The OPAL
Soil and Earthworm Survey
Booklet

OPAL
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NATURE

Please note: Online data entry for the OPAL Soil and Earthworm Survey is closed. However, you can still use the survey to explore soil quality and earthworms in your local area.

Introduction

Soil is one of the world's most precious natural resources. It is vital for plant survival and crop production. It stores and filters water, provides a foundation for buildings, and is home to a vast array of animals, including earthworms. Soil is made up of water, air, minerals and organic matter. Soil properties are influenced by the bedrock beneath it, the local environment, the plants that grow on it, and the animals that move through it. Of these animals, earthworms are one of the most important to soil structure and fertility.

This survey aims to find out more about soil and earthworms across the UK. The results will help scientists to investigate whether each earthworm species is found in a particular habitat or soil type. There are 27 different species of earthworms in the UK. Some are common and found in lots of places while others are rare. Earthworms are sensitive to many environmental factors, and these will influence where they live. If you find lots of earthworms in your soil it can be a sign of good soil quality.

"You may have seen worms before but do you know much about us? I don't mean to brag, but in the soil world we're classed as superheroes!

We eat on the move, churning the soil and leaving behind fertile worm casts. We help to keep the soil healthy by breaking down dead plant material and recycling nutrients. We burrow into the soil, improving its structure and drainage and creating space for air. With plenty of nutrients, air and water in the soil, plants can grow to their best. That's good news for you because plants provide most of your food.

For more information on us, check out the earthworm factfile on page 14."

Survey preparation

The OPAL Soil and Earthworm Survey has several activities:

- A Site characteristics (pages 3-4)
- B The soil pit and earthworms (pages 5-6)
- C Soil properties (pages 7-10)
- D Earthworms (pages 11-12)
- E Additional search for earthworms in other habitats (page 11)
- F Other organisms in your pit (page 13)

Essential equipment to take outside with you

- The OPAL Soil Survey pack which contains this survey **Booklet***, **Earthworm Identification Guide**, 2 **mustard sachets**, 2 **vinegar sachets**, 2 **pH strips** and OPAL **magnifier**

- A small shovel, spade or trowel

- Two 750 ml bottles of water
  We recommend that you re-use old plastic bottles filled with tap water. Please remember to recycle.
- Suitable containers (e.g. plastic cups, sandwich bags) for the soil tests and for storing earthworms
- Bin bags or tray (for the soil from the pit) and protective gloves

* You can download more recording sheets from the OPAL website.

Useful items to take outside (if you have them)

- A map or GPS device
- A mobile phone (in case of emergencies)
- A camera

The best time to carry out this survey is during the spring and autumn.

Safe fieldwork

We don't advise you to work on your own. Take a responsible friend who can help if things go wrong. Make sure that you know what to do in an emergency. Ensure that you have permission from the landowner to dig holes on their land. Where possible, wear plastic gloves and wash your hands before eating. Cover any open wounds before starting the activity. Don't handle soil if you see sharp objects (e.g. glass, wire). If the site has sharp objects then choose another site elsewhere. Be careful not to disturb local wildlife (e.g. adders).

This survey is designed for use in the UK. Check local conditions if you intend to use it elsewhere. Ensure that you have performed a risk assessment where applicable. The mustard and vinegar sachets supplied in the survey pack are not for human consumption. More general safety information is available from Royal Society for the Prevention of Accidents **www.rospa.com/leisuresafety**

The survey starts here

A Site characteristics

Choose a location to carry out your survey. Record information about the site's location by answering Questions **1**-**10** below.

1. Date of survey _____

2. Who are you doing the Soil Survey with today?

- ☐ Primary school
- ☐ Secondary school
- ☐ Youth group
- ☐ Adult volunteer group
- ☐ Friends or family
- ☐ College / university
- ☐ Other

3. Do you think soil and earthworms are important? yes | no | not sure

4. Record the location of your site (postcode / OS grid reference / GPS reading).
Further help is available on the OPAL website if you are unsure of the exact location.

_____

5. Choose the best description of your sampling site:

a Garden

b Parkland

c Playing field

d Wood or forest

e Heath or moorland

f Open, grassy field

g Ploughed field

h Grassy verge

i Industrial site

j Other

If *other*, please describe: _____

6. What is the surrounding area like?

a Urban b Suburban c Countryside

7. How far is the nearest road?

a Less than 20 metres b 20-100 metres

c More than 100 metres *Name of road* _____

8. Can you see any of the following signs of pollution? f Tick this box if *none*

a Storage tanks (oil, fuel, chemicals)

b Rubbish

c Industrial chimneys

d Discharge (waste) pipes

e Foam on the surface of any ponds, lakes or rivers

g Other (please describe): _____

9. What is the weather like today?

a

b

c

d

10. How much of the ground in your sample square is covered in living plants (including grass)?

a All bare earth

b Mostly bare earth

c Half earth, half plants

d Mostly covered with plants

e Totally covered with plants

B The soil pit and earthworms

Measure a 20cm x 20cm square and dig a soil pit to a depth of 10cm. Place the removed soil on a plastic bin bag and put any earthworms in a container.

