УМНО

We are investigating how to properly manage carbon in Mediterranean soils

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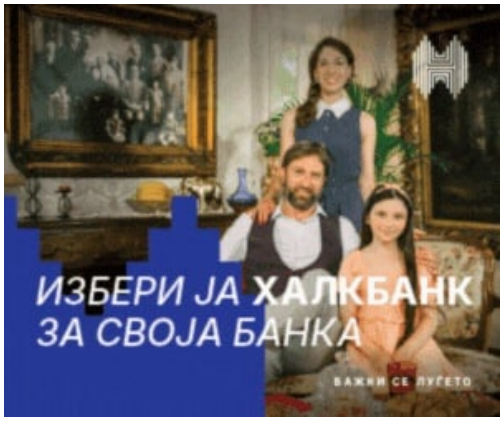
In the last few decades, special attention has been paid to the cyclical movement of carbon in nature, given its role in the emergence of the "greenhouse" phenomenon, says Prof. Dr. Dushko Mukaetov from the Agricultural Institute at UKIM.

Soil is one of the largest reservoirs of carbon, where it is bound in organic or inorganic form. With proper soil management, especially in agriculture and forestry, the carbon content in the soil can be increased and its presence in the atmosphere can be reduced. This is one of the many benefits of the CARBON4SOIL project, which is currently being worked on by the Institute of Agriculture at the University "Sts. Cyril and Methodius" in Skopje. The project is part of

the INTERREG EUROMED program, which aims to investigate several aspects related to carbon in the soil in the Mediterranean zone. Prof. Dr. Dusko Mukaetov from the Institute of Agriculture is the project manager from the Macedonian side and in an interview with Umno.mk explains the goals and benefits of this research, but also s about the situation with the soils in our country.



One of the projects currently being worked on by the Agricultural Institute at the University of St. Cyril and Methodius in Skopje is CARBON4SOIL. It is a two-year project involving eight institutions. How did the idea for this research project come about?

– Carbon is one of the basic elements in nature, both in terrestrial and aquatic ecosystems. The carbon cycle is associated with many important processes in nature on which the survival of life on the planet depends. In the last few decades, special attention has been paid to the cyclical movement of carbon in nature, given its role in the occurrence of the “greenhouse” phenomenon. Namely, carbon monoxide and dioxide, along with several other so-called “greenhouse gases”, are responsible for the occurrence of this phenomenon, therefore reducing the concentration of carbon in the atmosphere by reducing its emissions, as well as finding methods and techniques for its binding (sequestration) are of paramount importance. Soil is one of the largest reservoirs of carbon, where it is bound in organic or inorganic form. By applying appropriate soil management practices, especially in agriculture and forestry, it is possible to increase the carbon content in the soil and reduce its presence in the atmosphere.

Training session. Carbon agriculture – a model for a greener future and healthy soil

Based on all this, the idea arose to start a project from the INTERREG EUROMED program, the aim of which is to investigate several aspects related to soil carbon in the Mediterranean zone. The Agricultural Institute has decades of cooperation with some of the institutions participating in the project, so this activity is a kind of continuation of the fruitful cooperation so far.

The focus of the project is to provide a scientific basis for reducing carbon dioxide (CO2) in the air and storing it in the soil, using so-called "carbon agriculture." What exactly does this term mean?

– Simply put, “carbon agriculture” (CA) includes a group of measures (practices) that reduce carbon emissions from agricultural land. At the same time, it allows for greater carbon sequestration from the atmosphere, which is stored in the soil in various forms of organically bound carbon. CA is also an effective way to combat the negative impact of climate change, because it reduces the concentration of carbon in the atmosphere and thus reduces the greenhouse effect. At the same time, the soil is enriched with organic matter and its resilience to extreme events caused by climate change (floods, erosion, etc.) is increased.

By applying measures and practices that are part of the LS such as: reduced tillage, cover crops, crop rotation, agroforestry, composting, etc., the overall health and quality of the soil, its functions, and the

ecosystem services it provides are improved. Carbon agriculture (CA) also refers to business models that aim to promote the reduction of the impact of climate change, through payments to farmers who apply practices that are climate-friendly.

'bon agriculture is one of the climate actions of the European ɐen Deal and has the potential to become an example of ɪtegic sustainable soil management and a model for the 'opean Union. Where do you see CARBON4SOIL's role in this ...ɪtegic development?

– Carbon agriculture is clearly highlighted in the European Green Deal, especially in the climate action related to the Restoration of Biodiversity and Nature, and is closely linked to the action related to Sustainable Agriculture (Farm to Fork Strategy). CARBON4SOIL is a project that has the task of studying a wide range of aspects related to soil carbon, where carbon agriculture belongs as one segment. The project will conduct a detailed study of the current state of carbon content in Mediterranean soils, select the most appropriate methods for its monitoring and modeling in space and time, apply sophisticated remote sensing techniques, and determine the reference values of organic carbon in Mediterranean soils. Closely related to the European Green Deal is the research that will address the determination of the most favorable practices of PS in the Mediterranean region, as well as the development and testing of training modules that cover all aspects related to: soil quality, the importance of organic carbon on soil quality, carbon agriculture and the benefits of carbon credits and participation in carbon markets.

Analyses show that soil degradation is one of the threats to food security in the Mediterranean region. What are the main causes of soil degradation today? How much of it is due to human influence and how much to climatic factors?

