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DYNAMICS OF LAND FUND AND STRATEGIES ON SOIL CONSERVATION AND PREVENTION OF SOIL DEGRADATION IN ROMANIA

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Abstract

Soil is one of the Earth's most precious resources and is essential to sustaining life on our planet. However, soils are increasingly subject to degradation due to intensive agricultural practices, deforestation, pollution and climate change. Conserving soil and preventing soil degradation has become imperative in our efforts to ensure food security, protect biodiversity and maintain healthy ecosystems. Impact strategies are essential to maintain soil fertility, prevent soil erosion and degradation, conserve water and help reduce greenhouse gas emissions. In this context, the aim of the research is to explore the impact of key conservation strategies and practices that can be adopted to protect soils and ensure their long-term sustainability. Data were collected from public institutions, from the official National Institute of Statistics, NIS, website Tempo-Online and the National Land Improvement Administration. Implementing soil conservation strategies is essential to protect the environment, ensure the sustainability of the food system and maintain the ecological balance of our planet. S*oil conservation is a vital component of sustainable development and environmental protection in Romania. Through effective implementation of conservation strategies and stakeholder involvement, the country can protect the essential resource of soil with a positive impact for future generations. The strategic elements and techniques discussed in this article contribute to maintaining ecological balance and conserving natural resources for future generations.*

Key words**:** *soil fertility, degradation, strategies, key practices, Romania*

INTRODUCTION

The impact of soil conservation and soil degradation prevention strategies is crucial for several reasons:

Soil is the foundation of our food system. Most crops grow in soil and depend on their fertility. By conserving soils, we ensure that we have healthy and productive soils to support the food production needed for a growing population.

Agriculture is an important economic sector contributing to GDP [12].

Soils are home to much of the Earth's biodiversity, from small organisms such as bacteria and worms to larger organisms such as insects and mammals. Soil degradation can lead to habitat loss and species decline, affecting the whole food chain.

Healthy soil can play a significant role in absorbing carbon from the atmosphere and reducing greenhouse gas emissions. By adopting practices that increase soil organic matter content and improve soil quality, we contribute to the fight against climate change [9].

Healthy soils help retain and filter water, maintaining the water table and preventing run-off, thus reducing the risk of flooding and ensuring the availability of water for irrigation and domestic use.

Soil erosion is a major problem that can affect agricultural land and natural ecosystems. By applying conservation practices such as conservation agriculture and planting vegetation, we can prevent soil loss due to erosion.

Ecological restoration with biological material is extremely efficient when it comes from the same areas with those which need restoration. The necessity of restoration is generated by the huge damage brought by the surface and deep erosion to habitats, areas and soil [1].

Degraded soils require more inputs, such as chemical fertilizers, to maintain agricultural production. Soil conservation reduces the need for these inputs, saving resources and reducing environmental impact [6].
Climate stress factors, and especially drought, due to the lack of water in the soil reserve, correlated with the precipitation volume reduction, require new studies, highlighting the risks of reducing wheat yield, the main agricultural crop of the area and the development of new agricultural techniques, to capitalize more efficiently the reduced water resource and deal with hot summers, especially during the flowering – filling the grain – maturity periods, when the wheat is very sensitive to temperatures above 30°C [2].
After Romania's accession to the European Union, there is a significant improvement of the main technical indicators, so that the financial support provided to farmers is also reflected in the productions obtained [4].
The EU agriculture is highly developed but important differences are from a country to another In the EU the development of agriculture is based on small scale farms, the average farm size being about 12 ha, ranging between 152 ha in Czech Republic and 3 ha in Cyprus and Romania [11].
The aim of the paper is to examine and analyse strategies for soil conservation and prevention of soil degradation in Romania. Through the S.W.O.T. analysis the paper aims to provide a deeper understanding of the current state of soils and soil protection measures in the specific context of our country.
The paper should serve as a resource for policy makers, researchers, farmers and anyone interested in protecting soils and promoting sustainable agriculture in Romania.