Use the ruler on the Earthworm Identification Guide to measure a 20cm x 20cm square

Mark each corner of the square with a marker so that you know where to dig

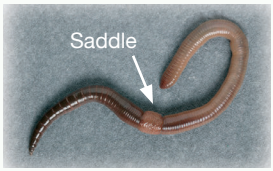
Use a spade or trowel to cut out and dig the pit. Try and keep the pit as square as possible

Place all the removed soil on a bin liner or tray

If you find glass, metal or other sharp objects, stop immediately and dig another pit elsewhere

Use the ruler on the guide to make sure your pit is 10cm deep

Look at each earthworm and see if it has a well-developed saddle.



Sort all earthworms found in the removed soil into 2 groups, those with saddles (adults) and those without saddles (immatures), and count the numbers in each group. Record these numbers in Question **11** below. Please rinse all earthworms with water, and return the immatures to the soil (not the pit). Save adult worms in a suitable container for identification in Section D. Don't let them dry out!

11. How many worms did you find in the soil pit?

Immatures numbers Adults numbers

To extract the deep burrowing earthworms, mix one of the mustard sachets provided into 750ml of water and pour into the pit (this is not toxic to the earthworms). If you are using mustard powder instead of the sachets, use 4 grams / a teaspoon of mustard powder.

Time how long it takes until the water has drained away (up to 3 minutes). Record this time in Question **12** below.

Collect any earthworms that emerge. Sort, count and rinse them. Record the numbers in Question **13** below.

12. How long did it take the water to drain away from the soil pit?

a Less than 3 minutes? _____ minutes _____ seconds

b More than 3 minutes

13. How many deep burrowing worms did you find?

Immatures numbers Adults numbers

C Soil properties

For questions in this section, use the soil you removed from the soil pit

14. How many plant roots are there?

a No roots b A few roots c Lots of roots

15. Can you see any objects in the soil that do not look like they should naturally be there? Remember to take care when handling the soil.

a Construction material e.g. brick, concrete, cement, mortar

b Metal e.g. wire, sheeting, tin

c Glass e.g. broken bottles

d Cut wood

e Other

f None

16. Push the pointed end of a pencil or pen into the soil surface. How hard was it to push into the soil?

a Easy b Difficult c Very difficult

17. Take a handful of soil in the palm of your hand and squeeze it. How moist is the soil? (Don't use any soil with mustard water on it).

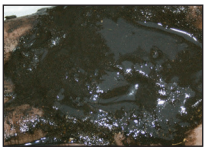
a Dry soil

Dry soil is where loose soil does not stick together when squeezed

b Moist soil

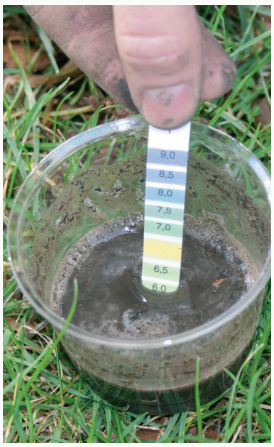
Moist soil is where no water drips out of the soil when squeezed

c Wet soil



Wet soil is where water runs or drips out of the soil when squeezed

Find out whether the soil is acid, alkaline or neutral by using one of the pH test strips in your pack.



Fill a cup with a 1cm depth of soil. Add enough water to cover the soil and stir the mixture for about a minute.

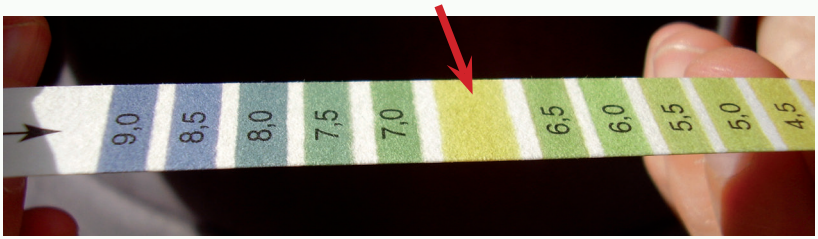
Holding the pH test strip by the arrow, completely immerse the strip in the soil solution for roughly **three seconds**.

