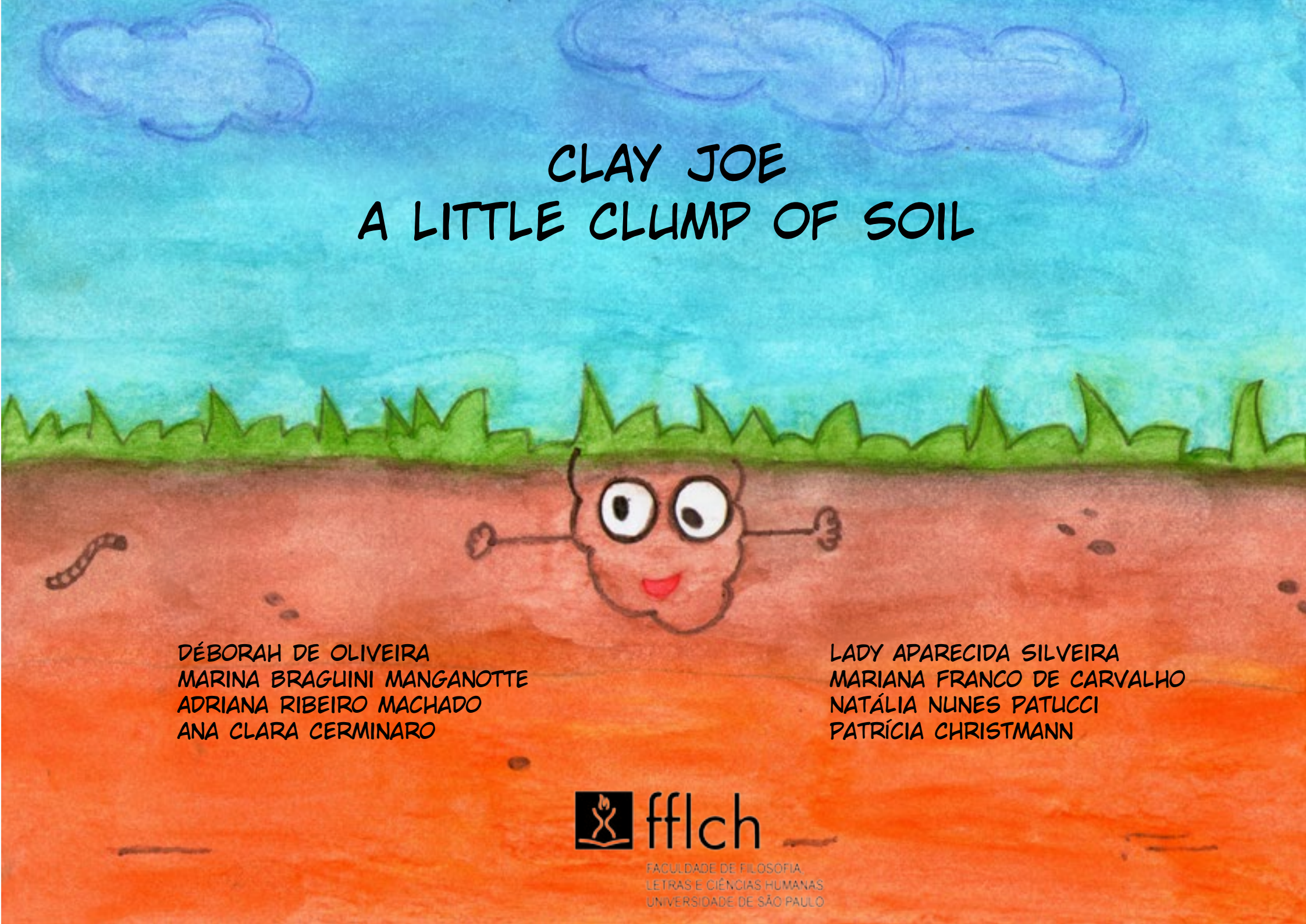
CLAY JOE
A LITTLE CLUMP OF SOIL



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English version by Cristiano Buoniconti Camargo

FFLCH/USP
São Paulo, 2020

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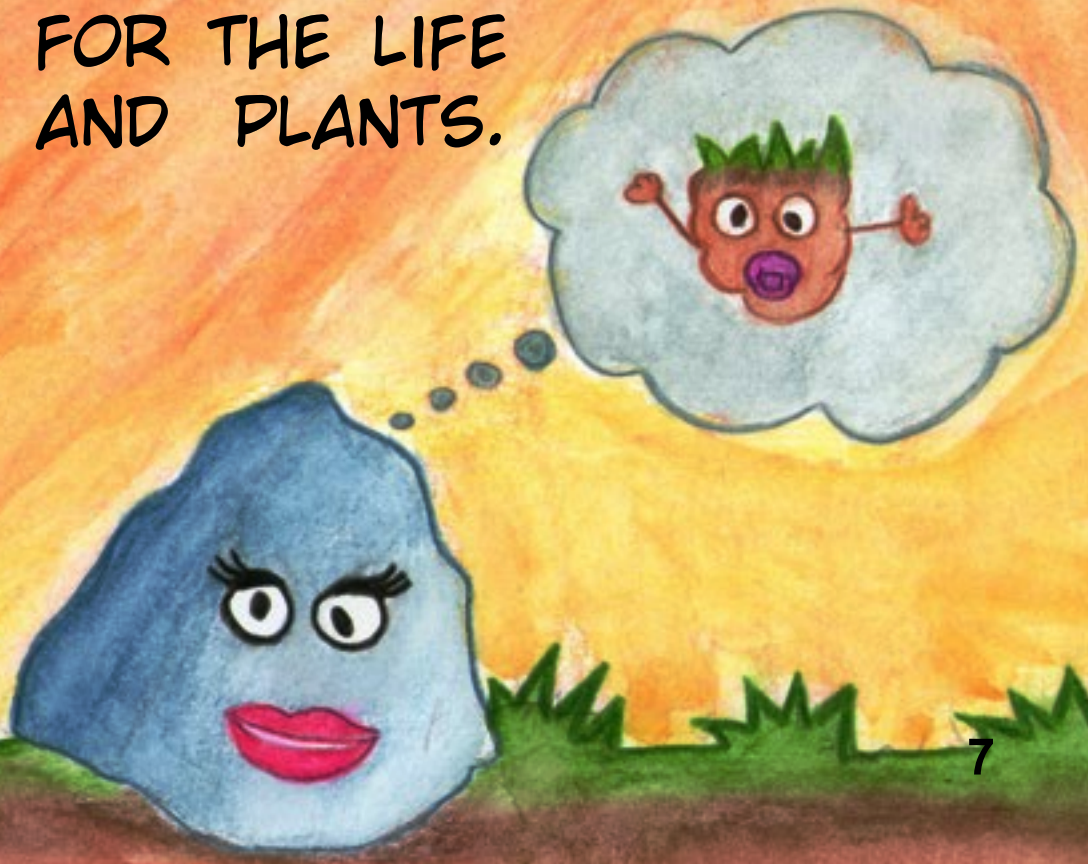
CLAY JOE, THAT'S ME!

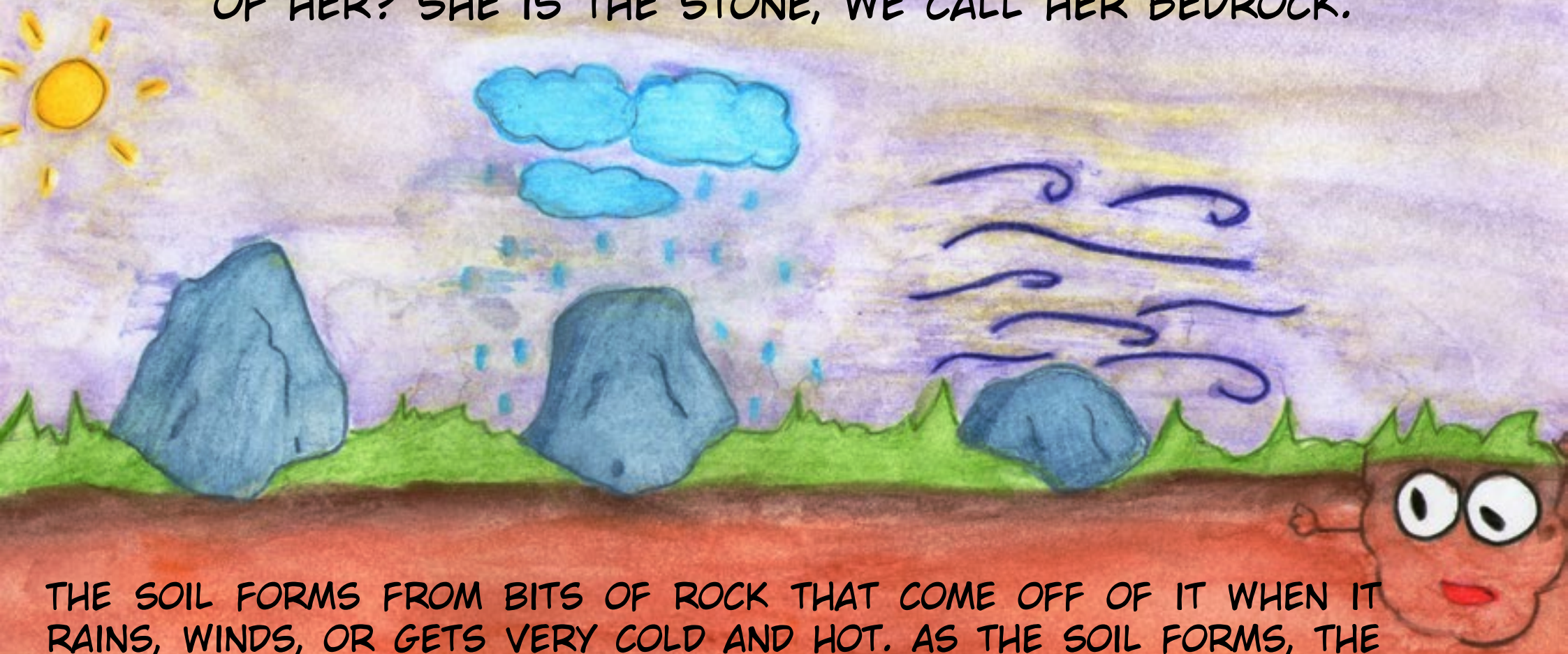
HELLO, I'M CLAY JOE. I'M A PIECE OF SOIL, AND MY HOUSE IS DOWN HERE, WHERE ALMOST NOBODY NOTICES! DO NOT THINK THAT BECAUSE I LIVE DOWN BELOW I AM LESS IMPORTANT. LIFE HERE IS VERY BUSY. MANY THINGS HAPPEN ALL THE TIME THAT NO ONE SEES.