MATERIALS AND METHODS

Data were collected from public institutions, from the official National Institute of Statistics, NIS, website Tempo-Online and the National Land Improvement Administration R.A, ZAV0232 [10] - Horizon 8 - Environment - Area of land improved with soil improvement and soil erosion control works, by land use categories.
The study was a literature search, carrying out analyses using the comparative method which led to a relevant interpretation of the statistical data.

RESULTS AND DISCUSSIONS

Soil improvement and erosion control works in Romania

Implementing soil conservation strategies is essential to protect the environment, ensure the sustainability of the food system and maintain the ecological balance of our planet. Neglecting these strategies can have serious consequences for society and our environment [5]. The area designed to combat soil erosion - is the complex of hydrotechnical works carried out to reduce or halt the degradation of the soil surface by removing its fertile layer under the action of external geographical agents and carrying out regularization works to prevent rainwater runoff from the slopes in order to avoid damage caused by floods on the land at the foot of the slope [7].
Agricultural area of Romania by category in the interval 2016-2020 is shown in Table 1.

Table 1. Romania's agricultural area by category (ha)

Agricultural area under development				
Unit of measure = Hectare				
2016	2017	2018	2019	2020
2,145,635	2,145,581	2,145,547	2,145,467	2,145,426
Arable land				
2016	2017	2018	2019	2020
1,227,584	1,227,554	1,227,521	1,227,444	1,227,407
Natural pastures				
2016	2017	2018	2019	2020
517,747	517,747	517,747	517,892	517,888
Natural meadows				
2016	2017	2018	2019	2020
200,680	200,677	200,677	200,677	200,677
Vineyards, vine nurseries and hop gardens				
2016	2017	2018	2019	2020
82,783	82,763	82,762	82,761	82,761
Orchards, nurseries, fruit bushes				
2016	2017	2018	2019	2020
116,841	116,840	116,840	116,693	116,693

Source: NIS, http://statistici.insse.ro [10].

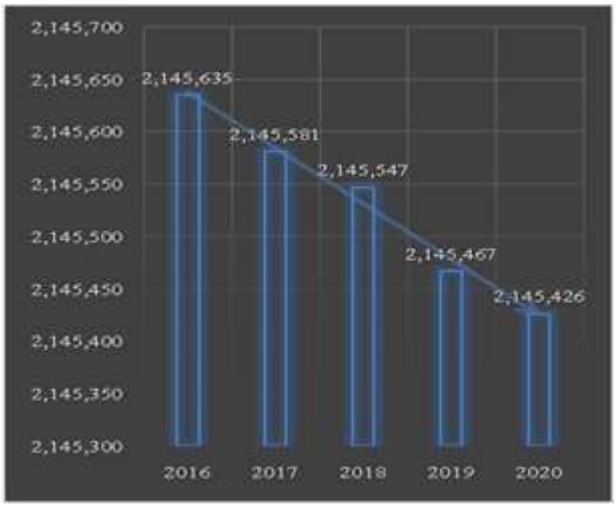

Fig. 1. Dynamics of agricultural area in Romania, 2016-2020 (ha)
Source: Own design based on the data from NIS, http://statistici.insse.ro [10].

As can be seen in Fig.1, the data are on an ascending scale, but the data in the 5 analyzed years are very similar because in Romania and the difference between the reference years 2016 - 2020 is not even 1 %.
The cereal market in Romania represents the total amount of grain transactions that have at its center the farm and the farmer. Both the farmer, exporters, port operators, lawyers, local and regional authorities, transporters, livestock consumers, and processing industries are meeting on this market [5].