Remove and quickly rinse with fresh water from the same bottle.

Hold the strip up to the light and compare the indicator zone (unprinted area) to the colour scale. Read off the printed pH value and record it.

It takes up to 2 minutes for the pH strip to develop the final colour, so don't read it right away.

Indicator zone



Alkaline	Neutral	Acidic
pH 8-9	pH 7	pH 4-6

What was the pH of the soil?

4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0

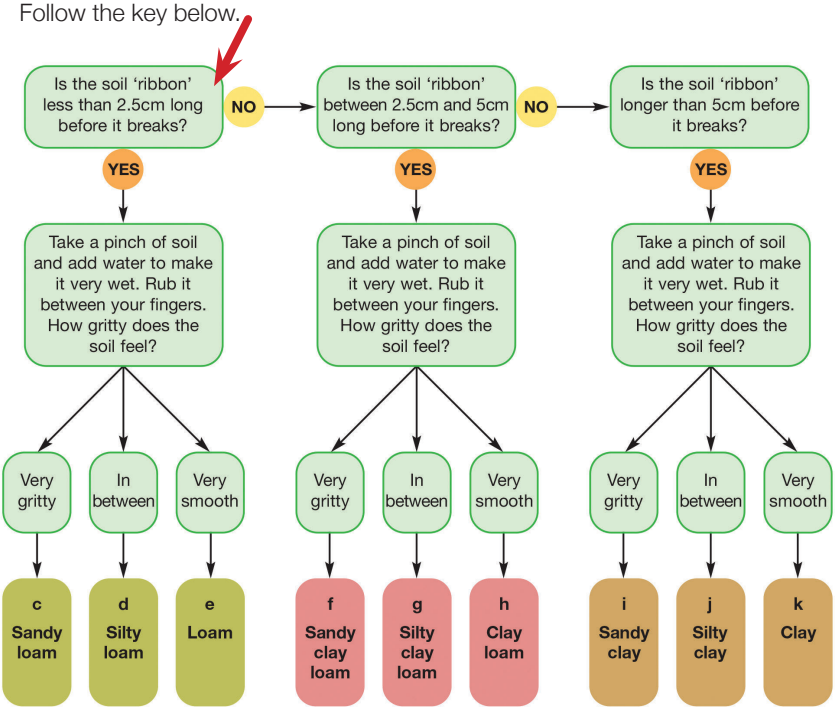
19. Find the texture of the soil, using the key below

1. Put some soil, about the same volume as an egg, in the palm of your hand. Remove any roots. Add drops of water and work the soil with your fingers to break down any lumps. Add sufficient water until the soil is evenly moist and feels like putty or play dough.

2. Squeeze the soil in your palm. Can you form it into a ball? If YES go to 3. If not the soil texture is (a) SAND.

3. Can you pinch the ball to make a flat ribbon of about 3 mm thickness? If YES go to 4. If not the texture is (b) LOAMY SAND.

4. Now feed the ribbon through your hand so that it supports its own weight. Follow the key below.



Record the texture of the soil:

a	Sand	b	Loamy sand
c	Sandy loam	d	Silty loam
e	Loam	f	Sandy clay loam
g	Silty clay loam	h	Clay loam
i	Sandy clay	j	Silty clay
k	Clay		

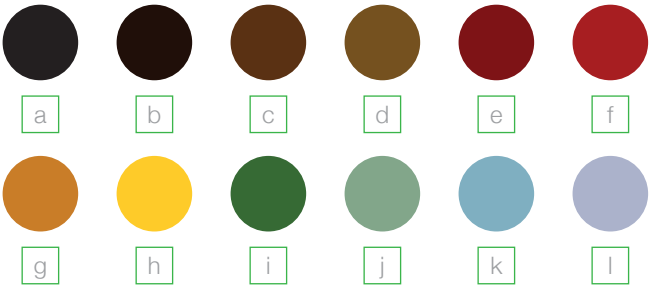
20. Smell the soil ribbon. Does the soil have:

a A sour, rotting or chemical smell?

b No smell?

c An earthy, sweet, fresh smell?

21. What colour is the soil ribbon? Choose the nearest colour match:



22. Soil fizz test

Take a small amount of the removed soil about the size of a 2p piece and put it on something waterproof. Open the sachet of vinegar and pour a few drops onto the soil. If the soil fizzes it means it contains a mineral salt called calcium carbonate ($CaCO_3$).

Does the soil fizz? yes no

D Earthworms

Use the Earthworm Identification Guide and the OPAL magnifier to identify and record the species of each adult earthworm found. Also record the length and colour of each adult earthworm. Record your results in the table on the next page.

