

LESSON PLAN

Living in the soil

SCRIPT

Mara Noemí Rodríguez Fonteboa

DOCUMENTATION AND SCIENTIFIC ADVICE

María Teresa Barral Silva
Montserrat Díaz Raviña
Francisco Díaz-Fierros V.

COORDINATION

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(Delegación Territorial de la Sociedad Española de la Ciencia del Suelo (SECS) en Galicia)

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Contextualization

The current lesson plan is programmed for students of level 5^o and 6^o of Primary School and students in 1^o and 2^o of Secondary School

Content, evaluation criteria and standards drafting according to:

Royal Decree 126/2014, 28th February, which establishes the basic curriculum of Primary Education.

Royal Decree 1105/2014, 26th December, which is establishes the basic curriculum of Secondary Compulsory Education and High School.

Living in the soil

2015 INTERNATIONAL YEAR OF SOILS



Script: M^a. Pilar Jiménez Aleixandre
Illustration: Estudio Tangaraño
Documentation and scientific advice: M. T. Barral Silva and F. Díaz-Fierros V.

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Illustration: Estudio Tangaraño
Documentation and scientific advice: M. T.
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Objectives

- To investigate what is soil and how is it formed.
- To examine what are the components of soil.
- To discover which living organisms depend directly or indirectly on the soils and in what way.
- To explore the uses of soil.
- To differentiate between the natural and the constructed.
- To relate health and nutrition, paying attention to the origin of the food we consume and how this is connected to our soils.
- To identify what is erosion and how it is caused.
- To evaluate the impact of our actions on soil and environment.
- To recognize the importance of soil as a limited natural resource.

Contents

Natural science

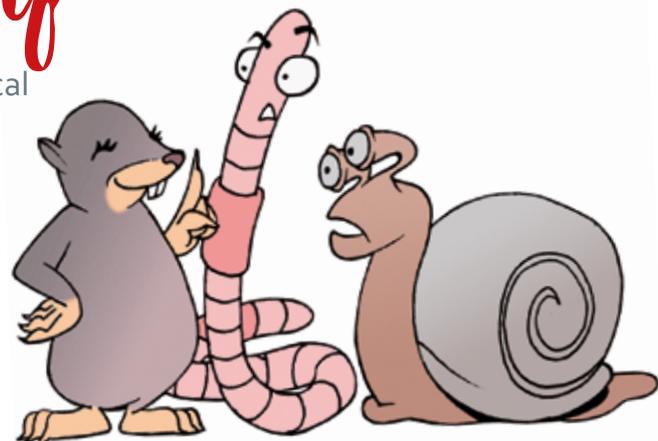
- Living organisms, inert beings.
- Communities and ecosystems.
- Characteristics and components of an ecosystem. Soil as an ecosystem.
- The biosphere. The different habitats of living organisms.
- Respectful habits and care towards living organisms.

Social science

- Human impact on the environment.
- Sustainable development.
- Pollution problems.

Biology and geology

- Contribution of living organisms to geological processes. Humans as geological agents.
- Soil as an ecosystem.



Evaluation criteria

Natural sciences

- To know the different classification levels of living organisms, paying attention to their types and characteristics.
- To know the characteristics and components of an ecosystem.
- To value the importance of the soil and the risks of its over-exploitation, deterioration or loss.

Social sciences

- To explain the influence of the human behavior on the environment, identifying the sustainable use of natural resources and proposing a series of necessary measures for human well-being and sustainable development, while recognizing their positive effects.

Biology and geology

- To discover the different factors that model the landscape in the student's surroundings.
- To identify the geological activity of humans and to recognize their importance as external geological agents.
- To value the importance of soil and the risks of its over-exploitation, deterioration or loss.

Learning standards

Natural sciences

- The student identifies and explains the differences between living and inert organisms.
- Identifies and explains the connections between living organisms, communities and ecosystems.
- Observes and identifies the main characteristics and components of an ecosystem.
- Observes and identifies the different habitats of living organisms.
- Shows a respectful behavior and care towards living organisms.
- Recognizes the fragility of the soil and appreciates the need to protect it.

Social sciences

- Explains the sustainable use of natural resources, proposing and adopting actions that lead to the improvement of the environmental conditions in our planet.

