



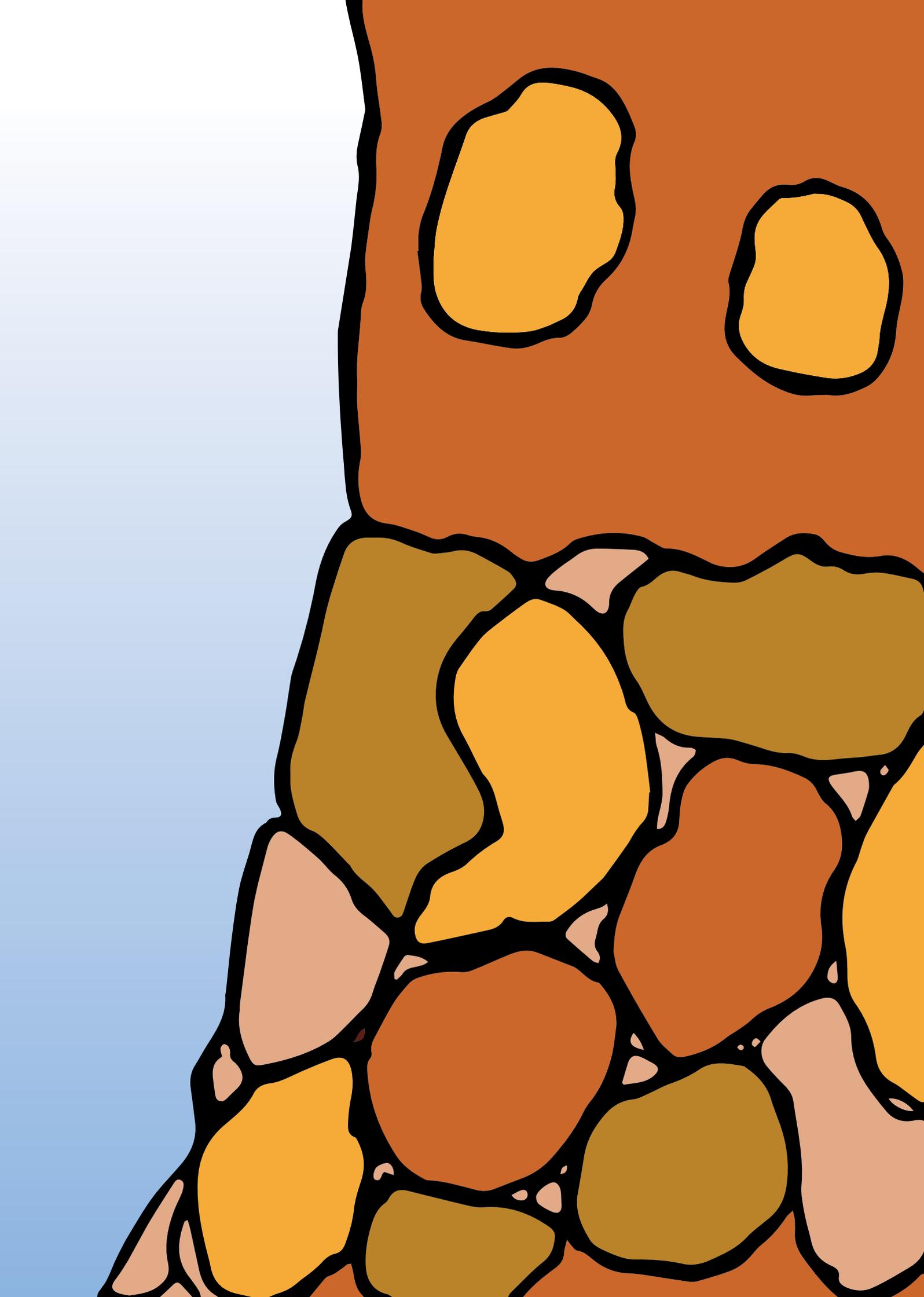
Food and Agriculture
Organization of the
United Nations



Soil experiments *FOR CHILDREN*

**LET'S CELEBRATE SOILS
AND TAKE A JOURNEY
TO DISCOVER THE GROUND
BENEATH OUR FEET!**





SOIL IS VITAL TO LIFE ON THE PLANET - IT IS CAPABLE OF SUPPORTING PLANT AND TREE LIFE BY PROVIDING THEM WITH NUTRIENTS, WATER AND MINERALS. IT IS HOME TO MILLIONS OF INSECTS, BACTERIA AND SMALL ANIMALS.