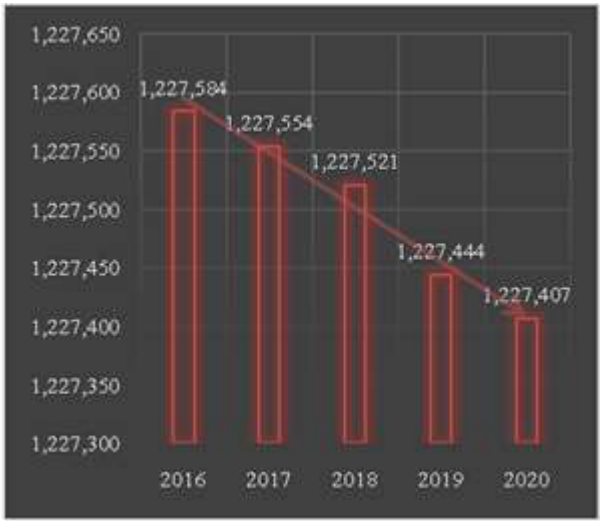

Fig. 2. Dynamics of arable land in Romania, 2016-2020 (ha)
Source: Own design based on the data from NIS, http://statistici.insse.ro [10].

Arable land in Romania is subject to a variety of protective measures and regulations to preserve soil fertility and prevent erosion and degradation. These measures include: Agricultural policies; Monitoring and evaluation; Use restrictions; Rural development programs; Education and awareness.

Fig. 3. Dynamics of the areas covered by natural pastures in Romania, 2016-2020 (ha)
Source: Own design based on the data from NIS, http://statistici.insse.ro [10].

Protecting and conserving Romania's natural grasslands is essential for maintaining biodiversity, natural resources and promoting sustainable agricultural practices.
Here are some ways in which Romania is helping natural grasslands:
-Compliance with land use regulations;
-Avoiding overcrowding;
-Application of rotational grazing;
-Avoiding the use of pesticides and chemical fertilizers;
-Preserving native vegetation;
-Participating in conservation programs;
-Supporting research and education;
-Respecting protected areas;
-Participating in voluntary actions.
Conservation of natural grasslands is essential for maintaining biodiversity and natural resources in Romania, and your contribution

can make a significant difference in protecting these ecosystems.

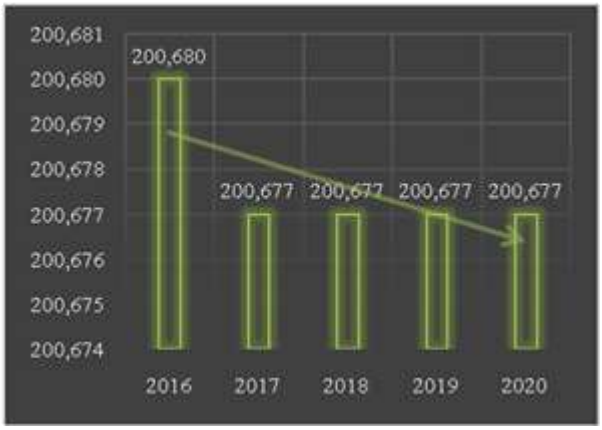

Fig. 4. Dynamics of the areas representing natural meadows in Romania, 2016-2020 (ha)
Source: Own design based on the data from NIS, http://statistici.insse.ro [10].

Natural meadows, like natural grasslands, play a vital role in maintaining biodiversity and natural resources in Romania.
Natural meadows are a valuable habitat for biodiversity and for the conservation of natural resources [3].
The risk of environmental degradation, depletion of resources, and impoverishment of the planet has existed and will continue to exist [8].
People's contribution to the protection and conservation of these ecosystems can have a significant impact on maintaining Romania's biodiversity and natural beauty.

Fig. 5. Dynamics of surfaces covered by vineyards, vine nurseries and hop gardens in Romania, 2016-2020 (ha)
Source: Own design based on the data from NIS, http://statistici.insse.ro [10].

