Soil Investigation Guide

Along with the water we drink and the air we breathe, soil is one of our most important natural resources. We need to protect soil by keeping it healthy and using it wisely. Soil scientists help us do this. This guide will help you to become your own soil scientist so that you too can help protect this amazing natural resource. Have fun!

Let the testing begin. Fill in all the results of your tests on the soil testing record sheet as you go along.

Sunlight Investigation

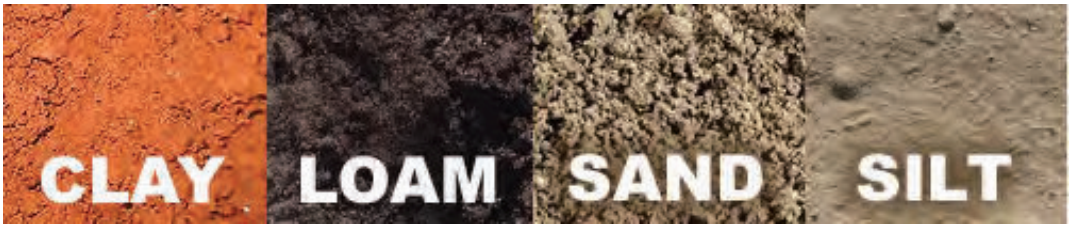
All plants need sun to help them grow, so let's find out if your planting area is the best place for growing!
Is your planting area somewhere where plants will have access to enough natural light? Check several times during the day to see if the area you have chosen to plant is in the shade or light. Check for possible obstacles.
Don't forget to fill in your observations on your record sheet!

Soil Type

There are two simple ways to investigate what type of soil you have.
You can try one or both!

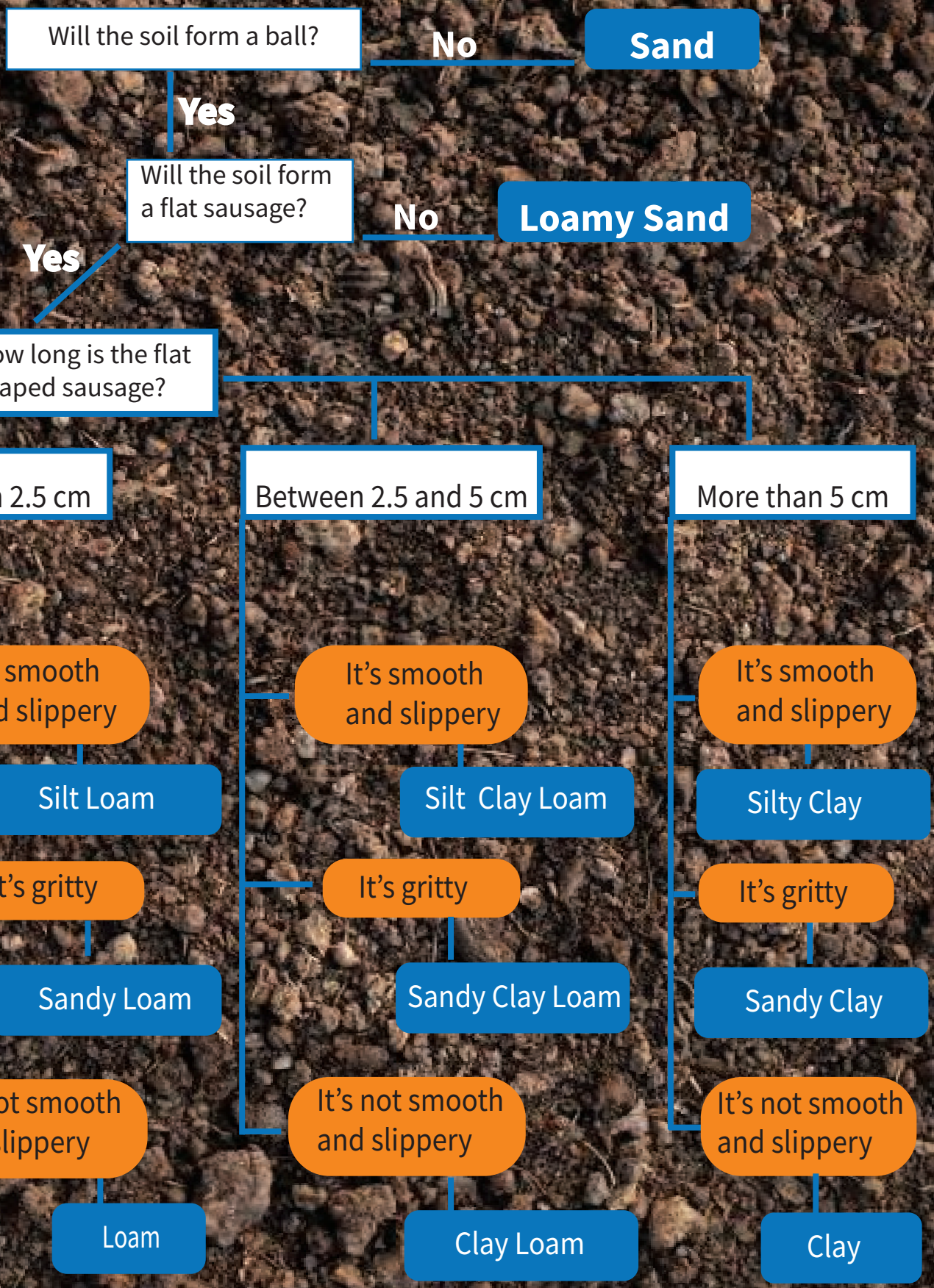
a. **Hand texturing**
This method is quick and lovely and messy!
Follow the soil texture test instructions on the folowing page to discover what type you have. Fill in your results on your record sheet.

