

Methodology for Understanding Soil Erosion

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Received: March 11, 2022

Accepted: May 14, 2022

Online Published: May 31, 2022

doi:10.5539/jsd.v15n4p43

URL: <https://doi.org/10.5539/jsd.v15n4p43>

Abstract

This article aims to propose teaching educational techniques that support the understanding of soil erosion and the importance of soil conservation. This port, soil as it is an important natural element that permeates our daily lives, whether through the supply of food, as in the purity of surface and underground waters. In this way, providing educational techniques associated with Soil Education becomes relevant. With this, we provide, through didactic illustrations, to provide this understanding so that it can be improved and disseminated to the academic and school community.

Keywords: soil education, techniques and soil erosion

1. Introduction

Accelerated soil erosion is an important environmental problem with a major negative impact on economies and livelihoods around the world. This as a result of causing nutrient losses from the soils; reduce plant productivity; decrease the quality of surface water; reduce the storage capacity of reservoirs by sedimentation and by increasing the possibility of flooding, as well as the costs of cleaning and mitigating these issues (Graves et al., 2015; Grand-Clement et al., 2014; Montgomery, 2007).

Recent research, involving the assessment and prediction of susceptibility to soil erosion based on projected climate change scenarios, indicates that vulnerability to soil erosion will increase compared to current soil erosion rates (Senanayake & Pradhan, 2022), which brings great concern.

In this sense, it is necessary to practice Solo Education to awaken its understanding from the teaching and learning process, thus making an expanded knowledge throughout society, which includes concepts such as education Sustainable Education (ESD) or Education for Sustainable Development and Development (EfS), for Development and Development for Zguir, Dubis & Koç (2021) , as being a concept developed to promote and systematically change the systems developed to incorporate the incorporation of the concepts developed and sustainability actions in the minds of future generations.

In the perspective of slowing down erosive processes, especially in the semi-arid context, where the predominance of shallow soils and the lower density of vegetation and changes in land use, such as the replacement of native ecosystems for agricultural activities without the proper use of conservation practices, contribute to the increase in susceptibility of this process, the intensification of soil degradation and climate change (Salazar, Baldi, Hirota, Syktus, McAlpine, 2015; Queiroz et al, 2020).

This article seeks to present a teaching methodology on soil erosion, in order to expand knowledge about the concepts, forms and techniques that promote the reduction of erosive processes through soil education of students of schools of schools elementary and high school.

1.1 Educational Practices and Soil Education

It should be noted that in the educational process it is necessary to know the soil element, understood as a component of the natural environment, essential to development; to be instrumental, so that their understanding becomes accessible. Although environmental concern integrates people's daily lives, the perception of the environment and its components are still restricted, nod. (C. Falcão & S. Falcão, 2020).

For the authors, the soil consists of a component of the natural environment that must be adequately known and preserved, in view of its importance for the maintenance of the terrestrial ecosystem and the survival of the organisms on which it depends. Soil degradation can be associated with the ignorance of part of the population regarding its characteristics, importance and functions, and should be seen as a cross-cutting theme, especially in teaching, to establish a relationship with the natural/social sciences, namely Geography and Biology.

Following this context, Silva, C. Falcão & S. Falcão (2008), when analyzing geography textbooks, pointed out that the existing content does not contribute, in a clear and coherent way, to the understanding of the soil, in the paradigm of the landscape, overlooking the recognition of its importance as an element of it. In an attempt to simplify the exposure of the soil formation process, they fail to address some significant themes, such as the types of source material, susceptibility, erosion, among others.

C. Falcão (2014), highlights the teaching of the soil should be associated with the production of teaching materials, among which, models; little caries; macropedoliths; earthworm breeding; earthly; teaching kits; pedagogical notebooks; games; folders; magazine; and, comic stories, all directed to the solo theme. It is noted that these materials illustrate different contents, which are concepts, components, formation process, morphological characteristics, emphasizing their importance, as a natural and essential resource, for the support of life and the terrestrial ecosystem.

For the author, these teaching support materials are available to the academic community, covering early childhood, secondary, higher and technical education, and are considered communication tools based on research, visualizing the (re)production of knowledge.

Thus, it seeks to fill a gap in soil teaching, especially with regard to its proper use, in addition to encouraging conservation practices, aiming at motivation for teachers, in a participatory approach, through pedagogical practices.

It is note point that the production of didactic material is in line with the proposal that has been configured in the teaching scenario in Brazil, portraying it through playful resources, such as games, drawings, cartoons, comic books, among others. It urges to clarify that exposing different materials directed to soil teaching is justified by the limited availability of alternative materials, in the context of basic education, notoriously, in the soil theme.

It is appropriate to affirm that the didactic instrument conditions the student to explore the concepts, besides making him an active agent of the teaching/learning process, through direct contact with the kits of experiments, simulations and, use of ludicity, present in comic books and games (C. Falcão & S. Falcão, 2021).