Biology and geology

- Investigates the landscape of his/her nearest environment and identifies some of the factors that have conditioned its shaping.
- Identifies the ways in which living organisms influence weathering, erosion and sedimentation processes.
- Values the importance of human activities in the transformation of the Earth's surface.
- Recognizes the fragility of the soil and is conscious of the need to protect it.

Key competences

All the key competences included in the curriculum will be worked on, as all the learning activities have been planned to cover them.

1. Linguistic communication. CL.
2. Mathematical competence and basic competences in Science and Technology. CMCT.
3. Digital competence. CD.
4. Learn to learn. CPAA.
5. Social and civic competences. CSC.
6. Sense of initiative and entrepreneurial spirit. SIE.
7. Consciousness and cultural expression. CEC.

Methodology

This lesson plan strengthens learning competences, integrating them into the tasks and curricular learning that are addressed in this lesson plan. Knowledge, motivation, practice, emotions, methods, problems resolutions, skills... are all combined. The goal is learning, but above all, learn to do.

Learning will be encouraged in different contexts (formal, not so formal and informal), together with the family or peer group.

The scientific methodology of formulation, investigation, planning and execution of activities and tasks, observation, information search, classification and systematization, and analysis and presentation of conclusions is contemplated in all the planned activities.

In addition, the lesson plan seeks to strengthen the learning process and the cooperative work in which the students are part of groups on which they rely and in which they acquire individual responsibilities.

activities

Getting to the point

1. Read carefully and individually the comic "Living in the soil".
<https://goo.gl/mxOD7A>

2. Learn the meaning of the words or unknown expressions related to soil:

Soil: Layer of loose materials which is found over the rock, made up by closely linked mineral and organic materials. Plants are rooted in soil and many organisms of various sizes (microorganisms and macro-organisms which include mesofauna and macrofauna) also live there.

Horizons: Layers of different color, texture or structure which form the soil.

Profile: Set of different superimposed horizons constituting the soil.

Soil Science: Science that studies the soils, their formation conditions and properties, and the relationships of soil with living organisms that live in and on the soil.

Erosion: Smoothing and modeling of the Earth's crust caused by the action of wind, rain and fluvial, maritime and glacial processes, and by the action of the organisms.

Fertile: Capable of producing abundant vegetation or crops..

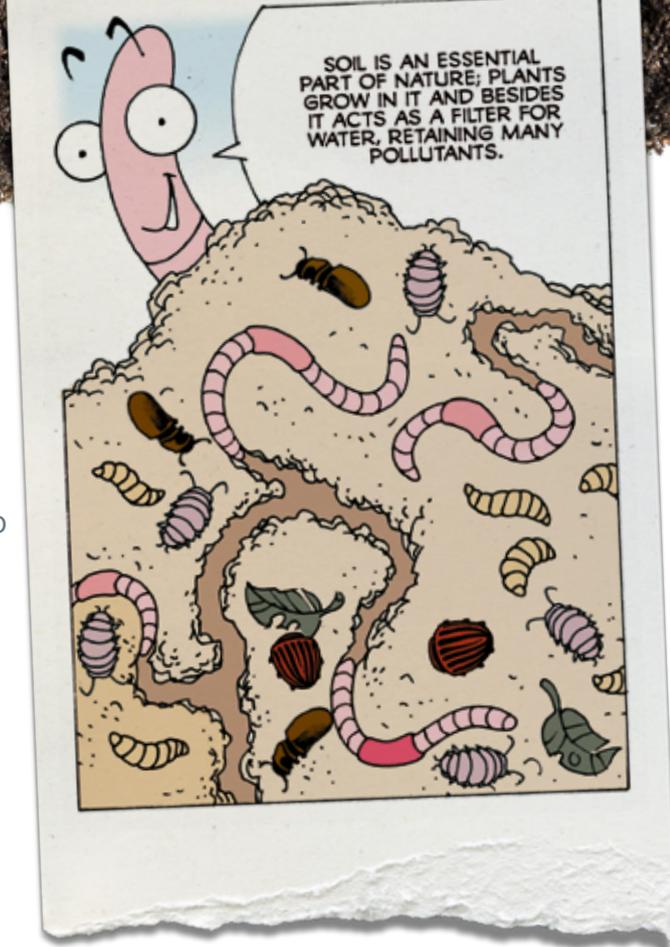
Degradation: Loss of the soil capacity to sustain its productive and ecological functions.