DO YOU WANT TO KNOW A LITTLE BIT MORE ABOUT ME?

BUT AFTER ALL, DO YOU KNOW WHO I AM? DO YOU KNOW WHAT SOIL IS? SOIL IS ALSO KNOWN TO MANY PEOPLE AS LAND, AND IS VERY IMPORTANT FOR THE LIFE OF MAN, ANIMALS AND PLANTS.



JUST LIKE YOU, I ALSO HAVE A MOTHER. HAVE YOU HEARD OF HER? SHE IS THE STONE, WE CALL HER BEDROCK.



THE SOIL FORMS FROM BITS OF ROCK THAT COME OFF OF IT WHEN IT RAINS, WINDS, OR GETS VERY COLD AND HOT. AS THE SOIL FORMS, THE ROCK DECREASES IN SIZE AS SEVERAL PIECES OF IT COME LOOSE FROM IT.
WE CALL THIS PROCESS WEATHERING. SO THESE LOOSE BITS OF ROCK, ALSO CALLED MINERALS, COME TOGETHER AND FORM THE SOIL.

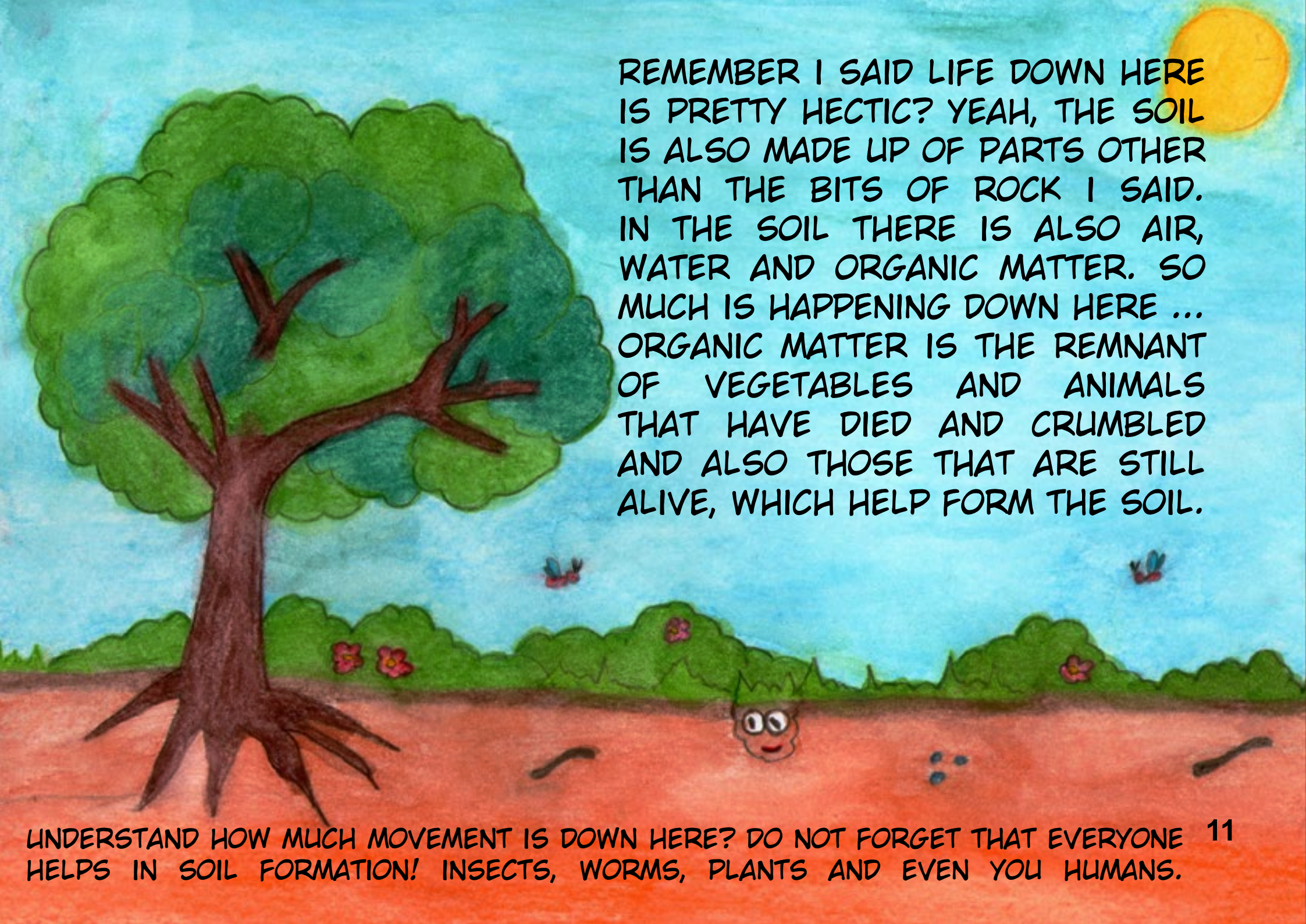
DON'T THINK IT HAPPENS FAST, IT DOESN'T! I, FOR ONE, AM A YOUNG SOIL!

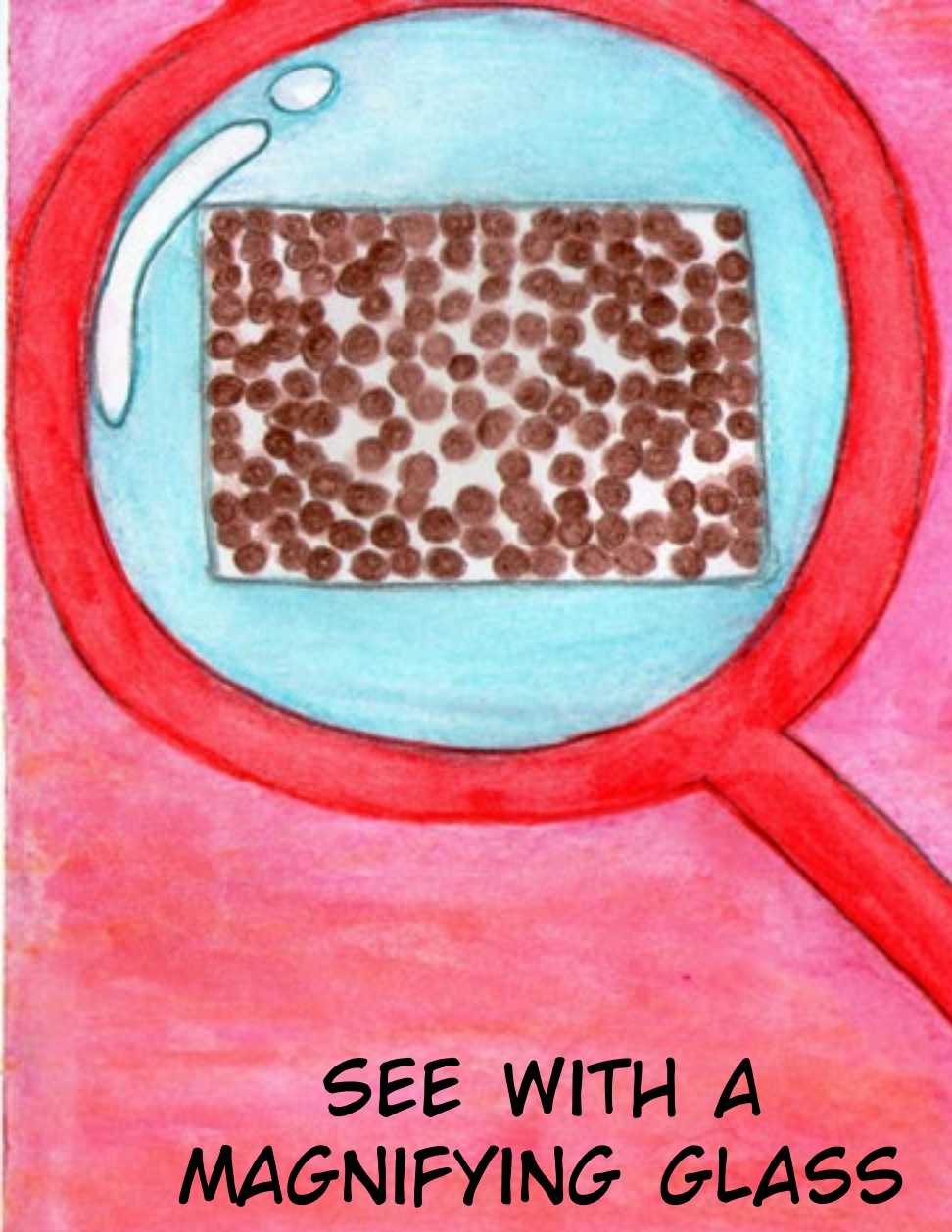
THE OLDER SOIL IS THE ONE THAT SUFFERED THE MOST WEATHERING DURING ITS LIFETIME. BUT ALSO, IT MAY LOSE ITS VITALITY THROUGH SOME HUMAN ACTIONS THAT I WILL TELL YOU LATER.

THE SOIL IS FORMED OF PIECES OF MANY SIZES. GRAVEL IS THE LARGEST OF THEM AND LOOKS LIKE LITTLE BITS OF ROCK. IT COULD BE THE PEBBLES WE FOUND OUT THERE IN THE STREETS.

THE SAND IS A BIT SMALLER, BUT YOU CAN STILL SEE THE BITS THAT MAKE IT UP. WE SEE THE SAND, FOR EXAMPLE, IN THE PLAYGROUNDS WHERE YOU PLAY FROM TIME TO TIME.