b. **Soil Layers**
You can find out more exactly what your soil is made up from. All soils will have a mixture of sand, clay and silt. Hand texturing estimates which part is the most abundant but you can follow the steps on the soil layer test instructions to get a more exact idea.



Soil Texture Test Instruction

Take a golf ball sized amount of soil. Knead it in your hand whilst adding a small amount of water until the soil feels like putty/ play dough



Soil Layer Test

You will need to get yourself a jar, a jam jar will do, and a handful of the soil you want to test and follow below instructions.

- Half fill a clear jar or plastic bottle with soil. Wet slightly until it is like mud and tap gently.
- Mark on your container the level your soil is at (point X). See Picture 2.1

Picture 2.1

Picture 2.2

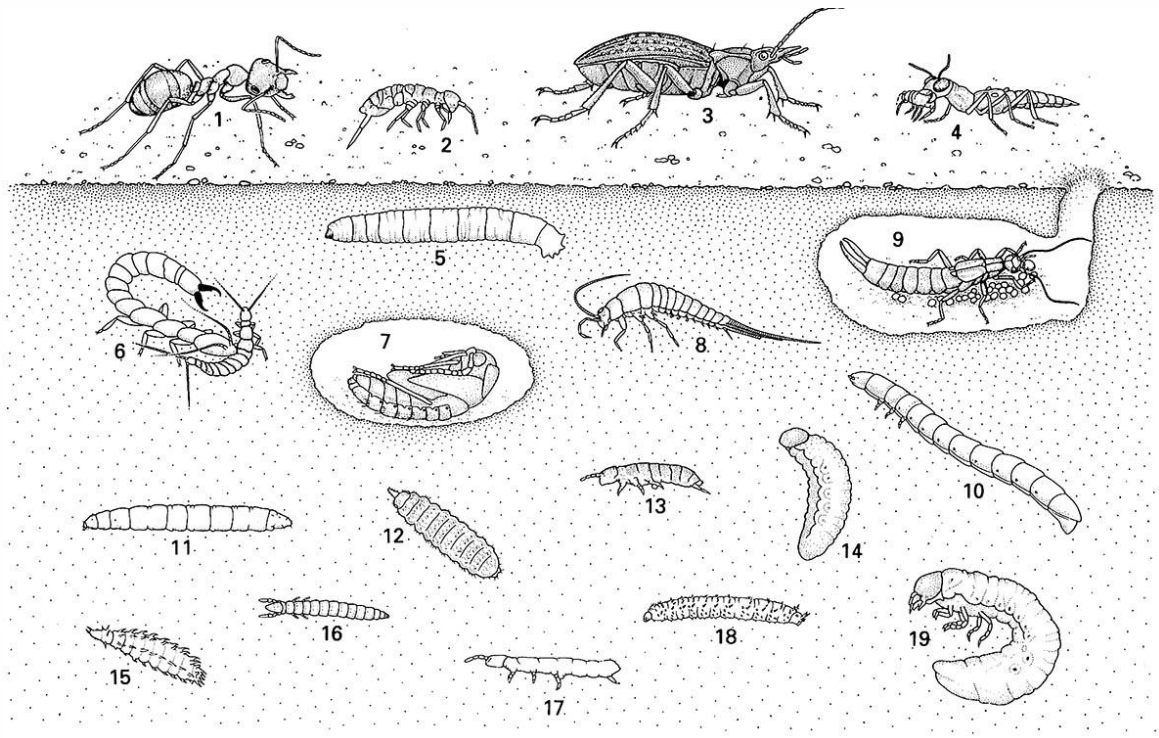
- Fill the container with water and shake strongly for about a minute.
- The soil and water should be completely mixed.
  Place on a flat surface.
- After 40 seconds mark the level on the container where soil has formed. This is the sand layer (Point A).
- After 1 hour mark the level the soil is at now.
  This is point B. The soil between A and B is the silt layer.
- After 24 hours mark the level the soil is at now
  (this should be the same level you initially marked before filling with water and shaking).