Vineyards, vine nurseries and hop fields are important for the wine industry and beer production and can contribute to biodiversity and environmental protection in Romania.
Environment conservation could be assured by **adopting sustainable viticulture practices** as mentioned below:
-use vineyard management methods that minimize the use of pesticides and chemical fertilizers. Opt for organic and environmentally friendly solutions where possible.
-promote crop rotation and intercropping with certain related crops to prevent soil depletion.
-install efficient irrigation practices to save water and prevent run-off.
Conserve water resources:
-use irrigation systems that minimize water loss and avoid surface runoff.
-collect rainwater and use it for irrigation or other agricultural purposes.
Promote biodiversity:
-leave areas of natural vegetation around vineyards and hop fields to provide habitat for native flora and fauna.
-plant perennials, flowers and grasses to attract pollinators and increase biodiversity in the area.
Recycle and reduce waste:
-implement recycling and waste management programs to minimize environmental impact.
Participate in green certification projects:
-If possible, consider organic certification of vine or hop crops. This involves adhering to higher standards of environmental and sustainability practices.
Support research and innovation:
-get involved in research and innovation projects aimed at developing more sustainable practices in viticulture and hop growing.
Promote awareness:
-organize events or workshops for the local community to raise awareness of the importance of environmental conservation and sustainable practices in viticulture and hop production.
Work with environmental organizations:
-work with environmental organizations and local authorities to develop and implement environmental conservation strategies in your community.

By applying these practices and promoting sustainability in viticulture and hop production, you will contribute to protecting the environment and maintaining the sustainability of these important crops in Romania.

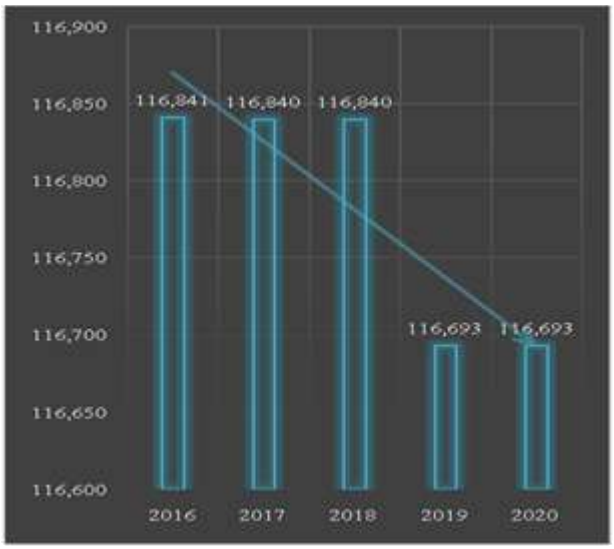

Fig. 6. Dynamics of the surfaces covered by orchards, nurseries, fruit bushes in Romania, 2016-2020 (ha)
Source: Own design based on the data from NIS, http://statistici.insse.ro [10].

Tree orchards, nurseries and fruit bushes are essential components of agriculture and gardens in Romania. These crops can benefit from sustainable practices and proper care to help protect the environment. Here's how you can help and make these crops more sustainable:

Use environmentally friendly management methods:

-avoid excessive use of pesticides and chemical fertilizers and opt for more environmentally friendly methods of plant protection.

-adopt weed and pest management practices that minimize environmental impact and reduce chemical use.

Efficient irrigation:

-use efficient irrigation systems that minimize water waste and help save water resources.

Respect crop rotation:

-promote crop rotation in orchards and gardens to prevent soil depletion and reduce the risk of diseases and pests.

Promote biodiversity:

-leave areas of natural vegetation or parts of the garden uncultivated to provide habitat for pollinators and other wildlife.

-plant flowers and plants that attract pollinators such as bees and butterflies.

Responsible waste management:

-implement recycling and waste management practices to minimize environmental impact.

Use organic fertilizers:

-organic fertilisers, such as compost, can improve soil quality and contribute to better soil fertility.

Restore degraded land:

-If you have degraded or eroded land in orchards or nurseries, implement restoration projects to restore them to their original condition.

Support research and education:

-get involved in research and education projects aimed at developing and promoting sustainable farming practices in your crops.