It is no secret that children and soil pretty much go hand in hand. Children usually love to find a dirt patch and make some mud and dig or romp in it. While they might find playing in it fun, they may be surprised to learn that soil is the basis for life and growth! Teaching children why **“Caring for the Planet Starts from the Ground”** is one of the major goals of the World Soil Day 2017 communication campaign.



This Soil-Lab Activity Book is designed to give children an insight into soil knowledge. Practitioners, youth leaders and teachers can support children’s learning through offering opportunities for them to: learn how to operate a range of tools safely; encounter creatures, plants and objects in their natural environments and in real life situations; undertake practical experiments; and work with a range of materials. Children will learn that without soil we would not be able to grow crops or other useful plants, support livestock, or have materials for building shelter! Healthy soils also store and filter water, recycle nutrients and help us to deal with the negative effects of climate change by storing large amounts of carbon.

LET'S CELEBRATE SOILS AND TAKE A JOURNEY TO DISCOVER THE GROUND BENEATH OUR FEET!

Tips on using the SoilLAB Activity Book with your group

1. INVESTIGATE: Encourage kids to learn how such a thin layer of the Earth's surface can support all life on the planet, and which risks we are taking not caring for soils.

2. SELECT: Participants are encouraged to select the activities that best match their needs, interests, and culture.

3. ACT: Allow enough time for the group to carry out the activities. Support and guide them through the process. Encourage exploration, observation, investigation, problem solving, prediction and decision making when undertaking the activities.

4. DISCUSS: Have participants present the result of their activities to the rest of the group. Do you notice any change of attitude? Encourage participants to find things out and try things out for themselves rather than always having things explained to them. Discuss with them about how their daily activities both depend and affect soil and our lives. Children need to be encouraged

5. CELEBRATE: Organize your own celebration for World Soil Day, December 5! Invite families, friends, journalists and community leaders to participate in the celebration.

6. SHARE: Share with us stories, videos, photos, drawings, ideas and suggestions: world-soil-day@fao.org

Age ranges

To help you and your group pick the most appropriate activities, the experiments selected should be suitable for 6 to 15 year olds. However, please note that this range is only indicative. You may find that an experiment listed at one level is suitable for another age group in your particular circumstances. As teachers and youth leaders you should use your judgement and experience to develop an appropriate curriculum for your group or class. This could incorporate additional activities not listed in the SoilLAB Activity Book but which allow you to achieve all the educational requirements.

Caution advice

Dear Teachers/Leaders/Practitioners,

The SoilLAB Activity Book supports you in undertaking educational activities. However, as you will be implementing these activities in different contexts and environments, it is up to you to ensure that the activities you choose are appropriate and safe. Please carefully plan and undertake activities with the support of one or more adults to ensure that participants are safe, especially when near water or fire. When exploring soils, remember to treat nature with respect, minimize your impact and take all garbage with you. Please consider the general precautions and carefully evaluate which other safety issues need to be taken into account before undertaking any activity.

Sample soil and make a soil profile Key processes forming soil include rock weathering, organic matter accumulation and downward transport, solutions of salts and oxidation of minerals. Because they occur very slowly and generally follow the direction of gravity, soils are composed of different layers called **horizons**. Discover how soil horizons arrange into a soil profile and make your own!

SOILS ARE VERY DEEP!



1

DIG ONE OR MORE SOIL PITS FROM DIFFERENT LOCATIONS AND LAND USES. COLLECT SOIL MATERIAL FROM DIFFERENT DEPTHS.

2

Soil Name _____

| Horizon | 0" |
|---------|-----|
| A | 12" |
| B | 24" |
| | 36" |
| C | 48" |
| | 60" |
| | 72" |

www.nrcs.usda.gov

DOWNLOAD AND PRINT THE SOIL PROFILE CARDS OR DRAW YOUR DESIGN ON A NOTE CARD.