  This is point C. The soil between point B and C is the clay layer.
  See Picture 2.2
- Use a ruler to work out how much of your soil is made up of sand, silt and clay. You can then calculate the percentage.

Life in the Soil

Insects are a really important component of many ecosystems. They perform many important functions. They aerate the soil, they pollinate blossoms, and they control other insects and plant pests. As decomposers, insects help create top soil, the nutrient-rich layer of soil that helps plants grow. So, time to find out what type of creatures live in your soil!

To investigate creatures in the soil dig a hole in your planting area about 20cmX20cm and 20cm deep. Put all of the soil you dig up into a bucket or place on a sheet. Carefully search through for any insects. If you have any magnifying glasses these can be very helpful to see even the smallest insects. Note the different types of insects you found on your record sheet and return gently to their home, the soil.



(1) wood ant (Hymenoptera: Formicidae); (2) springtail (Collembola: Isotomidae); (3) ground beetle (Coleoptera: Carabidae); (4) rove beetle (Coleoptera: Staphylinidae) (5) larva of a crane fly (Diptera: Tipulidae); (6) japygid dipluran (Dip lura: Japygidae); (7) pupa of a ground beetle (Coleoptera: Carabidae); (8) bristletail (Archaeognatha: Machilidae); (9) female earwig (Dermaptera: Labiduridae); (10) wireworm, larva of a tenebrionid beetle (Coleoptera: Tenebrionidae); (11) larva of a robber fly (Diptera: Asilidae); (12) larva of a soldier fly (Dipt era: Stratiomyidae); (13) springtail (Collembola: Isotomidae); (14) larva of a weevil (Coleoptera: Curculionidae); (15) larva of a muscid fly (Diptera: Muscidae); (16) proturan (Protura: Sinentomidae); (17) springtail (Collembola: Isotomidae); (18) larva of a March fly (Diptera: Bibionidae); (19) larva of a scarab beetle (Coleoptera: Scarabaeidae).
(Individual organisms after various sources, especially Eisenbeis & Wichard 1987)

Life in the Soil - Earthworms

Earthworms are vital to soil health because they transport nutrients and minerals from below to the surface via their waste, and their tunnels aerate the ground. As they burrow, they consume soil, extracting nutrients from decomposing organic matter like leaves and roots.
So, time to count those worms!

Worm Count

Using the same soil sample as above explore the worms in more detail.

Count and note the number of worms found in the soil from the dug hole and return gently to the soil. Carefully fill the hole back in.