Microorganisms: Microscopic organisms including bacteria, actinobacteria, fungi, algae and protozoa.

3. Now distribute the characters of the comic amongst the members of the group and do a dramatized reading.
4. After reading the European Soil Charter adopted by the European Council (see the back page), have a brainstorming session.

Hint the dirt

1. Have you ever thought about the importance of soil? Why the earthworm says it is essential?
2. Make suggestions about what can be done to value and protect our soils.
Curiosity: soil hosts a quarter of our planet's biodiversity; there are more organisms in one tablespoon of soil than there are people on Earth
3. Write a mythical dialogue with the soil and a tree/plant as the main characters.
4. Write what the earthworm says about how soils are formed.
5. Do you think that worms are important for the soil?
6. Have you ever heard that the soil is good when there are earthworms? Draw conclusions
Curiosity: earthworms move from 1 to 1,000 tons of soil/ha.
7. Which soils are of good quality according to the animals? Why?
Curiosity: Plants need water and essential nutrients to grow, which are taken from the soil.
8. The earthworm, the mole and the snail talk about the effects that fires can cause on the soil. List the effects.
9. Draw two pictures of the same scenery before and after a fire. Make a comparison and draw conclusions. Watch the video...: <https://goo.gl/7m7aTz>
10. The earthworm provides us with clues for recognizing the erosion of a hillside soil. Write what these are and add some more.
11. The animals in the comic also talk about fertilizers, pesticides and uncontrolled dumping sites. Write a short essay about their reflections.
Curiosity: 95% of our food comes directly or indirectly from the soil. Healthy soils are the basis for healthy food production.
12. Based on the last earthworm's conversation, write the Good Agricultural Farming rules on a big poster board to be presented.

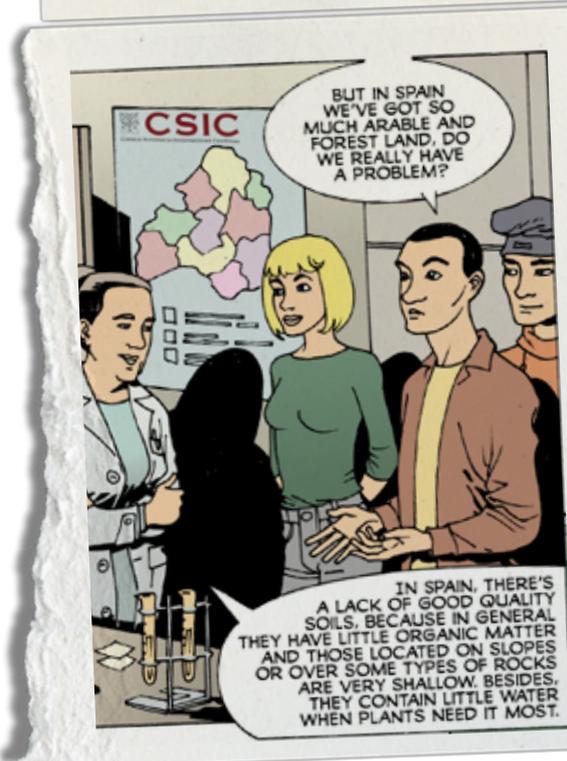


With healthy soil, look on the bright side

1. Which problem does the mayor have? Why?
2. What is the ongoing discussion the Vilaterra's neighbors are having?
3. Do you think people receive the same information about soil as about other environmental aspects? Give some reasons for your answer.
4. Do you think that buildings can be constructed on any kind of soil? Should there be any planning? Why?
5. When something is built, what is it recommended to do with the removed soil?
6. The young people in the comic have gathered up a lot of information and reach an agreement with Luis regarding the construction of his house. What is it?

For sure

1. According to the researcher how are the soils in Spain? Observe the map showing the different soil types in Spain. Investigate what types of soils are found in your autonomous region and draw a map (see Calendars SECS 2009 "Soil types" and 2015 "Soils and forestry biodiversity": <https://goo.gl/HFEXak>)
2. How does the researcher say that the soils on slopes can be protected?
3. Which factors have caused erosion throughout centuries in Spain?
4. Give examples of how soil erosion can be controlled in slopes.
5. According to the young people in the comic, what percentage of soils in the world is good for farming? Give reasons supporting your answer.
6. Besides overgrazing, uncontrolled logging, fires... Which other human actions, according to the mole, destroy soils?