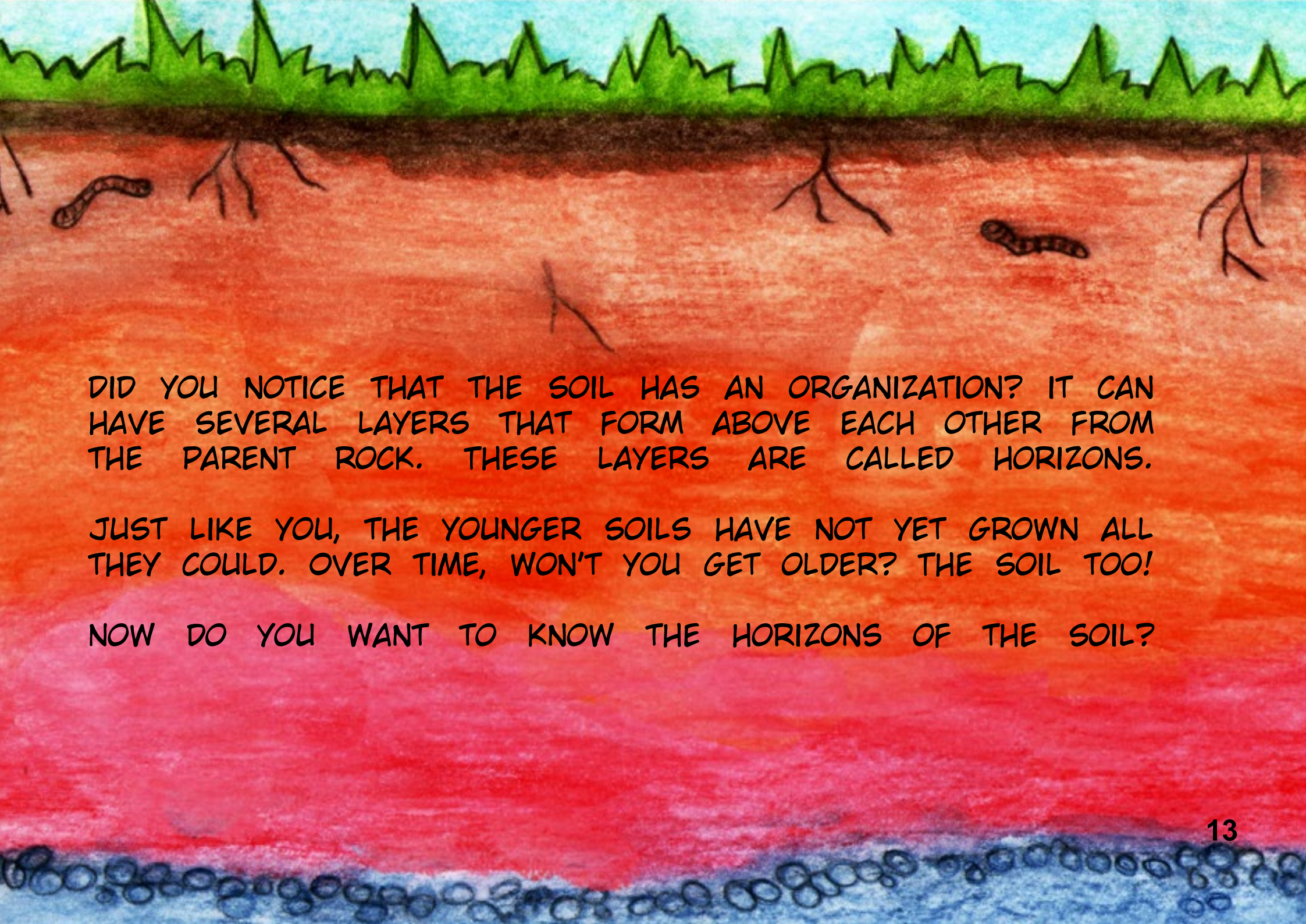
SILT IS WHAT WE CALL BITS EVEN SMALLER THAN SAND. IT LOOKS A LOT LIKE TALCUM POWDER BECAUSE WE CAN CATCH IT, BUT IT'S HARD TO SEE ITS GRAINS. AND CLAY IS THE NAME GIVEN TO BITS THAT ARE EVEN SMALLER THAN SILT.


REMEMBER I SAID LIFE DOWN HERE IS PRETTY HECTIC? YEAH, THE SOIL IS ALSO MADE UP OF PARTS OTHER THAN THE BITS OF ROCK I SAID. IN THE SOIL THERE IS ALSO AIR, WATER AND ORGANIC MATTER. SO MUCH IS HAPPENING DOWN HERE ... ORGANIC MATTER IS THE REMNANT OF VEGETABLES AND ANIMALS THAT HAVE DIED AND CRUMBLED AND ALSO THOSE THAT ARE STILL ALIVE, WHICH HELP FORM THE SOIL.
UNDERSTAND HOW MUCH MOVEMENT IS DOWN HERE? DO NOT FORGET THAT EVERYONE HELPS IN SOIL FORMATION! INSECTS, WORMS, PLANTS AND EVEN YOU HUMANS.



THE AIR INSIDE THE SOIL IS BETWEEN THE PIECES THAT FORM IT. THROUGH THESE HOLES PASS WATER, ANIMALS SUCH AS WORMS, THE ROOTS OF PLANTS, AND NUTRIENTS THAT MAKE UP THE SOIL. THERE ARE ALSO THINGS THAT GET INTO THE SOIL AND HARM IT, SUCH AS PESTICIDES.

SEE WITH A MAGNIFYING GLASS THE AIR HOLES IN THE SOIL.



DID YOU NOTICE THAT THE SOIL HAS AN ORGANIZATION? IT CAN HAVE SEVERAL LAYERS THAT FORM ABOVE EACH OTHER FROM THE PARENT ROCK. THESE LAYERS ARE CALLED HORIZONS.

JUST LIKE YOU, THE YOUNGER SOILS HAVE NOT YET GROWN ALL THEY COULD. OVER TIME, WON'T YOU GET OLDER? THE SOIL TOO!

NOW DO YOU WANT TO KNOW THE HORIZONS OF THE SOIL?

O - THE FIRST HORIZON THAT IS AT THE TOP OF THE IMAGE IS THE ORGANIC HORIZON CALLED "O". IT IS FORMED MAINLY OF THE LEAVES THAT HAVE FALLEN FROM THE PLANTS, AND THE REMAINS OF ANIMALS.

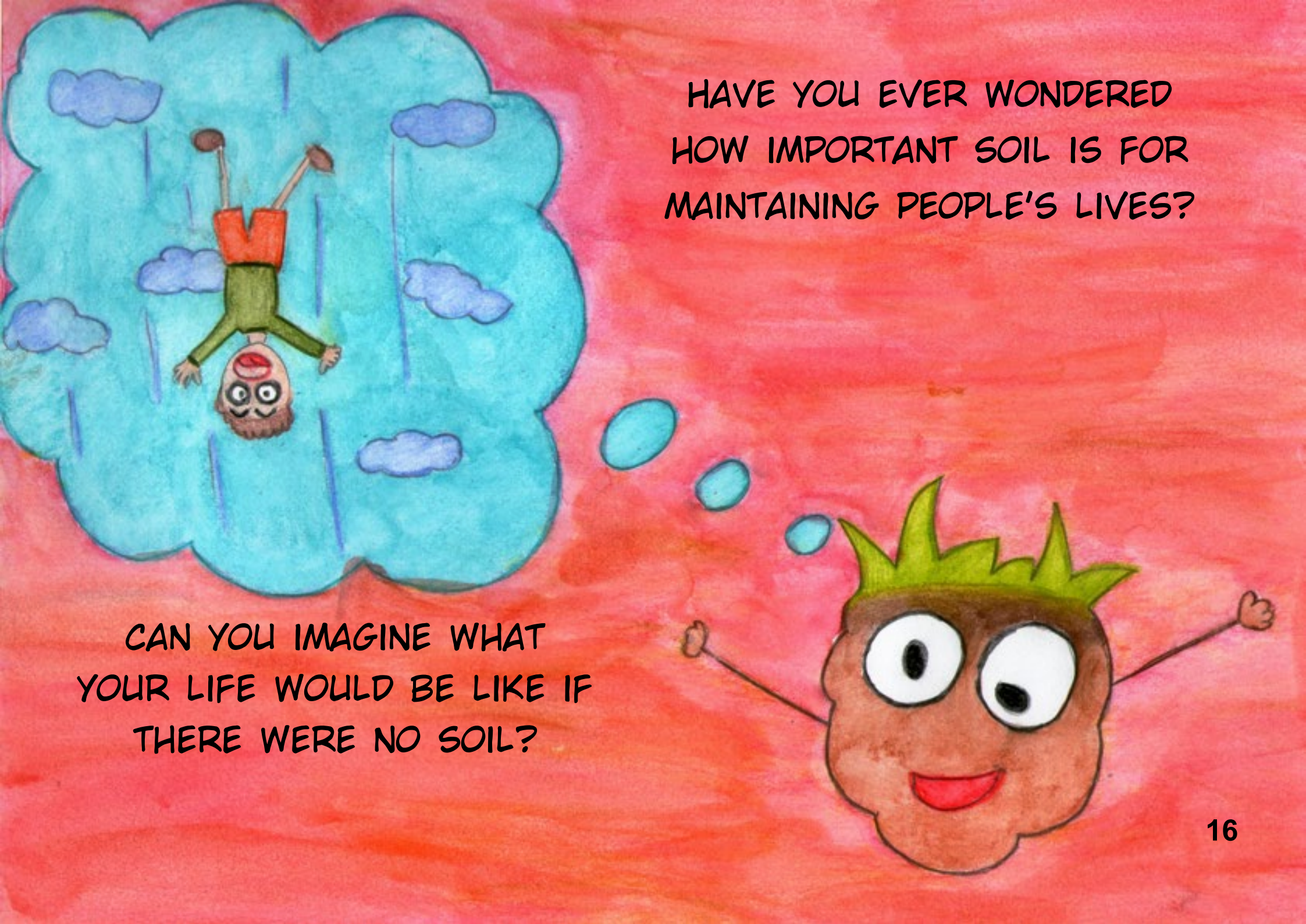
A - THE HORIZON BELOW THE "O" IS CALLED THE "A" HORIZON. IN IT WE CAN FIND THE ORGANIC MATTER THAT HAS ALREADY MIXED A LOT WITH SAND, SILT AND CLAY.

B - THE NEXT LAYER IS CALLED "B". IT RECEIVED MATERIALS FROM THE TOP LAYERS THAT WERE CARRIED BY WATER THAT FLOWED THROUGH THE HOLES IN THE SOIL. THIS IS THE MOST DEVELOPED LAYER OF ALL.

C - THE LAST LAYER IS "C", WHICH IS CLOSEST TO THE ROCK. AS IT IS DOWN THERE, IT HASN'T CHANGED MUCH YET.

R - FINALLY "R" IS THE NAME GIVEN TO THE HORIZON WHERE THE WHOLE ROCK IS UNCHANGED.