MATERIALS

spade/shovel

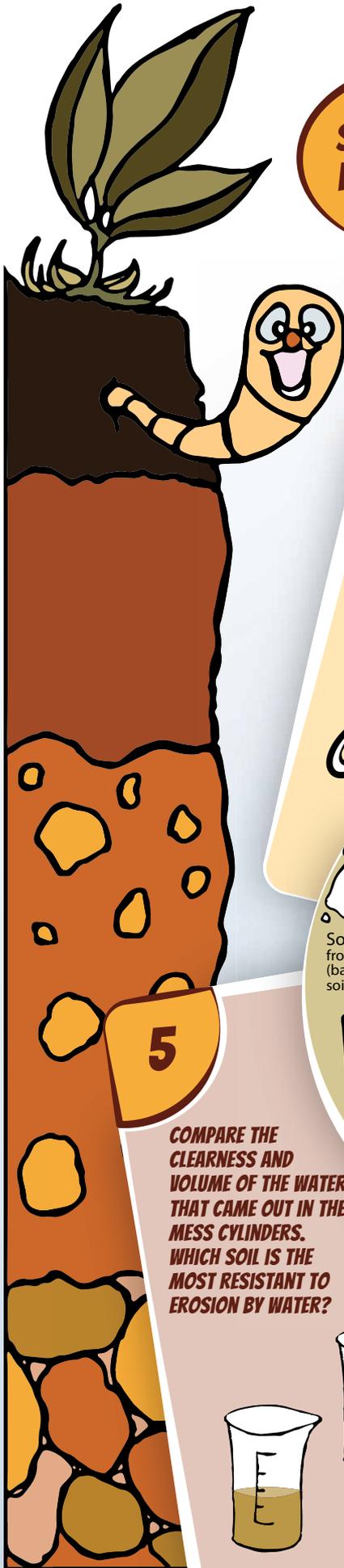
Double-sided adhesive tape

4

TAPE THE SOIL MATERIAL CORRESPONDING TO EACH DEPTH ACCORDING TO YOUR OBSERVATIONS IN THE SOIL PIT TO YOUR SOIL PROFILE CARD. AFTER COMPLETING YOUR SOIL PROFILE CARD, RESEARCH AND DISCUSS WITH YOUR CLASSMATES THE POSSIBLE REASONS FOR THE DIFFERENT SOIL HORIZONS.

3

ATTACH A DOUBLE-SIDED ADHESIVE TAPE TO THE CARD.



**SOILS CAN BE
WORN AWAY!**

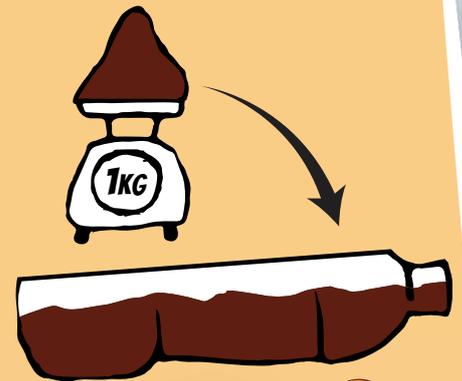
Soil Erosion by Water Water and wind can cause soil erosion and transport large amounts of soil. Even though it is a natural process, human activities can accelerate this process, causing serious soil degradation. Depending on different soil properties, such as texture (particle size distribution) and soil organic matter content, soils can be more or less resistant to erosion. Experiment with soils from three different land uses to discover how strong soil erosion can be!

1

CUT THREE PLASTIC BOTTLES HORIZONTALLY. USE THE BIGGER PART.



2
WEIGH 1 KG EACH OF SOILS AND PUT IT IN THE CUT PLASTIC BOTTLES.



3

SET THREE BEAKERS BENEATH THE PLASTIC BOTTLES TO CATCH THE WATER.