Home, sweet home

1. Draw a mural with collected images of good and bad practices for our soils
2. What decisions do the young people take? Are they similar to those you have taken in the activities of this lesson plan?

Sticking your feet into the soil

Activity to be done outdoors, during a fieldtrip, and later in the classroom or laboratory.

Required materials: Data sheet, as the one you have below, pens or pencils, plastic bags, permanent markers, small shovels, compass, tape measure, transparent bottles (either glass or plastic), big glass test tube, 4 mm sieve.

We look for a slope at the side of a path or road with not much traffic. We clean the surface of the soil from the top to the bottom with the help of a small shovel or something similar. We observe the soil site and its characteristics, and write down all the information in the data sheet.

Profile description

Horizon (symbol): Describe each horizon in terms of depth, color, texture (rubbing some soil between the fingers) and other characteristics (aggregates, roots, animal marks, coal ...)

Name we give to the soil:

Date:

Author/s:

Site information:

Location (locate with the help of a map, GPS or mobile app):

Orientation (using compass):

Topography (shape of the land: flat, hill, mountain, hillside, riverbank):

Soil use (meadow, forest, scrubland, arable crop):

Slope (none, slight, medium, pronounced):

Water content (indicate if the soil is waterlogged, humid or dry):

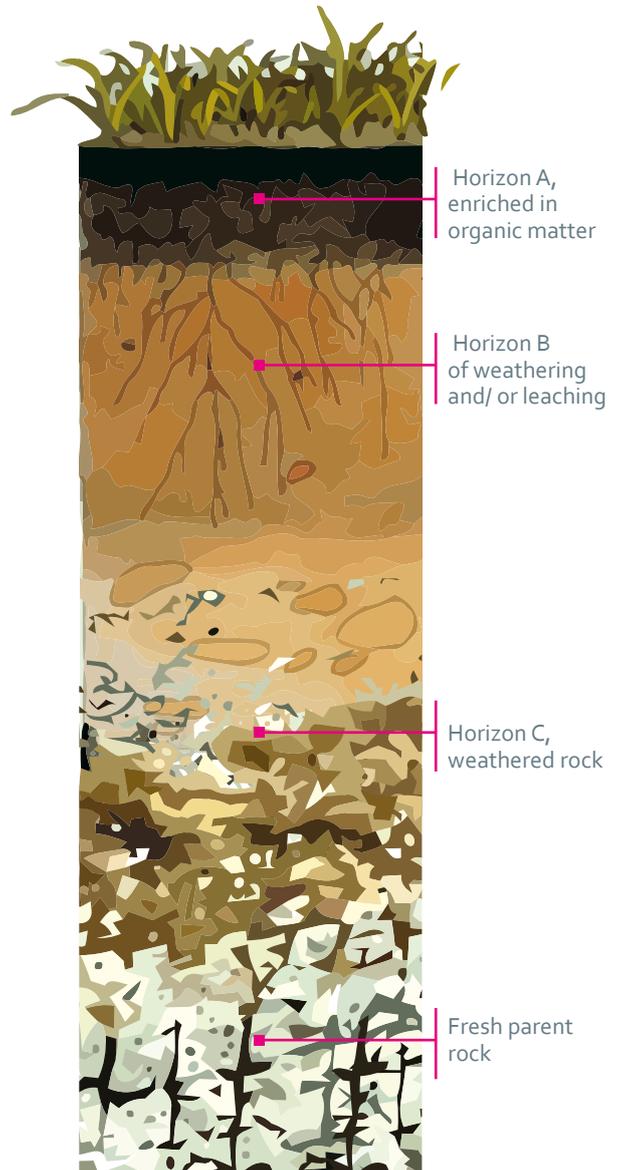
Are there any stones near the surface?

Profile description

Take the soil samples, beginning by the lower horizon. Put them in bags, mark with the name given to the soil and the denomination of the horizon, close and take them to school.