SOIL EVERYWHERE


HAVE YOU EVER WONDERED HOW IMPORTANT SOIL IS FOR MAINTAINING PEOPLE'S LIVES?
CAN YOU IMAGINE WHAT YOUR LIFE WOULD BE LIKE IF THERE WERE NO SOIL?

NOW THINK FOR A MOMENT:
- DO YOU KNOW WHERE THE FOODS YOU EAT EVERY DAY COME FROM?

BEFORE ARRIVING AT YOUR HOME YOUR FOOD WENT THROUGH SEVERAL OTHER PLACES. FOR EXAMPLE, SOMEONE BOUGHT THEM AT THE MARKET FOR YOU.

AND BEFORE REACHING THE MARKETS TO BE SOLD, THE FOOD HAD TO BE PLANTED.

FOOD IS PLANTED IN THE SOIL, AND IT IS THE SOIL THAT PROVIDES THE NUTRIENTS NEEDED FOR PLANTS TO GROW STRONG AND PRODUCE FOOD.


THE SOIL ALSO PROVIDES FOOD FOR THE ANIMALS.

AND TREES THAT ALSO GROW IN THE GROUND PROVIDE WOOD THAT IS USED TO DO MANY THINGS, SUCH AS:

FIREWOOD FOR COOKING

MAKING PAPER

BUILDING FURNITURE

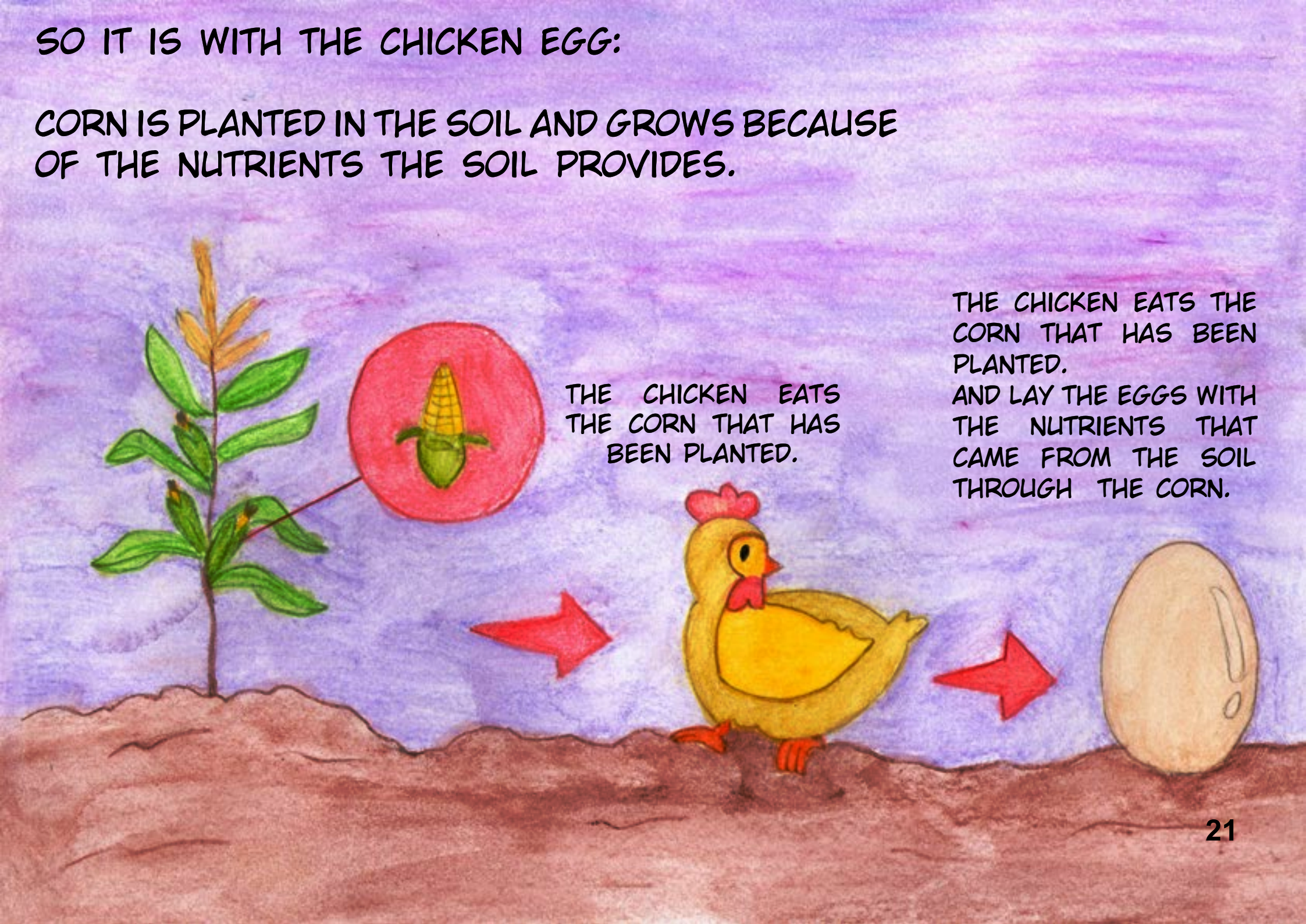
THE SOIL PROVIDES NUTRIENTS FOR PLANTS TO GROW.

THE COW EATS THE GRASS AND SO ALSO EATS THE NUTRIENTS.

WHEN YOU DRINK MILK IN YOUR HOME, YOU ALSO EAT THE NUTRIENTS THAT THE SOIL PROVIDED TO THE GRASS, WHICH THE GRASS PROVIDED TO THE COW, AND THE COW PROVIDED THE MILK, WHICH ALSO PROVIDED THOSE NUTRIENTS TO YOU.

SO IT IS WITH THE CHICKEN EGG:

CORN IS PLANTED IN THE SOIL AND GROWS BECAUSE OF THE NUTRIENTS THE SOIL PROVIDES.