– Soils are a direct product of environmental conditions, i.e. the complex interaction between soil-forming processes, namely: geological base, relief, vegetation in a given period of time. Any change in these processes leads to changes in the direction of soil development. The changes caused by humans are abrupt and in a short time can cause serious changes in soils in the direction of their degradation, i.e. the loss of soil fertility and the functions and services they perform in the ecosystem.

First meeting in Bled, Slovenia

In most cases, degradation processes are the result of human activity, which uses the soil in an inappropriate way to meet its needs, i.e. the production of food, plant fibers, wood mass and soil resources (ores and minerals). Climate change is just another phenomenon that additionally affects the accelerated degradation of soils.

One of the more severe forms of degradation is the reduction of organic matter in the soil, which is a result of the unsustainable use of agricultural and forest land, which disrupts all the properties that define soil fertility. Such soil is much less resistant to the negative impact of climate change, especially in terms of climate extremes: floods, droughts, etc. In this sense, the CARBON4SOIL project aims to study all aspects related to soil carbon. To provide an overview of the current situation with the application of the SD in practice and to identify the most suitable for the Mediterranean Region, to determine the reference levels of soil carbon and to recommend the best methods and practices for monitoring and managing the soil, as well as to identify problems and open questions that require additional research and testing.

What is the situation with soil degradation in our country, given that a large part of the territory is agricultural land?

– Soils in the Republic of North Macedonia are under constant pressure from various factors, including urbanization, industrial and

energy activities, agriculture, forestry, transport, mining, tourism and climate change. The most significant soil degradation processes in the country are: the reduction of soil organic matter content, erosion, soil sealing, pollution and salinization.

ural conditions, especially climatic and soil characteristics, ıbined with unsustainable agricultural practices and deforestation, the main causes of intensive soil erosion processes. According to a from the new soil erosion map, about 33.57 percent of the ntry's territory is exposed to the three most serious categories of soil erosion. It is estimated that about 11-15,000 hectares are naturally saline soils, which are mainly concentrated in three regions: Ovche Pole, Skopje Valley and Pelagonia. Unfortunately, due to the lack of systematic monitoring, the full extent and severity of salinization of agricultural land remains unknown, especially on arable land that is under threat from so-called secondary salinization due to irrigation with low-quality irrigation water.

Third meeting of the Carbon 4 Soil Quality project team in Skopje

Soil alkalization is another degradation process that can be significantly exacerbated by inappropriate soil and water management, especially in arid conditions. However, similar to salinization, there is insufficient data to accurately estimate the extent of alkalization.

Regarding the carbon content in the soil, due to the lack of continuous soil monitoring, it is not possible to say with certainty what its content is in the soil. Several efforts have been made to estimate its content based on global data as well as existing national data. From these studies it can be concluded that the organic carbon content in the soil significantly decreased. From the analyses carried out as part of process of setting targets for Land Degradation Neutrality (LDN) er the United Nations Convention to Combat Desertification ICCD), it can be determined that the annual accumulation of SOC ... ...e reference period (2001 – 2005) was approximately 90,000 tons per year, while in the reporting period (2015 – 2019) the accumulation decreased to 77,000 tons per year across all six land use categories. This clearly indicates a continuous decline in the level of SOC across the country.

The latest analyses of soil sealing in the period from 2000 to 2018 around several urban centers showed an increase in sealed areas from 1.73 percent (in the Lake Ohrid area) to 2 percent, at the expense of forest and agricultural areas.

The project will also produce a "Carbon Agriculture Handbook." What tools will it offer and who will benefit most from them?

– One of the anticipated results of the project activities is the development of five training modules that will address various topics related to soil carbon, namely: soil quality, carbon and its circular movement in nature, carbon agriculture, benefits of PF and how to choose the most suitable technique and practical guidance for farmers on how to take advantage of the benefits of carbon credits. All training modules are in the form of presentations, brochures and video materials that are also available in Macedonian. Training modules are intended to raise knowledge on various topics related to carbon agriculture, both among producers and other interested parties, including decision-makers. The materials have already been tested by all project participants, with representatives from various stakeholders, namely: farmers, academia, business community, farmers' associations, policy makers in agriculture and the environment, etc.

Why are these international projects and transnational cooperation important? And what key challenges will CARBON4SOIL offer solutions for?

– International projects provide a unique opportunity for collaboration between teams from the same field or multidisciplinary teams in

addressing a specific issue. Such transnational collaboration enables the exchange of experiences and ideas between scientists and practitioners, which helps in finding innovative solutions as well as implementing more complex activities in addressing a specific problem.

RBON4SOIL is a project that will provide a comprehensive rview of the status of organic carbon in Mediterranean soils, with a ticular focus on reference carbon contents in Mediterranean soils, ection of best standard methods for its monitoring and modeling, selection of the most suitable carbon agriculture techniques suitable for Mediterranean soils and existing production systems, as well as raising awareness among all stakeholders about the importance of CG and carbon credits.

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CARBON4SOIL **Agricultural Institute - Skopje**

carbon agriculture **Mediterranean** **soils**

over **Prof. Dr. Dushko Mukaetov**

greenhouse gases **UKIM**

Infinitely grateful!
The Umno.mk team

ɔmised Land" by Qendrim
ani – best documentary at
Fest in Pristina

Donnie McCaslin, Vladimir Nikolov and NJO performed a world-class jazz concert in Skopje