In the classroom or laboratory, determine the soil fractions (organic matter, sand, lime, and clay). To do this, take the same weight of soil sample from each horizon and put it in transparent bottles (a suitable amount can be 10 g in 500 mL or 5 g in 250 ml). Add the same amount of water to each bottle, shake them strongly and let them stand, so that the particles with different size start being deposited. Gravel and sand are deposited faster, then lime, while organic matter and clay remain longer in suspension.

Reproduce the soil profile in a glass test tube, using the soil samples collected in the field are used, preferably dried and sieved so as to remove the larger elements (stones and gravels). Then deposit them in the test tube, following the same order they have in the profile. The level reached by each horizon in the test tube will be proportional to that recorded in the data sheet. In this way, we will obtain something similar to the soil profile, showing the darker color of the upper horizon, richer in organic matter, and the ochre or reddish colors of the lower horizons.



Housing solutions

Build a natural scene in a small space. Be innovative and use your imagination. Represent in a creative way the life of soils (in and on them).

Resources

Shoe boxes, poster boards, pencils, color, scissors, glue, wire... Comic, books, web pages.

Instructions

Divide the classroom into groups (6 students in each one).

Use the information obtained in the previous activity.

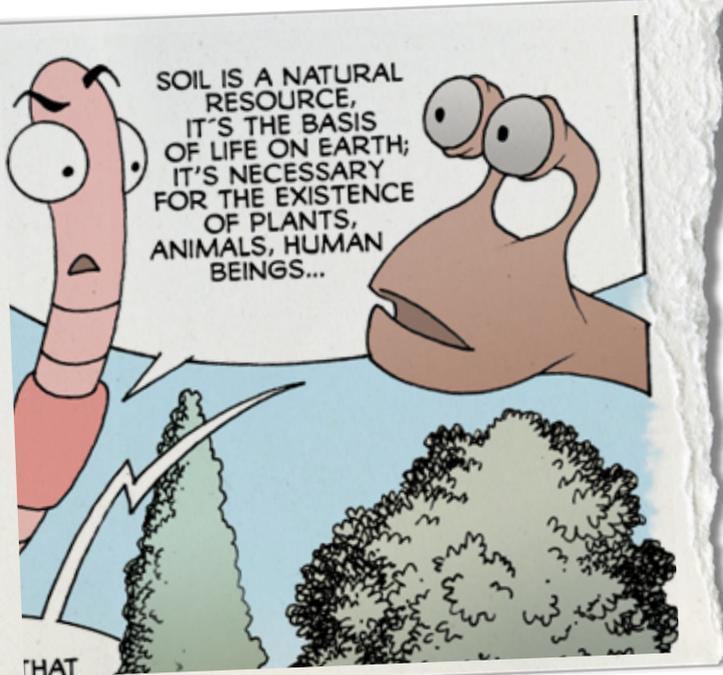
The students have to use the shoe box and the other materials to represent life in soils.

Place the selected animals and plants within or over the shoe box, depending on whether they live in or on the soils.

Group presentation of each scene to the classroom

Discuss about why plants and animals need soil and the way in which they interact amongst themselves and with us.

Present the built dioramas.



About erosion

Make a mind map explaining the main types of erosion and their characteristics.

Resources

Poster boards, pencils, colors ...
Comic, book, web pages.

Instructions

Make groups of four students

Look at the text about erosion in the Wikipedia: <https://goo.gl/TohRqY>

Students will take turns on tasks.

The first student reads the first paragraph, the second one writes a summary about what he/she has been listening to, and the other two students decide if they should add something to that summary. Follow the same method until the end of the text.

With the information obtained about erosion draw a mind map.

The main idea will be placed in the middle and, clockwise direction or counter clockwise, according to their choice, they will join in a radial way other concepts or pictures. The idea is that the students make maps with their conclusions about the topic.

Group presentation of each mind map to the classroom

Debate about the effects caused by natural erosion and by other causes (such as human influence).

Presentation of the mind maps.