2. Method

The methodological proposal for the teaching of soil erosion is based on the use of playful elements and on the simulation of natural environments conducive to the occurrence of erosive events.

Through the use of the strategies mentioned, we seek to present the concepts of soil erosion, the agents of this process and actions that prevent and/or reduce the accelerated occurrence of soil erosion. Some of the proposed strategies have as reference Knopki et al (2021), a book that was developed with the objective of assisting in soil education.

Regarding educational strategies, it is proposed the use of playful drawings (Almeida & Falcão, 2012) and experiments with soil (C. Falcão & S. Falcão, 2014 to, 2014b). Illustrations describing the stages of soil water erosion and experiments using sprays ejecting water on surfaces with soils and different slopes, can simulate how the impact of water droplets from precipitations can cause the detachment of soil aggregates, as well as the generation of surface runoff and sediment deposition, thus characterizing the erosive process and indicating that precipitation and slope are important factors in the erosive process.

With low cost materials and recyclables such as pet bottles, simple, fast, and suitable assembly experiments are possible for understanding at different school levels.

For demonstrations of the occurrence of soil water erosion,

Experiment 1: Water erosion in soils

Materials:

-6 PET bottles (2 liters);

-Solo;

-Living grass;

- Dead plant remains, burlap (dried leaves, branches, small branches);
- String or line;
- Water (for demonstration).

Construction of the experiment

1-For the assembly of the experiment, 3 bottles of 2 liters should be cut lengthwise, preserving the nozzle and the bottom top (figure 1).

2- The other three bottles should be cut apart from the neck, preserving the lids. Close to the surface where the cut will be carried out, two points should be drilled and threaded and fixed so that the container is placed in the mouthpiece of the bottle where the soils will be stored.

Containers must be placed with the aid of a string in the gallon nozzle so that the water is drained for comparison purposes.

3- The bottom of the other bottles should be cut and used as a basis for the support of the bottles with the different types of soils, emphasizing that it is important to leave the bottoms with the same height for the bottles to have the same inclination.

4- In the first bottle, soil is added with a live vegetation cover.

5-In the second is added soil with organic material, and bottlenecks in the nozzle of each bottle.

6-In the third, soil is added without any vegetation cover.

7-To simulate rainwater falling on the soils can be used watering can or disposable cups.





Figure 1. Preparation and assembly of the experiment. Source: authors (2022)

In order to ensure learning about the proposed theme, one should:

- Problematicized the theme with issues related to the dynamics of a hydrographic basin and the influence of the type of soil cover, slope, riparian forest, etc., under the erosive processes;
- Explain that the water drained superficially will carry not only soil particles, but also many elements not visible to the naked eye, such as nutrients and any xenobiotics that are in the soil in question;
- Compare the amount of water present in each bottle;

Compare the color of the water collected in the different treatments and the amount of soil lost in each case, since the color of the water is influenced by soil particles.

Experiment 2: Wind Erosion in Soils

Materials

- 1 Piece of grass of the same circumference as a 2 L pet bottle
- 2 pet bottles 2 L
- Dry soil
- Watering can or disposable cup
- Water

Construction of the experiment

- 1-Cut the bottom of the two pet bottles, forming containers;
- 2- Cut a piece of grass with the same measurements of the circumference of the container;
- 3- Insert the piece of grass cut inside one of the containers;
- 4- Fill the other container with dry soil (grind the soil before placing it inside the container);
- 5-Use a pipe to blow (representation of the activity of the winds), leaving about 5 cm away from the containers;
- 6-Blow the container with vegetable cover;
- 7- Repeat the procedure in the container with dry soil;



Figure 2. Preparation and assembly of the demonstration experiment of wind erosion. Source: authors (2022)

3. Expected Results

The experiments in question enable the establishment of relationships between soil erosion and environmental degradation; the importance of maintaining soil cover and ripiary forests in the control of erosive processes and pollution of water bodies, the which narrows the relationship between education, society and the environment and makes it possible to find theoretical and practical answers to socio-environmental challenges resulting from soil erosion and degradation, corroborating the importance of teaching in soils and environmental education, as cited by authors as Layrargues, 2004 and C. Falcão (2014).

In experiment 1 that deals with water erosion, it can be observed that the water drained superficially from the soil that does not contain vegetation cover carried more soil particles and with them chemical elements (nutrients and xenobiotics) not visible to the naked eye, which under natural conditions represents the decrease the natural fertility of the soils and increase water contamination (Wang, Yen, Huang, Wang (in press)).

The color of the water drained from the bottle with the soil without vegetation shows that a considerable amount of soil particles were carried along with the water, reinforcing that the soil with vegetation cover helps in protecting against surface runoff, reducing the silting of water bodies and the problems associated with it (floods).

Acknowledgments

This research thanks CAPES-Coordination for the Improvement of Higher Education Personnel, CNPq-National Council for Scientific and Technological Development and FUNCAP-Cearense Foundation for Support to Scientific and Technological Development, for their continuous help and financial support.

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