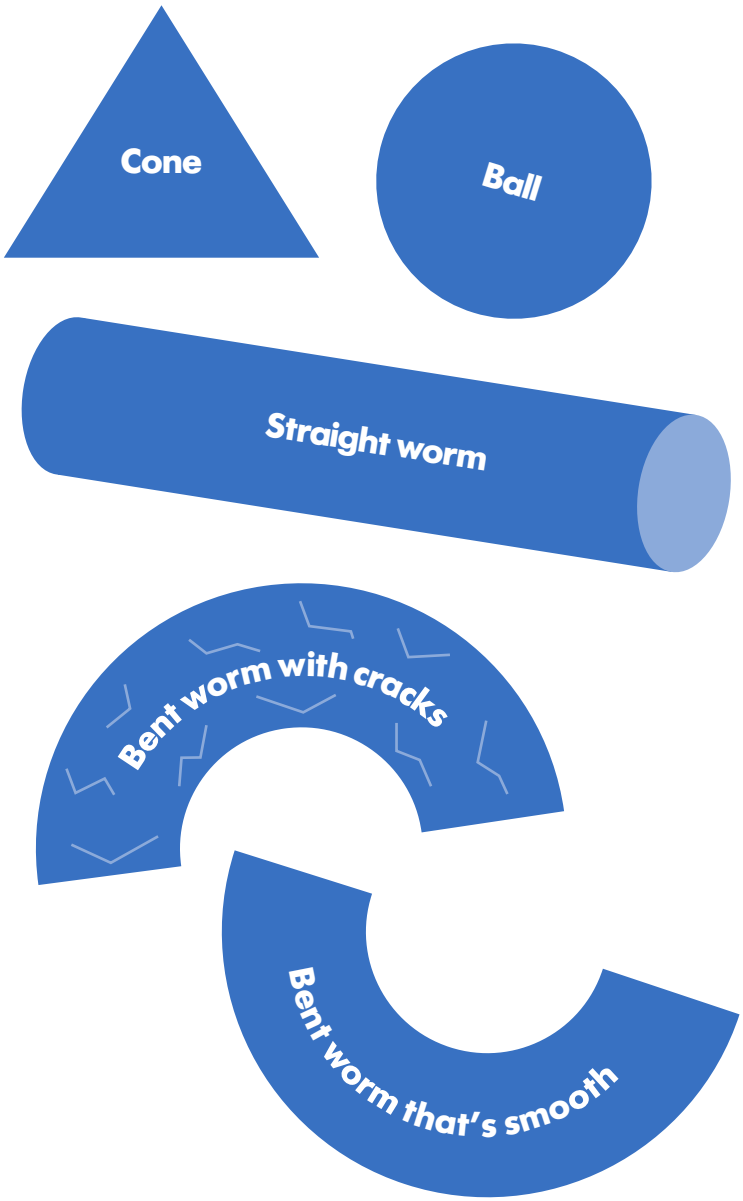
On an A4 piece of paper draw a cross-section of soil underground. Add some features, such as a tree, insect or animal. Now include organic matter (dead plants and animals): an old apple, some leaves, a piece of wood, a snail shell. Now, in a different colour, draw a mycelium network living underground, feeding off the organic matter. Where does the network reach? What is happening to the organic matter? How will it transform?

Create

Getting your hands dirty

Part A

1. Take a handful of soil and wet it
2. Squeeze out the water
3. Make the shapes shown in order
4. Depending on how many shapes you can make, you can tell what type the soil is. Check the table below to see, once you have played around with possible shapes.



Shapes you can make	Soil Type
1. Cone only	Sandy
2. Cone and ball	Loamy sand
3. Cone, ball and straight worm	Loam
4. Cone, ball worm, and bent worm with cracks	Clay-like loam
5. Cone, ball, worm and bent smooth worm	Clay

Part B

Design your garden

Some plants like to have very little water, such as a cactus. Others like to have lots of access to water, such as ferns. Some like to be somewhere in the middle, such as a tomato plant or a rose.

Draw an outline of a garden, it can be inspired by one you know.

Divide it into three sections or flower beds labelled as "loam", "clay" and "sandy" soils. Where might you plant your cactus, fern and tomato plant? Is there anything else you would like to plant?

What else do you want to put in your garden? Find out what kind of soil type they like before planting them in the flower bed.

Tip: If you are stuck, try and remember the different properties of the different types of soil. Which ones hold more water?

Life Forces by Tin&Ed

Create

Make a teeming underground party with a variety of soil guests.

- **Draw an outline of a landscape on big paper, or use the example on this page. Instead of leaving lots of room for sky, put the horizon near the top of your paper.**
- **Now, populate the underground of your landscape with all the creatures living in the soil. You don't need to be accurate with scale. How might you draw the things we can't see?**
- **Think about how you might bring fungi to life, where do the hyphae travel to? How might you include bacteria?**

Tip:

- Think about materials – you could use string, paint, pastels, tissue, old magazines or news paper – or any thing you can find. Which materials might work for certain creatures?
- Think about colour – how can you bring to life the variety in the soil? Perhaps the bacteria is radio active green, and the nematodes (who live in the droplets of water around roots) are blue like the sea.
- Think underground and imagine what a worm might see if it had eyes.

Further resources:

Food waste and composting:
School composting instructions

The soil food web:
The Way Soil Organisms Look Can Help Us Understand Their Importance · Frontiers for Young Minds
Soils4Teachers
Soils4Kids
Countryside Classroom (Rocks and Soils)

Carbon cycle
https://museum.wales/learning/activity/526/Carbon-Cycle-Passport/

Local area
Use this soil map to discover more about the soil in your area

Soil erosion and agriculture
Kiss the Ground (2020) – documentary on netflix

Courtesy of Julia Watson

Can I Live?

By Fehinti Balogun
Produced by Complicité
A new online performance about the climate emergency. With rap, theatre and animation, Fehinti links the climate crisis & social justice, finding hope, through activism, for the future.

Catch the Trailer of the film here
If you want to discover more about the ecological emergency, climate justice and the creatives behind this filmed performance download the digital resource pack here.

To screen the film at your school contact
creativeengagement@complicite.org

Credits

These Learning Resources were created by Hannah Calascione for Barbican Creative Learning, with ethical consultation from Angela Chan, Angela Camacho and Sarah Melia.