Activity to be done in the laboratory

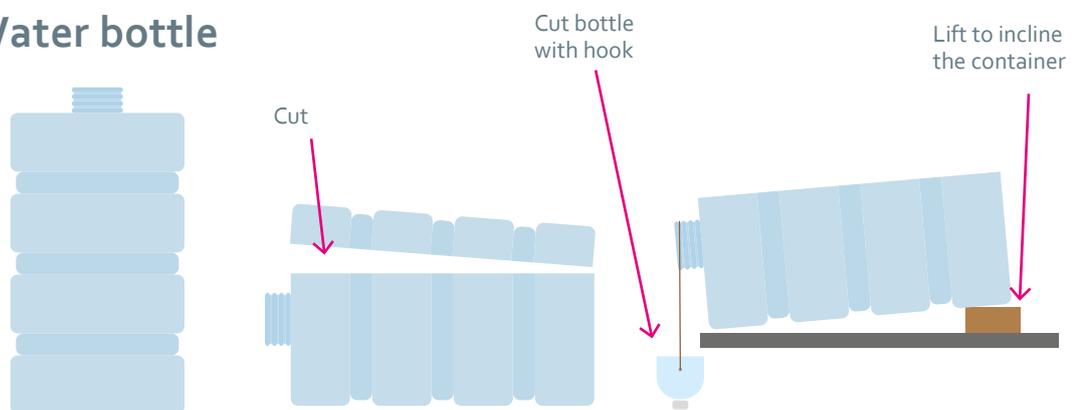
Erosion causes severe environmental problems because it leads to soil loss and degradation, and it affects the water cycle. Vegetation and its debris prevent soil degradation and reduce hydrological erosion, particularly of soils on slopes.

Objective: to test the effects of rain on erosion and water cycle on a bare soil, a soil protected by vegetation debris and a soil covered with herbaceous vegetation.

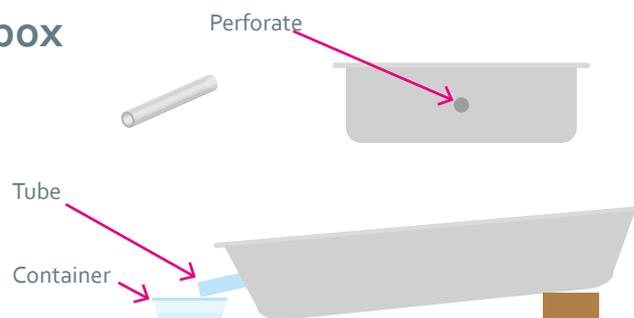
Materials:

- Three plastic containers (big sliced bottles or medium size rectangular lunch boxes). If lunch boxes are used, make holes in the middle of one of the smallest sides and place a small silicone tube in the outlet.
- Three small glasses or small cut plastic bottles with wire hooks.
- Watering can with small holes.
- Vegetation debris (grass, leaves, etc.), soil (from an orchard or garden), seeds that will be spread on the soil before the experiment (as an alternative grassland can be used with herbaceous vegetation).

Water bottle



Lunch box



Experiment:

- 1) Fill the containers with soil up to the outlet (it is recommended to put some sand or fine gravel at the bottom), then tilt the container, placing the end furthest away from the outlet on a support element such as a wood block or similar.
- 2) The treatments that will be compared will be the following: bare soil, soil covered with crushed vegetation debris and soil covered with herbaceous plants.
- 3) Slightly moisten the three soils with the same quantity of water and place the small glasses/bottles under the outlet of the plastic container.
- 4) Simulate rain by watering from a height of 50 cm. Pour the same amount of water over the three treatments, evenly distributing the water over the entire surface.
- 5) Observe and discuss:

What amount of water is collected in the glasses for each type of soil?

