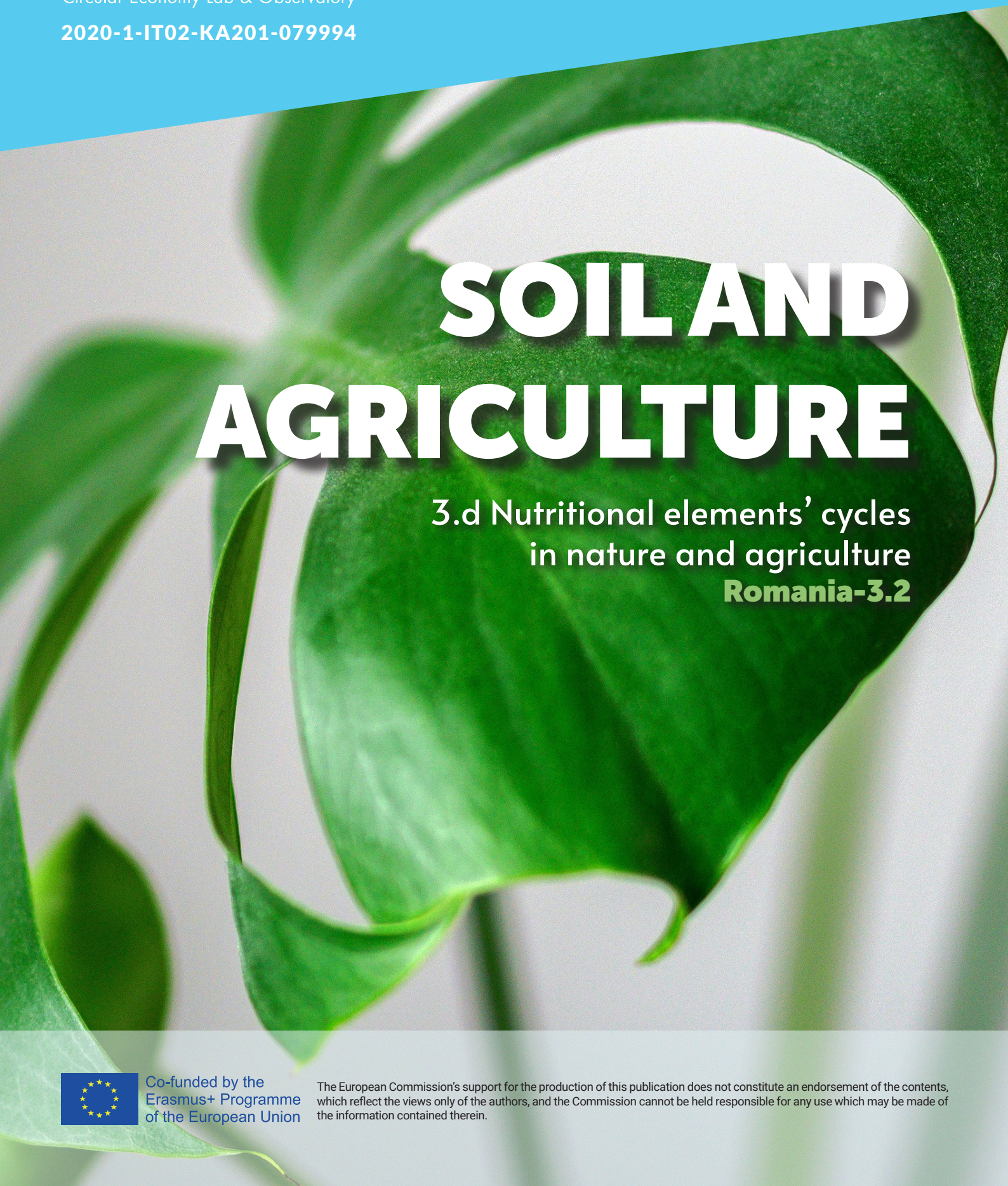
Circular Economy Lab & Observatory

2020-1-IT02-KA201-079994



SOIL AND AGRICULTURE

3.d Nutritional elements' cycles in nature and agriculture

Romania-3.2

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Introduction

The nutrient cycle explains the flow of nutrients from the physical environment into living things and their subsequent recycling back into the physical environment. The transfer of nutrients, which are necessary for life, from the environment into plants and animals and back again is a crucial component of any region's ecosystem.

The nutrition cycle explains how nutrients travel from the physical environment into living creatures and then are recycled back into the physical environment. This flow of nutrients—vital ingredients for life—from the environment into plants and animals and back again is a crucial aspect of any region's ecosystem.

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If the organisms that live in that habitat are to thrive and be kept in a steady population, the nutrient cycle in that ecosystem must be stable and in balance.