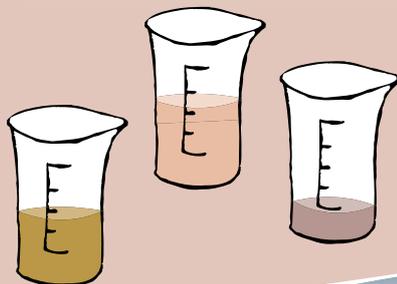


MATERIALS



5

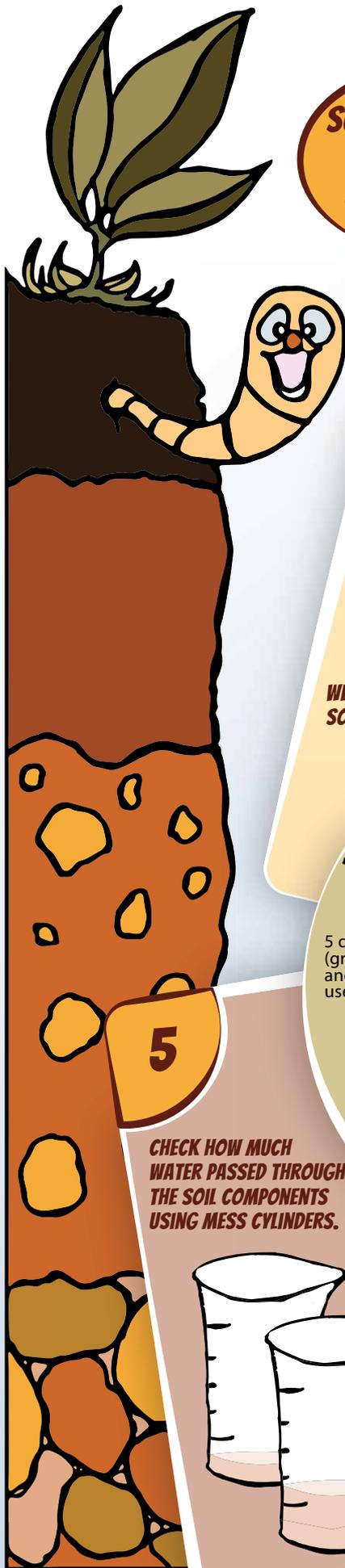
COMPARE THE CLEARNESS AND VOLUME OF THE WATER THAT CAME OUT IN THE MESS CYLINDERS. WHICH SOIL IS THE MOST RESISTANT TO EROSION BY WATER?



4

POUR 100 ML OF WATER SLOWLY INTO EACH BOTTLE, KEEPING THE BOTTLE TILTED. CARRY OUT THIS STEP TEN TIMES CONSECUTIVELY.





**SOILS CAN HOLD
TREMENDOUS
AMOUNTS OF
WATER!**

Water Retention in Soil This helps plant grow even when there is no rain for a longer period of time. Due to the interaction between water molecules and soil particles, the particle size distribution of soils or soil texture is one of the two main drivers of the water holding capacity of soils. Water is also kept by soil organic matter. Compacted soils or those poor in soil organic matter can hold less water. Test with your classmates which component of soils can hold the largest amount of water!

1



**WEIGH 50G OF EACH
SOIL COMPONENT.**

2
**SET A FUNNEL WITH A COFFEE
FILTER AND PUT ON TOP OF THE JAR.**



3
**SLOWLY, POUR 50
MILLILITERS OF WATER OVER
THE COMPONENTS.**

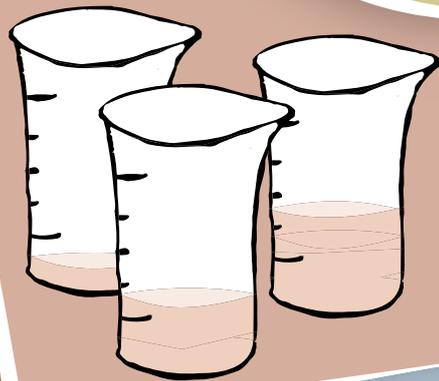


MATERIALS

- 5 different soil components (gravel, sand, silt, clay, and to test organic matter use potting compost)
- 5 Funnels
- 5 Coffee filters
- 1 or more 50 mL mess cylinders
- 5 Beakers (or jars)
- Balance