Use measuring tape/metre stick/rulers etc to measure the size of your raised beds/planting area.

When you get back into the classroom use number of worms in your sample hole to estimate the total number of worms in the planting area.

Use the number found in your sample as follows:

Do the maths:
Sample hole of 20cmX20cmX20cm= 8000cm3.
30 worms were found in this area.
Size of bed of 100cmX50cmX20cm= 100,000cm3.
Number of beds is 4 which are all the same size.
100,000/8000 is 12.5 so the raised bed is 12.5 times the size of your sample
If you find 30 worms in your sample you can estimate there would be 30X12.5= 375 worms in the raised bed. If there are 4 raised beds then you can estimate there are 375x4= 1500 worms total in the raised beds.

Soil pH test

A soil pH test will tell you how acidic or alkaline your soil is.
This is an optional test that requires equipment. Your school may have pH strips or they can be bought for a low cost.

- To measure the pH of soil take a small teaspoon of soil and mix with a small glass of water. Make sure you remove any stones, worms etc first!
- Dip your pH strip into the mixture for a few seconds and remove. Wait about a minute. It will start to change colour.
- The colour it turns will match with a number on the pH scale to give you your result. Remember most plants like to grow between 6 and 7 on the pH scale.

Air in Soil

Another very important ingredient of soil is air. Plants growing in it as well as other living creatures rely on the oxygen, nitrogen and carbon dioxide in the air that is present in the soil. How can we measure if there is enough air in our soil? See below for a guide on how to measure air in soil and get measuring.
Don't forget to add your findings on your record sheet!

To get an idea of how much air your soil contains you have to force it out. When water is added to soil there is less room for the air and it will be released. To compare the air in the soil you use for planting versus other soil in the grounds follow these steps:

- **Take a handful of soil from your planting area and a handful of soil from another part of the grounds and squish each into a clod/ball of soil.**
- **Start to spray each with water and allow it to be absorbed. See Picture 5.1.**
- **Then place each clod in a separate glass/jar/see-through container of water.**
- **Count the bubbles which are released from each. The more bubbles released the more air was in the soil. See Picture 5.2.**
- **Note which soil sample released more bubbles.**

Picture 5.1: Soil ball after spraying with water

Picture 5.2: Bubbles appearing

Measuring Soil Erosion

Wind and water can wear away soil and remove the important top soil which contains the nutrients plants need to grow. Some soil types are more resistant to erosion than others. Let us find out how your soil stands up to erosion!

To compare the soil you use for planting to other soil in your school grounds carry out the following steps:

- Take two plastic bottle and cut about a third off the top off them (horizontally)
- Cut from the bottom of the bottle. You don't need to cut through the bottle cap. See picture 6.1 below.

Picture 6.1

Picture 6.2

- Fill the larger half of each bottle with a different soil sample. The bottles should be packed full of soil.
- Give each bottle to a different student and have them hold it at a slight angle facing slightly towards the ground. Place a beaker or glass under the bottle opening.
- Another pair of students will now slowly pour about 100mls of water into the bottle. Start pouring at the slightly raised end so that the water is flowing through the soil and into the beaker/container beneath the bottle. See Picture 6.2.
- Repeat this process about 10 times.
- Compare the two containers which caught the water. The darker the colour of the water the more soil was eroded (washed out). Note which sample was eroded the most.
- Afterwards you can try pouring faster/with force/all in one spot/blowing on it to mimic different types of weather to see the effect it has.

Soil Testing Record Sheet

Follow along with the Soil Investigation Guide and record your answers below.

School Name:

Date: Weather:

Area/Bed sampled:

Sunlight Investigation

Is the area in direct sunlight at 9am: 12pm: 2pm:

Soil Type

Soil Type (Hand Texture) :

Soil Type by layers:

Life in the Soil

Types of Insects Found:

Number of worms in sample hole:

Estimated number of worms in all raised beds/planting area:

Soil pH:

Air in Soil

Air bubbles in Sample 1:

Air bubbles in Sample 2:

Soil Erosion

Which soil sample was eroded most easily?