Today, a significant portion of humanity alters the nutrient cycle in such a way that we extract nutrients from the land and release them into aquatic habitats. This results in the loss of soil on the land, but it also has other negative effects.

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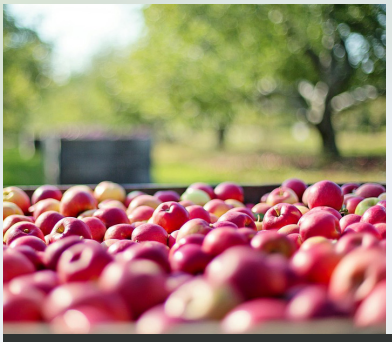
Problem's description
The nutrient cycle, which deals with how much soil organic matter, such as carbon, nitrogen, and phosphorus, is absorbed and retained in soil, is one cycle in which soil plays a critical role. In order for plants to employ organic materials like leaves and root tips, soil-dwelling organisms must first convert them to simpler chemicals.

Mineral nitrogen, which is necessary for plant growth, is created by some soil bacteria from atmospheric nitrogen. Fertilizers add phosphate and nitrogen to the soil to encourage plant growth, but not all of it is absorbed by the plants. Excess can reach lakes and rivers, affecting the aquatic life there.

Nutrients are regularly recycled in a natural environment, as previously mentioned. Recent decades have seen some significant changes in nutrient cycles as a result of population growth and related human activities like large-scale farming.
There are five main nutrient cycles:
* Carbon cycle.
* Oxygen cycle.
* Water cycle.
* Phosphorus cycle.
* Sulfur cycle.



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What exactly is the carbon cycle?
The carbon cycle is nature's method of recycling carbon atoms, which travel from the atmosphere into organisms on Earth and then back into the atmosphere. The majority of carbon is stored in rocks and sediments, with the remainder in the ocean, atmosphere, and living organisms. Which of the following are the four stages of the oxygen cycle? Consider the oxygen cycle.

Oxygen is depleted in the following processes:
Oxygen is used by all organisms for respiration.
Decomposing – Plants and animals decompose when they die.
Rusting – This process, also known as oxidation, causes metals to rust.
Combustion – The process by which fire is created requires oxygen, in addition to heat and fuel.

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What is the significance of the oxygen cycle?
The Oxygen Cycle is a biogeochemical cycle that is required to maintain the concentration and level of oxygen in the atmosphere. The Oxygen Cycle is one of the primary reasons for life on Earth. The biosphere could not exist without oxygen. Anaerobes, on the other hand, can survive in the absence of oxygen.

What is the water cycle and how does it work?
Water Cycle Illustrations
The water cycle depicts the continuous movement of water within the Earth's and atmosphere's atmosphere. It is a complicated system with numerous processes. Liquid water evaporates into water vapor, condenses into clouds, and falls back to earth as rain and snow.

What are the 7 steps of water cycle?
- the water cycle.
- evaporation.
- condensation.
- precipitation.
- interception.
- infiltration.
- percolation.
- transpiration.

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What happened to the phosphorus cycle?
Phosphorus is locked up in rock and sedimentary deposits, where it is released through weathering, leaching, and mining. Some of it makes its way through freshwater and terrestrial ecosystems via plants, grazers, predators, and parasites, eventually returning to those ecosystems through death and decay.

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What is the significance of the phosphorus cycle?
The phosphorus cycle is important because phosphorus is a necessary nutrient for life on Earth, where it is involved in the transfer of energy within organisms, the structure of genetic material, and the composition of cell membranes, bones, and teeth.

What is the significance of the sulfur cycle?
The sulfur cycle is covered in Part IV of "Matter Cycles."
Sulphur is required for the proper functioning of proteins and enzymes in plants, as well as in animals that rely on plants for Sulphur. Sulphur is absorbed by plants when it is dissolved in water. Animals consume these plants to ensure that they get enough Sulphur to stay healthy.

What are the sulfur cycle's six major steps?

1. Organic Compound Decomposition Protein degradation produces Sulphur-containing amino acids.
2. Hydrogen Sulphide Oxidation to Elemental Sulphur Elemental Sulphur is formed when hydrogen sulphide oxidizes.
3. Elemental Sulphur Oxidation
4. Sulphate reduction.

Possible solutions
Nutrients are continuously recycled in a natural ecosystem, as previously described. Population growth and the resulting human activities, such as large-scale farming, have resulted in significant changes in nutrient cycles in recent decades. Nutrients are removed from the soil when crops are harvested.

For centuries, animal dung has been used as a fertilizer to replenish the soil's nutrients, and in many cultures, including Europe and China, human excreta has also been recycled back to agricultural fields. As a result, nutrients returned to the soil at roughly the same rate at which they were withdrawn. This cycle, however, was disrupted by the introduction of water-borne sewage, which was replaced by a linear system that transports nutrients away from soils and into watercourses (see also water).