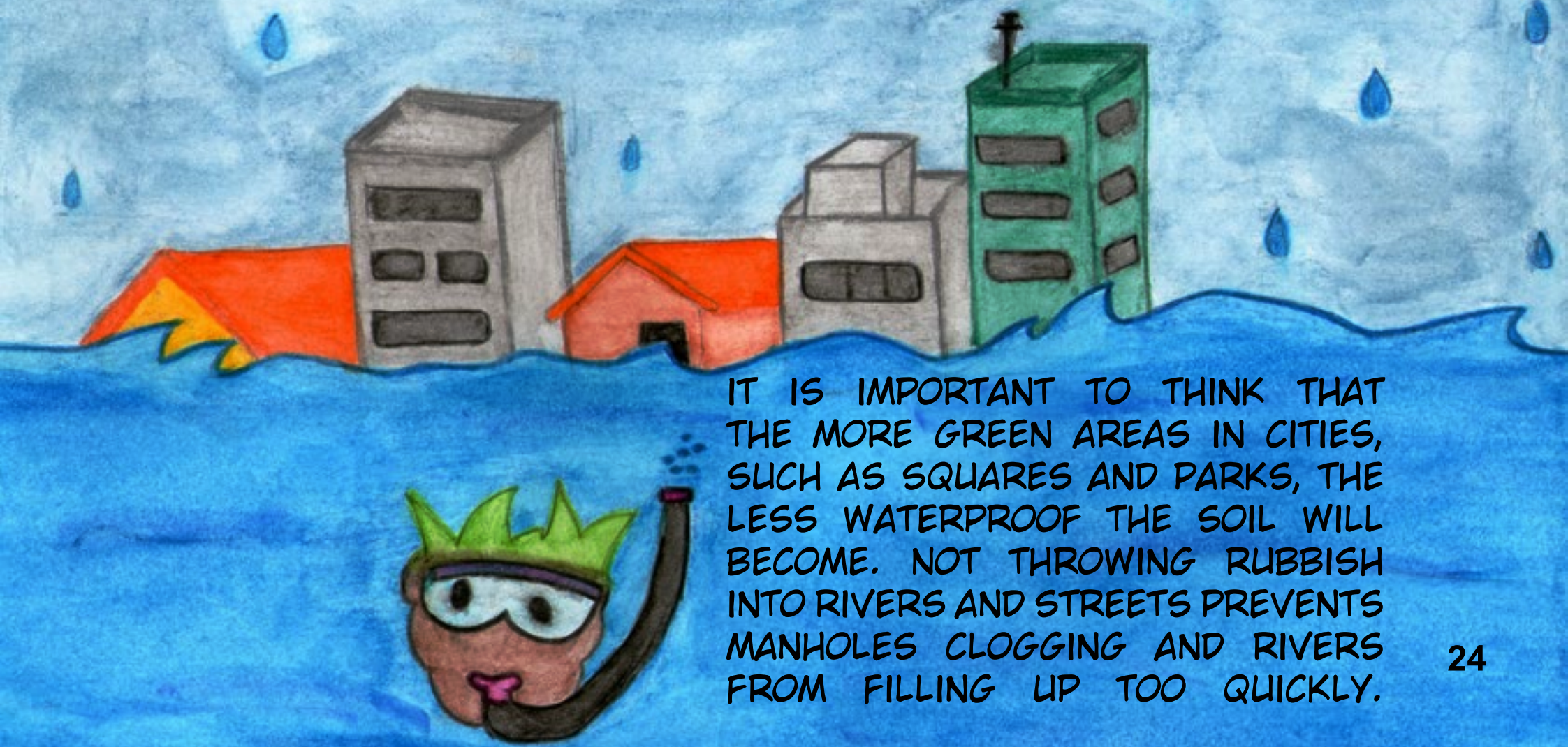


CARE AND CONSERVATION

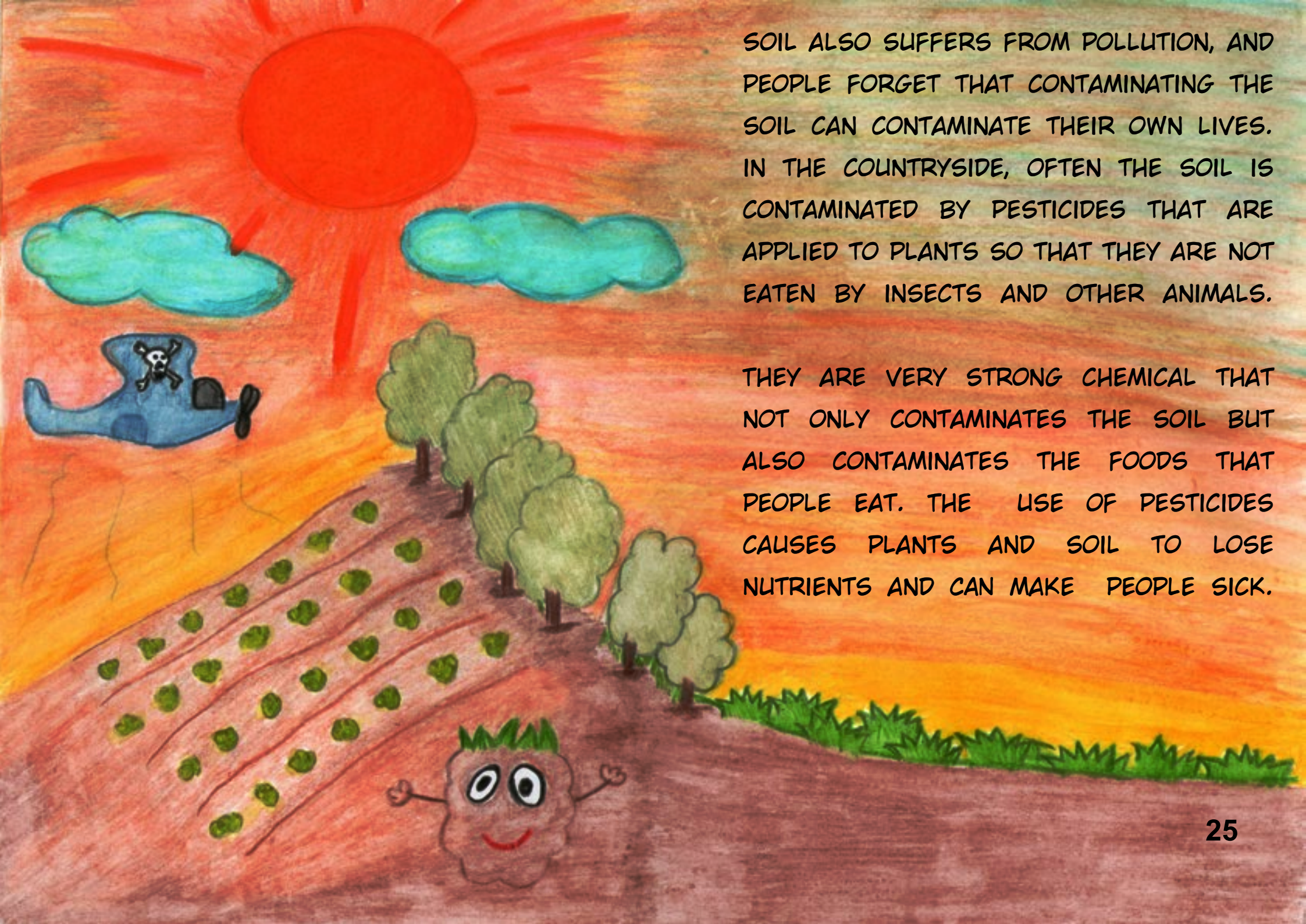
NOW THAT YOU KNOW A LITTLE MORE ABOUT THE SOIL AND ITS IMPORTANCE IN MAINTAINING LIFE, I'LL SHOW YOU WHAT HAPPENS IF WE FORGET TO TAKE CARE OF THE SOIL AND USE IT WITHOUT LIMITS AND WITHOUT CARE.

IN CITIES, THE SOIL IS USUALLY COVERED WITH ASPHALT, CEMENT AND SIDEWALKS. THIS MAKES THE SOILS TO BE UNDER A COVER. WHEN IT RAINS THIS COVER DOES NOT LET WATER ENTER AND BE ABSORBED BY THE SOIL.

WHEN THE SOIL CAN NO LONGER ABSORB WATER, WE SAY THAT IT IS WATERPROOF. IF WATER CANNOT GET INTO THE SOIL, IT FLOWS DOWN TO THE LOWER AREAS OF THE CITY, WHERE THE RIVERS USUALLY LIE. OFTEN THE RIVER RECEIVES SO MUCH WATER THAT IT FILLS AND OVERFLOWS WATER THROUGH THE CITY, CAUSING FLOODING.



IT IS IMPORTANT TO THINK THAT THE MORE GREEN AREAS IN CITIES, SUCH AS SQUARES AND PARKS, THE LESS WATERPROOF THE SOIL WILL BECOME. NOT THROWING RUBBISH INTO RIVERS AND STREETS PREVENTS MANHOLES CLOGGING AND RIVERS FROM FILLING UP TOO QUICKLY.



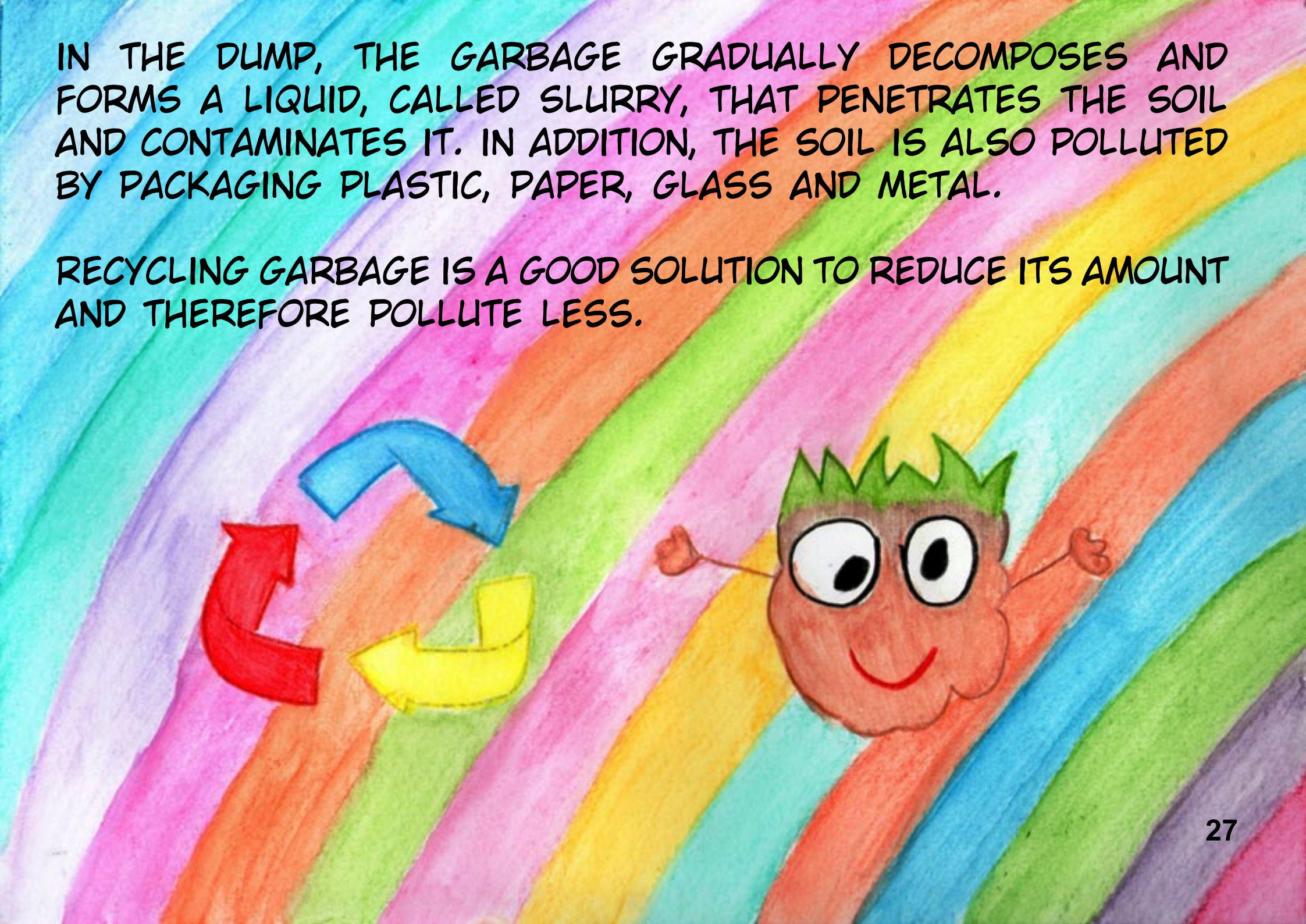
SOIL ALSO SUFFERS FROM POLLUTION, AND PEOPLE FORGET THAT CONTAMINATING THE SOIL CAN CONTAMINATE THEIR OWN LIVES. IN THE COUNTRYSIDE, OFTEN THE SOIL IS CONTAMINATED BY PESTICIDES THAT ARE APPLIED TO PLANTS SO THAT THEY ARE NOT EATEN BY INSECTS AND OTHER ANIMALS.