If you find any other organisms in the pit, you can record what you have found on page 13. When you have finished, return the soil to the pit, replace any turf carefully and leave the area as you found it. Take any litter away with you.

E Additional search for earthworms in other habitats

If you still have more time available, search for earthworms in habitats within 5 metres of your pit – there are some ideas of where you could look below. Follow the process outlined in Section D for any earthworms found.

compost heaps

logs and branches

leaves

plant pots

Adult earthworms (one line per worm)	Where was the worm found?			Length (cm)	Colour (if species unknown)				Earthworm species (ID number from key)														
	Soil from pit	Mustard water	Other		Red	Stripy	Pale	Green	1	2	3	4	5	6	7	8	9	10	11	12	13		
									Compost worm	Brandling worm	Green worm (green form)	Redhead worm	Black-headed worm	Lob worm	Octagonal-tailed worm	Chestnut worm	Little tree worm	Rosy-tipped worm	Grey worm	Blue-grey worm	Green worm (pale form)	Unidentified adult worms	

Write length here

F Other organisms in your pit

Insects

Beetles	numbers	Flies	numbers	Larvae	numbers
Bugs	numbers	Other	numbers		

Non-insects

Snails	numbers	Slugs	numbers		
		Arachnids (spiders)	numbers	Other	numbers

"Thank you for taking part in the OPAL Soil Survey! Now you have gathered your results it is important that you input them onto the OPAL website so that they can be shared and used to map the soil quality and earthworm species across the UK.

Once you have entered your results online you can browse maps showing the results of the national survey so far."

Earthworm factfile

There are 27 species of earthworm in the UK, all of which are from the family Lumbricidae. The 12 species listed below are common and thought to be widespread, while the other 15 species are rarer and may have limited geographical distributions. More information about how to identify all the UK species can be found in Sherlock (2012): *Key to the earthworms of the UK and Ireland*.

1. Compost worm *Eisenia veneta* Usually found in garden compost but can also occur in wet decaying leaf litter, organic-rich soils and manure heaps. Eats rotting vegetation.
2. Brandling worm *Eisenia fetida* Usually found in garden compost but also occurs in wet decaying leaf litter, organic-rich soils and manure heaps. Eats rotting vegetation.
3. Green worm *Allolobophora chlorotica* Very common and widespread. There are two colour varieties: a 'greenish' variety (3) and a pale variety (13). Lives in the topsoil, often among plant roots. Eats soil.
4. Redhead worm *Lumbricus rubellus* A widespread species, found in most habitats. Lives in the topsoil and leaf litter, and is thought to feed on decaying leaf litter fragments.
5. Black-headed worm *Aporrectodea longa* A large worm. Abundant and widespread. Builds permanent vertical burrows up to 60cm deep and deposits casts on the surface. Eats soil.
6. Lob worm *Lumbricus terrestris* The largest British earthworm, common and widespread. Builds permanent vertical burrows up to 3m deep. Emerges at night to pull leaf litter into its burrow.
7. Octagonal-tailed worm *Dendrobaena octaedra* The tail is octagonal in cross-section but this is difficult to see in live earthworms. Can be locally abundant. Lives and feeds in leaf litter.
8. Chestnut worm *Lumbricus castaneus* Common and widespread, found in many habitats. Lives in leaf litter and under logs.
9. Little tree worm *Satchellius mammalis* Widespread in many habitats, from woodlands and field margins to marshy habitats and river banks, but is seldom abundant. Lives and feeds in leaf litter.
10. Rosy-tipped worm *Aporrectodea rosea* The first 10 or 15 segments are rosy pink or pale pink in colour. Widespread and found in most habitats. Can be locally abundant. Lives in the topsoil and eats soil.
11. Grey worm *Aporrectodea caliginosa* Very common and widespread. Lives in non-permanent horizontal burrows in the topsoil. Rarely found in leaf litter. Eats soil.
12. Blue-grey worm *Octolasion cyaneum* Occurs in pasture and arable land, gardens and woodlands. Lives in the topsoil and feeds on soil.
13. Green worm *Allolobophora chlorotica* See (3)

This activity is one of a series of nature surveys developed by the Open Air Laboratories (OPAL) programme to help you get closer to your local environment while collecting important scientific data. With funding from the Big Lottery Fund, our network of leading universities, museums and wildlife organisations has been developing citizen science activities since 2007 and our resources are available throughout the UK.

If you've enjoyed this survey, why not try another? You can find everything you need to get involved at **www.opalexplorenature.org/surveys**

You can also see what your data has revealed so far and discover a range of ways to get more involved in studying the environment on our website: **www.opalexplorenature.org**

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British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

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