5

**CHECK HOW MUCH
WATER PASSED THROUGH
THE SOIL COMPONENTS
USING MESS CYLINDERS.**

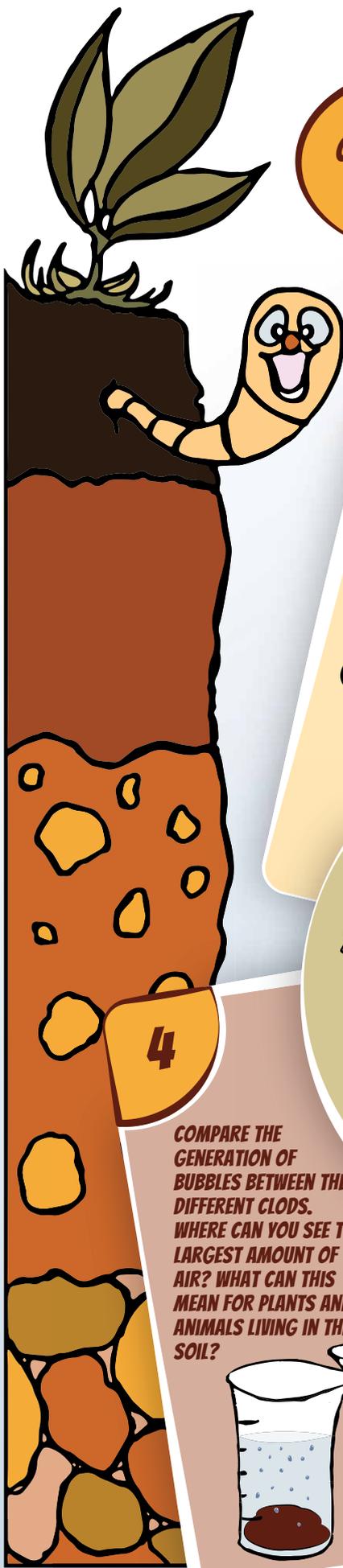


4
WAIT 5 MINUTES



Air in the Soils Up to 50% of the soil is made up of diverse gases - simply said, air! Among these gases, oxygen plays a crucial role for letting plant roots and soil animals breathe. Certain soil bacteria are able to use different gases such as carbon dioxide or nitrogen gas in their metabolisms. Soil gases can prevail within the pore network of soils. When soil is compacted or filled with water, there is less space for soil air.

**UP TO 50%
OF THE SOIL IS
MADE UP OF
AIR!**



1

MOISTEN THE SOIL LIGHTLY AND PREPARE SEVERAL SIMILARLY SIZED SOIL CLODS WITH YOUR HANDS.

2

SPRAY THE CLODS AND WAIT 2 MINUTES.

MATERIALS

3-4 different soils

Beakers (or jars)

Tap water

1 Sprayer

3

DRIP THE CLODS IN DIFFERENT JARS FILLED WITH WATER. WATCH THE BUBBLES.

4

COMPARE THE GENERATION OF BUBBLES BETWEEN THE DIFFERENT CLODS. WHERE CAN YOU SEE THE LARGEST AMOUNT OF AIR? WHAT CAN THIS MEAN FOR PLANTS AND ANIMALS LIVING IN THE SOIL?

Separating soil and estimating soil texture. Soils are composed of particles of different sizes. The smallest particles are referred to as "clay", the medium sized "silt" and the largest ones "sand." Soil texture defines which percentage of the total soil each of these particle size classes represent. Texture is the most important physical property and defines most key functions of soils, especially in relation to porosity, water infiltration and retention as well as erosion resistance.

SOILS ARE COMPOSED OF PARTICLES OF DIFFERENT SIZES



1

FILL EACH JAR HALF FULL WITH SOIL. WET THE SOIL TO A MUD CONSISTENCY AND TAP THE JAR TO LET THE SOIL SETTLE.



2

MARK THE LEVEL OF SOIL ON EACH JAR. ADD A TEASPOON OF WATER SOFTENER.

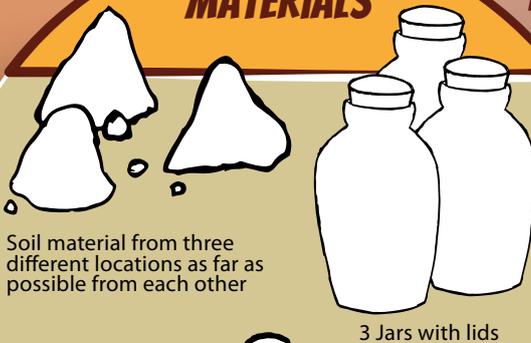


3

ADD SUFFICIENT WATER TO ENTIRELY FILL THE JAR AND SHAKE THE SOIL-WATER MIXES THOROUGHLY.



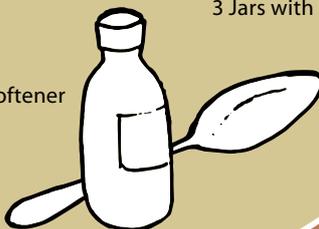
MATERIALS



Soil material from three different locations as far as possible from each other

3 Jars with lids

Water softener



6

- Clayey soils over 30% clay
- Sandy soils over 60% sand
- Loamy soils over 60% silt

CLASSIFY YOUR SOILS' TEXTURE: FIND OUT WITH YOUR CLASSMATES, WHICH SOILS HAVE WHICH PROPERTIES AND WHICH ONES ARE BEST SUITED FOR DIFFERENT USES!