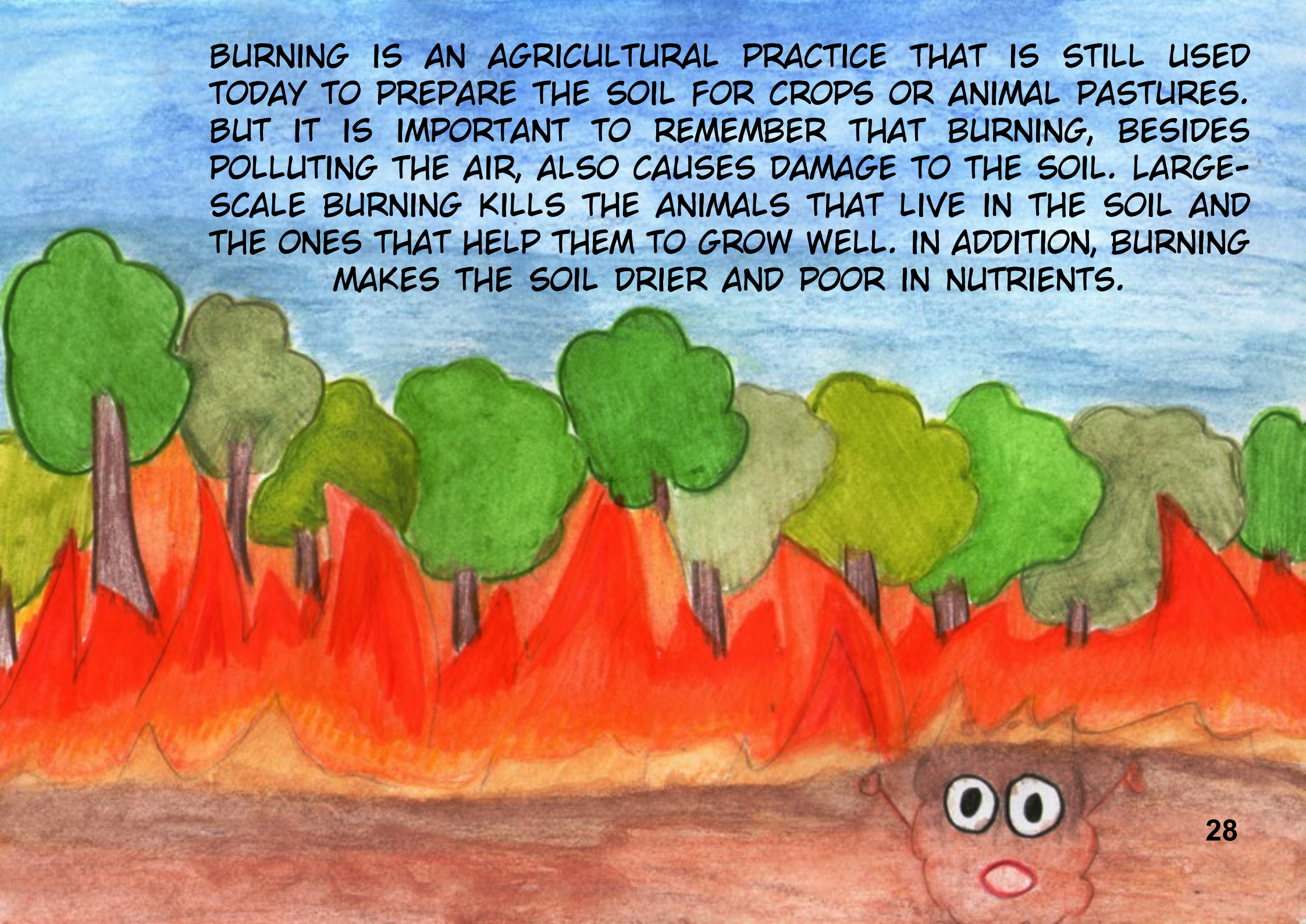
THEY ARE VERY STRONG CHEMICAL THAT NOT ONLY CONTAMINATES THE SOIL BUT ALSO CONTAMINATES THE FOODS THAT PEOPLE EAT. THE USE OF PESTICIDES CAUSES PLANTS AND SOIL TO LOSE NUTRIENTS AND CAN MAKE PEOPLE SICK.

THERE IS ANOTHER VERY COMMON FORM OF SOIL CONTAMINATION. DO YOU KNOW WHERE YOUR TRASH GOES? SOMETIMES THE WASTE IS NOT TREATED OR RECYCLED. MUCH OF THE TRASH IS PUT IN A DUMP, WHICH IS THE NAME OF THE PLACE WHERE THE GARBAGE IS DISPOSED OF WITHOUT ANY TREATMENT.

IN THE DUMP, THE GARBAGE GRADUALLY DECOMPOSES AND FORMS A LIQUID, CALLED SLURRY, THAT PENETRATES THE SOIL AND CONTAMINATES IT. IN ADDITION, THE SOIL IS ALSO POLLUTED BY PACKAGING PLASTIC, PAPER, GLASS AND METAL.

RECYCLING GARBAGE IS A GOOD SOLUTION TO REDUCE ITS AMOUNT AND THEREFORE POLLUTE LESS.




BURNING IS AN AGRICULTURAL PRACTICE THAT IS STILL USED TODAY TO PREPARE THE SOIL FOR CROPS OR ANIMAL PASTURES. BUT IT IS IMPORTANT TO REMEMBER THAT BURNING, BESIDES POLLUTING THE AIR, ALSO CAUSES DAMAGE TO THE SOIL. LARGE-SCALE BURNING KILLS THE ANIMALS THAT LIVE IN THE SOIL AND THE ONES THAT HELP THEM TO GROW WELL. IN ADDITION, BURNING MAKES THE SOIL DRIER AND POOR IN NUTRIENTS.

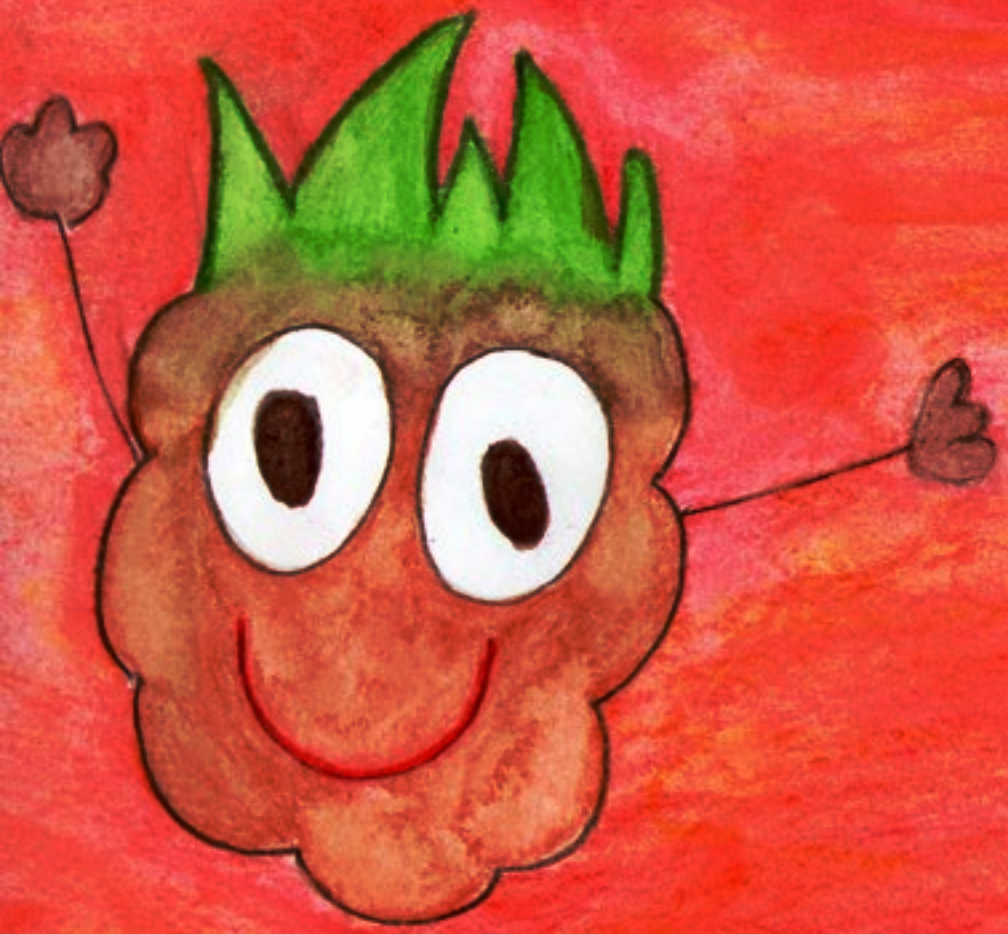
YOU MAY HAVE HEARD OF DEFORESTATION, RIGHT? DO YOU KNOW WHAT THAT MEANS?

DEFORESTATION IS THE REMOVAL AND DESTRUCTION OF FORESTS BY MAN, EITHER TO USE THE SOIL FOR AGRICULTURE OR TO USE WOOD FROM TREES. WHEN YOU CLEAR THE VEGETATION, THE SOIL IS MORE EXPOSED, SO IT CAN BE MORE EASILY ERODED.

AND DO YOU KNOW WHAT EROSION IS? EROSION OCCUR WHEN RAINWATER, WIND, OR ICE DESTROY THE SOIL, TURNING IT INTO A BUNCH OF LOOSE PIECES THAT ARE TRANSPORTED ELSEWHERE.

VEGETATION IS A PROTECTION FOR THE SOIL, LIKE AN UMBRELLA, AND WHEN IT IS REMOVED IT BECOMES MORE FRAGILE AND EXPOSED TO THE ACTION OF WATER AND WIND. SO IT IS IMPORTANT THAT THE SOIL IS COVERED WITH PLANTS BECAUSE THEY PROTECT IT.

IN MANY CITIES, PART OF THE POPULATION LIVES IN AREAS WHERE THE RELIEF IS VERY STEEP WHICH ARE CONSIDERED DANGEROUS PLACES. IN ORDER TO BUILD THEIR HOUSES, PEOPLE ALSO REMOVE THE VEGETATION THAT IS ON THE GROUND AND LEAVE IT EXPOSED, MAKING IT EVEN WEAKER. THE SOIL IN THIS PLACES MAY GIVE WAY AT ANY TIME, CAUSING WHAT IS CALLED A LANDSLIDE.



AND NOW THAT YOU HAVE LEARNED THAT ABOUT SOIL, DO YOU UNDERSTAND HOW IMPORTANT IT IS? SOIL IS NOT JUST THE GROUND YOU STEP ON, AND IT'S NOT JUST DIRT EITHER. IT IS IMPORTANT TO THE LIFE OF HUMANS, ANIMALS AND PLANTS. BUT DON'T FORGET: IF PEOPLE DON'T TAKE CARE OF THE SOIL IT CAN BE RUINED. CAN YOU HELP ME TELL EVERYONE HOW IMPORTANT SOIL CARE IS?

SOIL EXPERIMENTS

EXPERIMENT 1 - SOIL WATER INFILTRATION AND RETENTION

PROCEDURES:

ASK AN ADULT TO CUT 3 PLASTIC BOTTLES IN HALF.

THEN PUT SOME SAND, CLAY AND GARDEN SOIL INTO A PAN AND HAVE AN ADULT PUT IT IN THE OVEN FOR 30 MINUTES SO THAT THE SAMPLES ARE WELL DRIED.
TAKE SAMPLES OUT OF THE OVEN AND ALLOW THEM TO COOL WELL. THEN FOR AN ADULT TO BREAK THE CLAY INTO A POWDER.

PUT THE TWO PARTS OF THE BOTTLE BACK TOGETHER AS SHOWN BELOW SO THAT IT FORMS A FUNNEL INTO A GLASS.

PLACE A PAPER FILTER INSIDE EACH FUNNEL.

IN ONE FUNNEL PUT THE SAND HALFWAY, IN THE OTHER PUT THE SAME AMOUNT OF CLAY, AND IN THE OTHER THE SAME AMOUNT OF GARDEN SOIL.