Collaborate with environmental organizations:

-collaborate with environmental and other local agricultural organizations to develop and implement conservation strategies in your garden and orchard.

By adopting sustainable practices in the management of tree orchards, nurseries and fruit bushes, you contribute to the protection of the environment and to the sustainability of these vital crops in Romania.
In order to provide an accurate picture of the application of soil conservation and soil erosion prevention measures in Romania in reality, it is important to consider the following aspects:

-Adoption of conservation measures: Romania has implemented a number of measures and programs for soil conservation, including subsidies for farmers who adopt conservation farming practices and for the rehabilitation of agricultural land affected by erosion.

-Infrastructure and construction projects: In certain areas of the country, earthworks and construction works are carried out to combat soil erosion, especially in mountainous areas.

-Pasture and meadow management: In mountain and rural areas, grassland and

pasture management practices are applied, including rotational grazing to prevent soil compaction.

Education and awareness raising programs: The existence of education and awareness programs on soil conservation and soil erosion prevention may vary from area to area.

However, the application and effectiveness of these measures can be uneven depending on the region and socio-economic factors. There are several challenges in implementing these measures in Romania:

-*Limited resources:* Some regions and communities may have limited resources to implement soil conservation practices and address erosion.

-*Limited awareness:* In some areas, farmers and local communities may not be sufficiently aware of the importance of soil conservation and sustainable practices.

-*Climate change:* Climate change may exacerbate soil erosion problems, making them more difficult to manage.

-*Infrastructure deficit:* In some cases, lack of adequate water management infrastructure can contribute to erosion.

In general, Romania has a legislative framework and agricultural policy aimed at soil conservation and prevention of soil degradation, but uniform and effective implementation may require additional efforts and resources in some areas. Awareness, education and continued support from authorities and communities can help to better implement these measures across the country. Climate change could influence the increase of the incidence of pests and pathogenic agents attack on agricultural crops, but it is still considered to have a minor role, the main drivers in the use of pesticides being agronomic, economic, environment reasons and social reasons [13].

Fig. 7. S.W.O.T. analysis on the impact of soil conservation and soil degradation prevention strategies in Romania
Source: authors' own conception.

Strategies for soil conservation and prevention of soil degradation in Romania are essential for maintaining agricultural sustainability and protecting the environment. However, there are challenges, such as limited resources and low awareness, that need to be addressed. Technology development and application, financial support and cooperation between stakeholders can help improve soil conservation practices in Romania.

CONCLUSIONS

Soil conservation and the prevention of soil degradation are crucial issues for maintaining the fertility of agricultural land and protecting the environment in Romania.

There are effective measures and strategies that can be applied to conserve soils and prevent soil erosion and degradation in the country.

These measures include the adoption of conservation agriculture, use of cover crops and mulch, water management, use of organic fertilizers, grassland and pasture management, reforestation, education and awareness, government policies and continuous monitoring of soil condition.

Recommendations:

It is important to continue education and awareness campaigns for farmers, communities and the general public on soil conservation practices and their importance. Conservation agriculture needs to be further promoted and supported through government programs, subsidies and technical support for farmers.

Soil condition monitoring systems, such as moisture sensors and remote sensing, would should be more widely implemented to help detect problems and assess the effectiveness of conservation strategies.

Scientific research and development of more effective soil conservation technologies and practices should continue to address new challenges and climate change.

Collaboration between environmental organizations, government and the agricultural sector is key to addressing soil issues and successfully implementing conservation strategies.

It is important that the government implements clear policies and effective laws that promote soil conservation practices and sanction harmful land use.

Romania's agricultural potential is still insufficiently exploited.

Monitoring soil condition and the results obtained by applying conservation strategies should be a continuous practice to ensure the maintenance of soil health in Romania.

Soil conservation is a vital component of sustainable development and environmental protection in Romania. Through effective implementation of conservation strategies and stakeholder involvement, the country can protect the essential resource of soil with a positive impact for future generations.

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