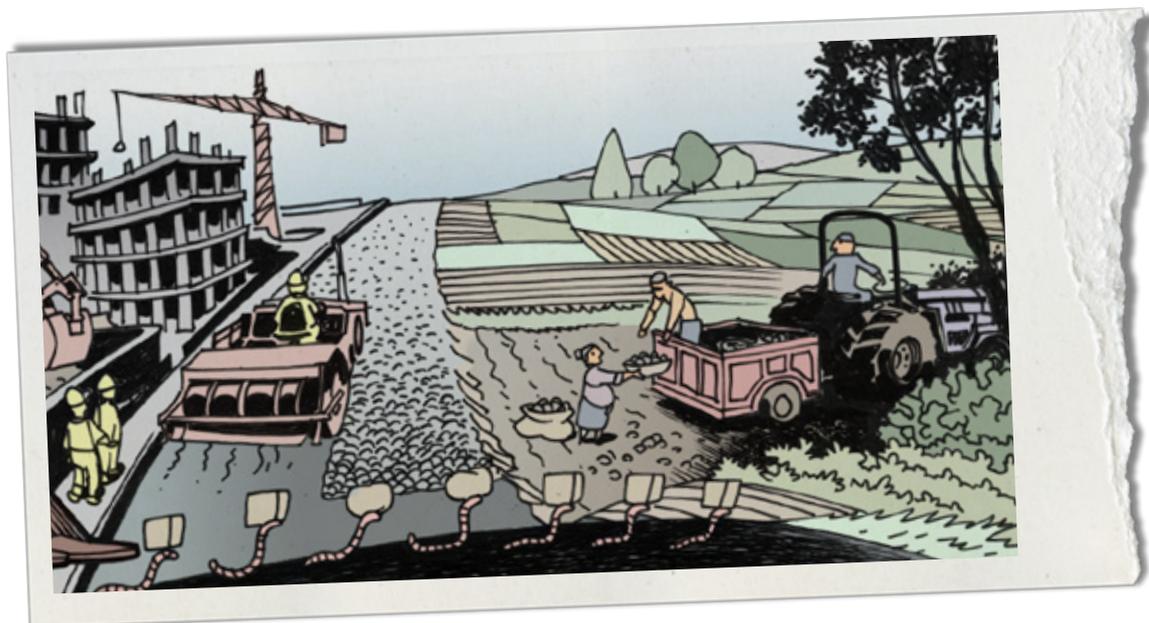
What are the characteristics of the water collected?

How much soil was lost by erosion and deposited in each glass?

Run off and infiltration processes are related to soil use. Natural soils, covered with vegetation, have a greater infiltration capacity and lower susceptibility to erosion –loss of soil- than cultivated soils (where the soil remains bare periodically).



About humus and litter



To value the reduction of wastes and the recycling of organic residues by means of composting.

To elaborate compost and analyze the changes caused in plants fertilized with natural compost or without it or with artificial fertilizers.

Curiosity: while over a third of our food goes to waste, up to half of our household waste can be composted to nurture our soil.

Optional activity to be carried out at home with friends and family

In this web link the elaboration of a home compost of red earthworms is explained step by step: <https://goo.gl/9NmDeL> (spanish) or <https://goo.gl/zqFvA> , <https://goo.gl/ZNr7rh> (english)

You can compost without worms too.

Some of the links where this is explained: <https://goo.gl/wRogUI> <https://goo.gl/7yBNLW> (spanish) or <https://goo.gl/XPwVwI> (english video) or <https://goo.gl/mPemhz>

In the classroom, discussion or presentation by some expert guest about:

- The organic material (compostable) which we throw in the trash daily and the benefits obtained by composting.
- -The importance of the soils in our life (health, non renewable resources....).

Painting with soil

Use samples of soil with different colors and textures to create artistic works.

Resources

Mortar, poster boards, canvas, board, white wooden glue, samples of different soils, 2 mm sieve, scraper, paint brushes (different kinds and sizes), sponges, rags

Instructions

Each student should draw a painting on a theme of his/her choice using the previously collected soil samples. The dried and sieved soil should be fixed with glue to be applied on the poster board, canvas or board, to obtain the desired form.



Painting of José Caballo, image mounting by Miguel Silva

Procedure

1. Collect samples of soils with different colors and textures. Different colors can be naturally obtained by mixing samples of different horizons of various soils.
2. Spread out a thin layer of soil on a filter paper for air drying and further sieving to 2 mm. Place the sieved sample in a mortar and grind to a fine texture.
3. Put the different soil samples in paper cups and observe the colors and textures.
4. Draw a sketch on the poster board, canvas or board, and decide which colors (soil samples) are going to be used in the different parts of the drawing.
5. With a spatula or painting brush spread out the white glue across the area you want to paint in a particular color and then sprinkle directly with your hands the soil over the area where the glue has been spread. Once the soil powder is fixed, turn the poster board, canvas or board upside down to remove the excess of soil. Let it dry and repeat the process (glue, soil) if you want to get some relief effect. Glue can be also directly applied on the poster board or canvas, and paint without a previous sketch, using sponges, brushes, painting brushes and different rags (abstract work).