BEFORE YOU START, TAKE A LITTLE OF EACH SAMPLE AND FEEL THE TEXTURE OF EACH SEPARATELY BETWEEN YOUR FINGERS. NOTE THAT THE SAND HAS LARGER GRAINS AND THE CLAY HAS VERY SMALL IMPERCEPTIBLE GRAINS, WHILE THE GARDEN LAND HAS GRAINS OF VARYING SIZES AND MIXED WITH VERY SMALL PLANT DEBRIS.

NOW AT THE SAME TIME POUR A GLASS OF WATER INTO EACH FUNNEL OVER THE SOIL SAMPLES, AND REALIZE WHAT HAPPENS. IN WHICH SOIL DID THE WATER BEGIN TO DRIP FASTER? WHY? WHICH OF THE SAMPLES STORED THE MOST WATER? WHAT COLOR IS THE WATER RELEASED IN EACH SAMPLE? WHICH SOIL WOULD YOU USE TO GROW A VEGETABLE GARDEN?

EXPERIMENT 1 - SOIL WATER INFILTRATION AND RETENTION

-RESULTS:
NOTE THAT THE SANDY SOIL SAMPLE HAS LESS WATER HOLDING CAPACITY, SO IT PASSED FASTER THROUGH IT, MOST OF THE WATER DRIPPING THROUGH THE SAND, AS THERE ARE MANY EMPTY SPACES HERE. THIS IS ALSO WHY SANDY SOILS LOSE NUTRIENTS MUCH FASTER BY LEACHING AND THEIR ABILITY TO SUPPLY WATER IN DRIER PERIODS IS LESS. A PLANT PLANTED THERE RECEIVES VERY LITTLE WATER BECAUSE THE SAND CANNOT HOLD IT. CLAY DEPOSITS WATER AND DOES NOT LET IT EASILY INFILTRATE, BECAUSE ITS PORES ARE SO NARROW THAT EVEN WATER HAS DIFFICULTY CROSSING THEM. A PLANT IN THIS KIND OF SOIL WOULD PROBABLY ROT IN A LITTLE WHILE. ORGANIC MATTER, MOST PRESENT IN GARDEN LAND, IS IMPORTANT TO INCREASE WATER RETENTION CAPACITY IN VARIOUS SOIL TYPES, ESPECIALLY IN SANDY SOIL, WHICH TENDS TO RETAIN LESS WATER. THE EARTH RICH IN ORGANIC MATERIAL SOAKS AND THE EXCESS WATER RUNS DOWN. HERE, IT IS VERY LIKELY THAT A PLANT WILL FEEL VERY GOOD. IN ADDITION TO WATER COLORATION, THE GARDEN SOIL SAMPLE MAY BE DARKER IN COLOR DUE TO THE PRESENCE OF NUTRIENT RICH ORGANIC MATTER, WHILE IN OTHER SAMPLES THE WATER MAY COME OUT MORE CRYSTALLINE.

TO THE TEACHER:
HERE THE TEACHER CAN APPROACH THE CONCEPTS OF POROSITY, PERMEABILITY, AND DEAL WITH SOCIAL AND ENVIRONMENTAL PROBLEMS SUCH AS SOIL TYPES THAT ARE CONDUCIVE TO AGRICULTURAL DEVELOPMENT, LANDSLIDES ON STEEP SLOPES, AND MAY POSE TO STUDENTS SOME QUESTIONS RELEVANT TO THE DISCUSSION OF THE SUBJECT AND OBSERVABLE IN THE EXPERIENCE SUCH AS: • EXAMINE EACH SOIL COMPONENT CAREFULLY AND NOTE ITS DIFFERENCES. • IN WHICH OF THE MATERIALS (CLAY, SAND AND SOIL WITH ORGANIC MATTER) DID WATER SEEP IN FASTER? • 'WHY DOESN'T WATER INFILTRATE EVERY SOIL EQUALLY? • WE CAN ALSO MIX THE COMPONENTS IN THE SAME CONTAINER BY ALTERNATING THE POSSIBLE COMBINATIONS (SOIL • CLAY; SOIL + SAND; SAND + CLAY) AND FINALLY THE THREE TOGETHER AND REPEAT THE PROCEDURE ADDING WATER TO EACH MIXTURE. COMPARE THE PERMEABILITY OF THESE MIXTURES WITH THE PERMEABILITY OF THE COMPONENTS WHEN ANALYZED SEPARATELY. • WHAT WOULD BE THE BEST SOIL TYPE FOR AGRICULTURE? 'WHY? • WHAT COLOR DOES THE WATER GET THROUGH EACH COMPONENT? WHY DOES EACH ONE HAVE A DIFFERENT COLOR? THE PURPOSE IS TO HELP THE STUDENT TO UNDERSTAND THE DIFFERENCES BETWEEN EACH TYPE OF SOIL FORMING COMPONENT, AND THAT THEIR DIFFERENT CONCENTRATIONS MAY ALTER THE CHARACTERISTICS OF THE SAME. THUS, WE CAN DISCUSS THESE DIFFERENCES, OBSERVING THE RESULTS OF THE EXPERIMENT. THE SANDY EXITS SAMPLE, FOR EXAMPLE, HAS LOWER WATER RETENTION CAPACITY BECAUSE IT HAS HIGHER PERMEABILITY DUE TO ITS HIGH POROSITY, SO WATER INFILTRATED THE SAND MORE QUICKLY IF COMPARED TO CLAY. WE CAN ALSO PAY ATTENTION TO THE CONSEQUENCES OF THIS PHENOMENON. ONE OF THE MOST SIGNIFICANT EXAMPLES OF EVERYDAY LIFE RELATES TO AGRICULTURE. HIGHER NUTRIENT LOSS FROM SAND-RICH SOIL BY LEACHING, AND THE LOWER ABILITY OF THESE SOILS TO HOLD WATER IN DRIER PERIODS, HAS CONSEQUENCES FOR AGRICULTURE, AS A PLANTATION ON SANDY SOILS HAS REDUCED PRODUCTIVITY AND IS THERE. IN SUCH ENVIRONMENTAL CONDITIONS IT MAY RECEIVE LESS WATER. ALSO PAY ATTENTION TO THE LOW POROSITY OF THE CLAY THAT MAKES WATER INFILTRATION DIFFICULT. A CROP IN THIS KIND OF SOIL WOULD PROBABLY ROT IN A SHORT TIME. ALREADY THE GOAL RICH IN ORGANIC MATTER, IS IMPORTANT TO INCREASE THE WATER RETENTION CAPACITY, ESPECIALLY IN A SANDY SOIL, WHICH TENDS TO RETAIN LESS WATER. SOIL RICH IN ORGANIC MATERIAL DRENCHES AND EXCESS WATER FLOWS DOWN. HERE IT IS VERY LIKELY THAT A CROP WILL THRIVE AS WELL BECAUSE OF THE INCREASED NUTRIENT SUPPLY THAT THIS TYPE OF SOIL OFFERS.

EXPERIMENT 2 - WATER EROSION PROCEDURES:

TAKE 3 PLASTIC BOTTLES AND MAKE THREE TRAYS, HAVE AN ADULT CUT THEM AS FOLLOWS:

WITH THE OTHER 3 PLASTIC BOTTLES WITH LIDS MAKE THREE CUPS, HAVE AN ADULT CUT THEM AS ABOVE.

ASK AN ADULT TO DRILL TWO HOLES IN EACH CUP AND TIE A STRING AS ABOVE.

IN ONE OF THE TRAYS PUT THE SOIL OR GRASS SAMPLE, IN THE OTHER PLACE GARDEN SOIL MIXED WITH LEAVES AND VEGETABLE DEBRIS, AND IN THE OTHER PLACE ONLY SOIL.

LET TRAYS SLIGHTLY LEAN FORWARD AND HANG A SMALL CUP ON EACH TRAY BY THE NECK OF THE BOTTLE AS FOLLOWS:

NOW POUR A LARGE GLASS OF WATER INTO EACH TRAY OVER THE SAMPLES AND GET WHAT HAPPENS. WHICH OF THE CUPS FILLED WITH WATER FASTER? IF WE LEFT THE SAMPLES MORE INCLINED, WATER WOULD FLOW FASTER? WHAT COLOR IS THE WATER IN EACH CUP?

EXPERIMENT 2 - WATER EROSION

RESULTS:

NOTE THAT THE VEGETATION-COVERED SAMPLE (GRASS OR WEEDS) RETAINED WATER IN THE SOIL LONGER THAN IN THE OTHER SAMPLES, SHOWING THE IMPORTANCE OF VEGETATION COVER FOR WATER RETENTION AND DECREASED PARTICLE DETACHMENT AND SOIL EROSION. THEREFORE, IT IS ALSO IMPORTANT TO PRESERVE THE RIPARIAN FOREST, TO MAINTAIN THE WATERCOURSES IT PROTECTS FROM SILTATION. NOTE THAT RUN-OFF WATER CARRIED NOT ONLY THE SOIL PARTICLES, NOTED BY THE COLOR OF THE OUTGOING WATER, BUT ALSO MANY ELEMENTS NOT VISIBLE TO THE NAKED EYE, SUCH AS POLLUTANTS, NUTRIENTS, PESTICIDES, AMONG OTHERS. IF THE SAMPLES WERE MORE INCLINED, WATER WOULD FLOW FASTER AS IT DOES ON STEEP TERRAIN WHEN IT RAINS.