5



CALCULATE THE PERCENTAGE OF SAND, SILT AND CLAY BY MEASURING THE DEPTH OF EACH MARK. THE DIFFERENCE BETWEEN HIGHEST MARK AND THE SILT MARK REPRESENTS THE CLAY FRACTION.

4

LET THE SOIL SETTLE FOR 40 SECONDS AND MARK THE LEVEL OF SOIL ON THE JAR TO IDENTIFY THE SAND PORTION. LET THE SOIL SETTLE FOR 6 HOURS AND MARK THE LEVEL OF SOIL ON THE JAR. THE DIFFERENCE BETWEEN THIS MARK AND THE SAND MARK REPRESENTS THE SILT PORTION.



Bioturbation by Earthworms in the Soil. They feed on organic matter, so they regulate its fragmentation and decomposition. In this way earthworms also help nutrient recycling, from which many soil inhabitants profit. Through their activity, the soil structure gets loosened, so air and water transportation is positively influenced. They also contribute to soil aggregation, giving soils more stability and resistance against erosion. See for yourselves what earthworms can do!

**EARTHWORMS
ARE ONE OF SOILS'
BEST FRIEND!**



1

MAKE SOME HOLES IN THE UPPER 5 CENTIMETERS OF THE CONTAINER TO ALLOW AIR EXCHANGE. MOISTEN THE SOILS. PILE UP THE DIFFERENT COLORED SOILS AS LAYERS MIXING THEM AS LITTLE AS POSSIBLE. STAY BELOW THE HOLES.

6

ARRANGE THE PHOTOS IN A TIME SEQUENCE AND EXPLORE THE DIFFERENCES BETWEEN THE BEGINNING AND THE END. WHAT CAN YOU SEE? WHICH BENEFICIAL ROLE DO YOU THINK EARTHWORMS PLAY AND HOW IS THIS VISIBLE IN YOUR EXPERIMENT?



2

COVER THE SURFACE WITH THE DEAD LEAVES AND PLANT RESIDUES.

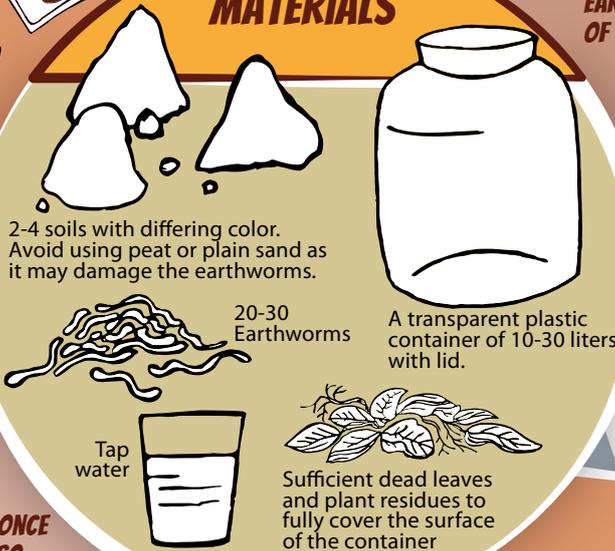


3

PLACE THE 20-30 EARTHWORMS ON TOP OF THE PLANT COVER.



MATERIALS



2-4 soils with differing color. Avoid using peat or plain sand as it may damage the earthworms.

20-30 Earthworms

A transparent plastic container of 10-30 liters with lid.

Tap water

Sufficient dead leaves and plant residues to fully cover the surface of the container

5

TAKE PHOTOS OF THE SIDE AND TOP OF THE CONTAINER AT LEAST ONCE PER DAY. YOU CAN ALSO RECORD VIDEOS ON SOME DAYS.



4

CLOSE THE CONTAINER WITH THE LID AND KEEP THE CONTAINER IN A COOL PLACE FOR UP TO ONE MONTH. CHECK THAT THE SOIL DOES NOT DRY OUT.





The Global Soil Partnership (GSP) was established in December 2012 as a strong interactive partnership to promote sustainable soil management and guarantee healthy and productive soils for a food secure world, as well as support other essential ecosystem services. Awareness raising, advocacy, policy development and capacity development on soils, as well as relevant implementation in the field are among the main GSP activities.

Thanks to the financial support of