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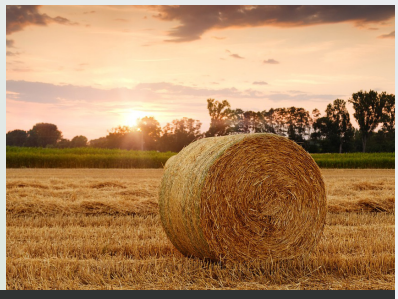
Nutrient cycles in agriculture can be opened in two ways. First, when animals and/or plants leave the farm as a result of harvesting or slaughtering. The second method is through leaks into the environment, resulting in water and air pollution. Leaching (when a nutrient travels deep into the ground to the water table), volatilization, denitrification, runoff, or erosion can all cause leaks.



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Furthermore, agriculture affects the nutrient cycle in another way: because ploughing and tilling disturb and expose the soil, more nutrients drain away with runoff (see also soil degradation). Flood control also contributes to the disruption of the natural nutrient cycle. Typically, river floods redistribute nutrient-rich sediments to lower lands, where they are once again available to ecosystems.

Instead, dams trap sediment or embankments confine it to the river until it washes out to sea. As a result, too many nutrients from eroded soil and human and animal waste end up in lakes and oceans, where they fuel massive, uncontrolled algae blooms. Once they die and sink to the bottom, their decay deprives other organisms of oxygen, resulting in “dead zones” and contributing to global warming.

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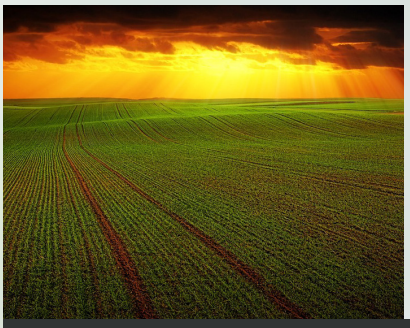
Conclusions

Essentially, the issue with human alterations to the natural nutrient cycle is that we are extracting nutrients from the soil and discharging them primarily in aquatic environments, resulting in a heavy imbalance with serious consequences.

These human-caused changes in nutrient cycles cause an imbalance in nutrient availability, with serious consequences, particularly for water:

1. Soil depletion: The accumulation of nutrients in the seas means that they are depleted elsewhere, primarily from soils. As a result, many fruits and vegetables consumed by animals and humans now contain fewer nutrients, minerals, vitamins, and so on than they did decades ago. More artificial fertilizers are not the answer: they are energy and cost intensive; they can cause salinization; and they are essentially incomplete because they are based primarily on the three main components Nitrogen, Phosphorus, and Potassium.



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2. Depletion of nutrient sources: While nitrogen can be obtained from the air, it is an energy-intensive process that relies heavily on the use of fossil fuels. Other artificial fertilizer components, such as phosphorus, are derived from fossil resources. The amount that can be easily mined is limited (see above). If these easily mined resources are depleted, phosphorus prices will skyrocket.

3. Affordability and food security: "Fertilizers are bound to world market prices, which are already significantly high for many farmers in developing countries." A price increase, as is expected in the case of phosphorus, will make them unavailable to many farmers. This may increase the cost of agricultural products, particularly in developing countries, and thus lead to a decrease in production.

4. Waterway eutrophication and dead zones: "Fertilizer runoff and wastewater discharge contribute to eutrophication, which causes uncontrolled algae blooms in rivers, lakes, and oceans that feed on nitrogen and phosphorus from fertilizers. When they die, their decomposition depletes the oxygen in the water and gradually chokes aquatic life, resulting in "dead zones." Off the Mississippi delta is the largest dead zone in American waters, with a surface area of 20,000 square kilometers in July 2008. There are now over 400 dead zones in the world, covering an area of more than 245,000 square kilometers."

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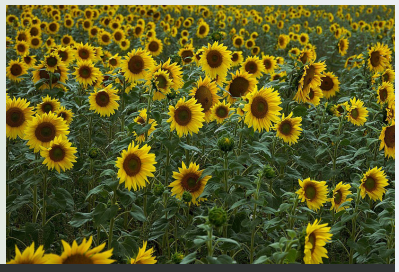
The nutrient cycle describes how nutrients move from the physical environment to living organisms and then back again. This movement of nutrients, which are necessary for life, from the environment into plants and animals and back again is a critical function of any region's ecology.

The nutrient cycle in any given environment must be balanced and stable if the organisms that live there are to thrive and maintain a constant population (MARTIN 2010). Large parts of humanity currently influence the nutrient cycle in such a way that nutrients are removed from the land and discharged into aquatic environments.



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