TO THE TEACHER:

THE AIM OF THIS EXPERIMENT IS TO SHOW THE IMPORTANCE OF VEGETATION COVER IN SOIL PROTECTION AND WATER RETENTION, INTRODUCING THE POSSIBLE CONCEPTS TO BE WORKED, SUCH AS: LAND COVER, LANDSLIDE, SILTATION, RIPARIAN FOREST IMPORTANCE, AND WATER EROSION. THE EXPERIMENT IS CARRIED OUT IN 3 MOMENTS THAT DEMONSTRATE THE EFFECTS OF RAIN AND RUNOFF ON 3 TYPES OF SOIL COVER (VEGETATION SOIL, ORGANIC SOIL WITHOUT VEGETATION COVER AND INORGANIC SOIL). IT IS IMPORTANT TO NOTE WHAT HAPPENS WHEN RAINWATER HITS THE GROUND IN ALL 3 TYPES OF COVER, UNTIL IT STOPS FLOWING AND SEEPING (WHEN IT STOPS DRIPPING). ESTABLISH A DISCUSSION WITH STUDENTS ABOUT THE DIFFERENCES NOTED IN THE FINAL PRODUCT OF THE EXPERIMENT (WATER RUNOFF IN THE POTS), AND WHAT POSSIBLY OCCURRED FOR THESE DIFFERENCES TO EXIST. COMPARE WITH THE STUDENTS WHICH SAMPLES OBTAINED THE LARGEST AMOUNT OF WATER INSIDE THE COLLECTION VESSEL AT THE END OF THE RUNOFF AND INFILTRATION, AND COMPARE THE WATER COLOR OF EACH SAMPLE. THE VEGETATION-COVERED SAMPLE RETAINED WATER IN THE SOIL LONGER THAN IN THE OTHER SAMPLES. THIS DEMONSTRATES THE IMPORTANCE OF VEGETATION COVER FOR WATER RETENTION AND THE REDUCTION OF PARTICLE DETACHMENT AND SOIL EROSION. ALSO DEMONSTRATE THE IMPORTANCE OF PRESERVING RIPARIAN FOREST, FOR THE MAINTENANCE OF WATERCOURSES THAT IT PROTECTS FROM SILTATION. THE DARKER THE COLOR OF THE WATER COMING OUT, THE GREATER THE AMOUNT OF LEACHED MATERIAL. WE NOTE THAT RUN-OFF WATER NOT ONLY CARRIES SOIL PARTICLES, BUT ALSO LEACHES OTHER ELEMENTS THAT COMPOSE SOIL, HORN NUTRIENTS AND SUBSTANCES THAT CAN HARM THE HEALTH OF PLANTS AND WATERWAYS SUCH AS PESTICIDES. WE CAN ALSO ENJOY AND REPEAT THE EXPERIMENT MORE OFTEN, BUT WITH DIFFERENT SLOPE LEVELS OF THE SAMPLES TO DEMONSTRATE THAT THE HIGHER THE SLOPE OF THE TERRAIN, THE GREATER THE EROSION FORCE OF THE WATER, THE FASTER THE DRAINAGE OCCURS ON STEEP TERRAIN. THUS, WE CAN RELATE THE RESULTS OF THE EXPERIMENT WITH EROSIVE PHENOMENA PRESENT IN EVERYDAY LIFE, AND THEIR CONSEQUENCES FOR SOCIETY AS:

- SUPPRESSION OF RIPARIAN FOREST AND SILTATION OF WATERCOURSES;
- LANDSLIDES ON STEEP SLOPES AND PLACES WITH NO VEGETATION COVER;
- URBAN PROBLEMS RELATED TO SOIL IMPERMEABILIZATION, SUCH AS FLOODS;
- NUTRIENT LEACHING.

EXPERIMENT 3 - SOIL SALINITY
PROCEDURES:

ASK AN ADULT TO DRILL A FEW HOLES IN THE BOTTOM OF THE CUPS WITH THE HOT TIP OF A KNIFE.

IN EACH CUP PUT EQUAL AMOUNT OF GARDEN LAND;

PLANT 1. BEANS IN EACH CUP. (IT IS NOT NECESSARY TO BURY THE SEED);

WATER ALL 5 WITH A LITTLE WATER AND LET IT GROW FOR ABOUT 2 WEEKS, DO NOT FORGET TO WATER IT EVERY 2 DAYS.

WHEN THE BEANS ARE GROWN, CHOOSE 3 OF THEM THAT ARE THE SAME SIZE TO DO THE EXPERIMENT.

ON ONE OF THE CUPS WITH THE BEAN YOU SHOULD WRITE "WATER", ON THE OTHER WRITE "WATER WITH SALT" AND ON THE OTHER WRITE "NO WATER". ON THE CUP THAT YOU WROTE "WATER WITH SALT" START WATERING IT WITH A SOLUTION OF WATER AND TABLE SALT, AND THE ONE IN WHICH YOU WROTE "WITHOUT WATER" STOP WATERING.

NOTICE WHAT HAPPENS TO EACH OF THE BEAN PLANTS.

EXPERIMENT 3 - SALINITY

RESULTS:
SALT HAS TOXIC EFFECTS ON PLANTS, SO THE BEANSTALK THAT RECEIVED SALT WATER WITHERED BECAUSE SALT CAUSED A SERIES OF REACTIONS THAT CAUSED THE PLANT CELLS TO LOSE WATER VERY QUICKLY. IN BRAZILIAN CAATINGA WE CAN OBSERVE THE PRESENCE OF SOILS RICH IN SALT, WHERE THERE ARE PLANTS THAT ARE ADAPTED TO SALINE SOIL CONDITIONS SUCH AS CACTI. THIS IS ALSO WHY THIS REGION OF BRAZIL IS NOT CONDUCIVE TO THE DEVELOPMENT OF AGRICULTURE.

TO THE TEACHER:
THE PURPOSE OF THIS EXPERIMENT IS TO DEMONSTRATE THE CONSEQUENCES OF SALINIZED SOIL (RICH IN SOLUBLE SALTS) UNDER VEGETATION AND HOW THE TYPE OF SOIL IN A REGION DIRECTLY INFLUENCES AGRICULTURE AND SOCIETY.
IN BRAZIL, SOILS RICH IN SOLUBLE SALTS ARE A MAJOR PROBLEM IN COASTAL REGIONS SUCH AS RESTINGAS AND MANGROVES AND IN SEMI-ARID REGIONS SUCH AS CAATINGA. IN THESE REGIONS THE DEVELOPMENT OF AGRICULTURE IS VERY HARD, BECAUSE THE HIGH CONCENTRATION OF SALT IN THE SOIL HINDERS THE ABSORPTION OF WATER BY THE PLANT AND CAUSES IT TO LOSE WATER BY OSMOSIS. THIS HAPPENS BECAUSE SALT HAS TOXIC EFFECTS ON PLANTS THAT ARE NOT ADAPTED TO THESE CONDITIONS, SO OUR BEANSTALK THAT RECEIVED WATER WITH SALT QUICKLY WITHERED BECAUSE SALT CAUSED A SERIES OF REACTIONS THAT CAUSED THE CELLS OF THE PLANT LOST WATER VERY QUICKLY. IN BRAZILIAN CAATINGA THERE ARE PLANTS THAT ARE ADAPTED TO SALINE SOIL, SUCH AS CACTUS.
FROM THE RESULTS OF THE EXPERIMENT WE CAN START TO ASK SOME QUESTIONS, SUCH AS:
- WHY DID THE BEAN PLANT THAT RECEIVED WATER WITH LEAVES WITHER?
- WHY ARE THERE REGIONS THAT HAVE SALINE SOILS ?
- SOIL QUALITY AND ECONOMIC DEVELOPMENT OF A REGION.

EXPERIENCE 4 - SCULPTURE: COLOR, TEXTURE AND COMPOSITION

PROCEDURES:

TAKE A LITTLE SOIL OF ONE COLOR, AND TRY TO MAKE A VERY LONG WORM - REPEAT THE PROCEDURE WITH THE OTHER SAMPLES OF DIFFERENT COLOR, ALWAYS WITH THE SAME AMOUNT OF SOIL.

IF NECESSARY, ADD SOME WATER TO THE SAMPLE FOR EASE OF HANDLING.

EXPERIMENT 4 - SCULPTURE:
RESULTS:
COLOR, TEXTURE AND COMPOSITION

WHAT COLOR SAMPLES DID YOU CHOOSE FOR THE EXPERIMENT? WHAT DID YOU NOTICE? WITH WHICH SAMPLE WAS IT POSSIBLE TO MAKE THE LONGEST WORM? WHICH OF THE SAMPLES WAS THE EASIEST TO MAKE THE WORM ON AND WHICH WAS THE HARDEST? WHY? SOIL COLOR IS DIRECTLY ASSOCIATED WITH ITS COMPOSITION, WHICH HAS A CERTAIN TEXTURE TO THE TOUCH OF THE HAND. DARKER SOILS ARE RICH IN ORGANIC MATTER, YELLOWISH AND REDDISH SOILS ARE RICH IN CLAY AND SAND IN DIFFERENT PROPORTIONS. WHEN TRYING TO MAKE THE EARTHWORM WITH SOIL RICH IN SAND WE CAN FEEL WHEN HANDLING IT WITH FRICTION. WE ALSO NOTE THAT AT SOME POINT THE EARTHWORM CRACKS WHICH INDICATES HIGHER SAND CONTENT IN THE SOIL COMPOSITION. IN CONTRAST, CLAY-RICH SOILS ARE SOFTER TO THE TOUCH AND STICKIER, SO THEY ARE MORE MALLEABLE AND BARELY ABLE TO FEEL SAND PARTICLES, THE LONGEST WORM PROBABLY MADE OF CLAY-RICH SOIL.

TO THE TEACHER:

THIS SIMPLE EXPERIMENT AIMS TO MAKE THE STUDENT REALIZE THROUGH TOUCH, THAT THERE ARE DIFFERENT TYPES OF SOIL WITH DIFFERENT PHYSICAL CHARACTERISTICS, SUCH AS COLOR, TEXTURE AND COMPOSITION SOIL COLOR IS DIRECTLY ASSOCIATED WITH ITS COMPOSITION, WHICH HAS A CERTAIN TEXTURE TO THE TOUCH OF THE HAND. DARKER SOILS ARE RICH IN ORGANIC MATTER, YELLOWISH AND REDDISH SOILS ARE RICH IN CLAY AND SAND IN DIFFERENT PROPORTIONS. WHEN TRYING TO MAKE THE WORM WITH SAND RICH SOIL WE CAN FEEL THE FRICTION WITH IT HANDLING IT. WE ALSO NOTE THAT AT SOME POINT THE EARTHWORM CRACKS WHICH INDICATES HIGHER SAND CONTENT IN THE SOIL COMPOSITION. IN CONTRAST, CLAY-RICH SOILS ARE SOFTER TO THE TOUCH AND HAVE MORE STICKINESS, SO THEY ARE MORE MALLEABLE AND WE CAN HARDLY FEEL SAND PARTICLES, THE LONGER WORM WAS PROBABLY MADE OF CLAY-RICH SOIL. FROM THE RESULTS OF THE EXPERIMENT, WE CAN SUGGEST SOME QUESTIONS FOR DISCUSSION:

- WHAT COLOR SAMPLES HAVE YOU CHOSEN FOR THE EXPERIMENT?
- WHAT DID YOU NOTICE?
- WITH WHICH SAMPLE WAS IT POSSIBLE TO MAKE THE LONGEST WORM?

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