Examples and inspiration from the work of the artist José Caballo
<https://goo.gl/ysCF1c>



It's high time to talk about soil

Soil is a non-renewable resource which is the basis of food, feed, drugs and fuel production, and offers other essential ecosystems services.

Underline the human dependence on the soils and watch how its sustainable development is being threatened by soil management trends.

Resource

Video "Let's talk about soil" FAO: <https://goo.gl/q4O8j4>

This animation presents the current situation of soil resources all around the world. It covers the topics of degradation, urbanization, appropriation of lands and over-exploitation. It offers solutions to use our soils in a more sustainable way.

Instructions

Tell the students about the title of the video and ask them to make predictions about what will happen in the video or what will be said? Write the answers and ask the students to take note of evidences or proofs which confirm/reject their predictions, while watching the video (5 minutes 24 seconds).

See which predictions are right and how accurate are they.

Form groups of various students. Each group should deal with one of the topics seen in the video (students can choose the topic they liked the most or the topics can be distributed by the teacher).

The group has to express its reflections and improvement proposals in any of these formats: computer graphics, front-page in a newspaper, graphic guide notes, scripts, timeline, television advertisement, publicity poster, election campaign slogan, mobile app, letter to the mayor...



Resources for teachers

Didactic leaflet of the FAO on the importance of the soil (2015) directed to children from 5 to 14 years old.

<https://goo.gl/tEziAP> (Dig it, the secrets of the soils, beginner)
<https://goo.gl/5Y3tZ3> (Dig it, the secrets of the soils, intermediate)
<https://goo.gl/t9xDR8> (Digi it, the secrets of the soils, advanced)
<https://goo.gl/kPAoxB> (Search, the secrets of the soils, soil services)
<https://goo.gl/bkLnyG> (Teacher's guide)

Teacher studio "Enseñando suelos" XXX Reunión Nacional de Suelos, Universidad de Granada (2015)

<https://goo.gl/ASDbf2>
<https://goo.gl/xwQrl3>

Teaching resources

<https://goo.gl/QEo85F>
<https://goo.gl/Yl7oql>
<https://goo.gl/F2lghY>
<https://goo.gl/KCIXG4> "edafos, epidermis viva de la tierra "

Blogs

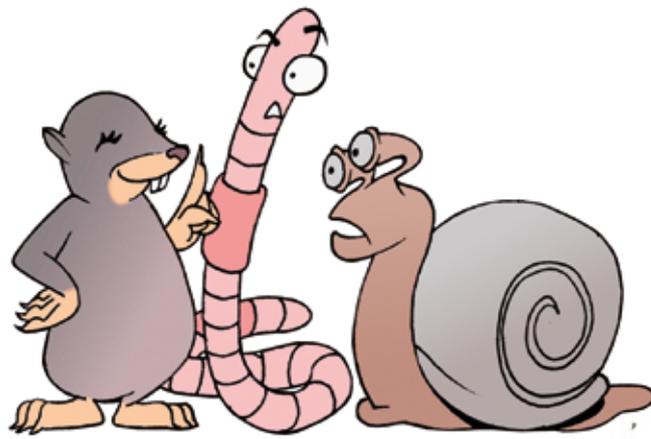
<https://goo.gl/CZQwiz> "Un universo invisible bajo nuestros pies"

Videos

Virtual visit to the soil room of Museo de Historia Natural de la USC
<https://goo.gl/h4uBzZ> (see "solo")
Video about the comic "Vivir no solo", Programa Labranza
<https://goo.gl/BVTvts>
Video about Ribeira Sacra "Labor de conservación do solo dos socialcos da Ribeira Sacra"
<https://goo.gl/zHGjBg>

Aknowledgements

Francisco Bueno, from Estudio Tangaraño, by the assignment of the images of the comic "Living in the soils" used in this lesson plan, and Purificación Pérez and Petra Kidd for English translation.





Soil is one of humanity's most precious assets. It allows plants, animals and humans living on the Earth's surface.

Soil is a limited resource which is easily destroyed.

Soil must be protected against erosion and pollution.

More effort is needed to ensure a wise use and conservation of this resource

(From the "European Soil Charter", 1972, Council of Europe)