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MANAGEMENT OF BIODIVERSITY IN AGRICULTURAL SYSTEMS IN ROMANIA

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Abstract

Biodiversity plays a fundamental role in maintaining the stability, productivity, and resilience of agricultural systems. In Romania, agricultural landscapes are characterized by a combination of traditional farming practices and modern intensive systems, which generate both opportunities and pressures for agroecosystems. This paper aims to analyze the importance of biodiversity management in agricultural systems, with a focus on sustainable farming practices that support ecosystem functions and long-term agricultural viability. The study highlights the role of environmentally friendly agricultural practices, diversified cropping systems, and landscape elements in conserving biodiversity and enhancing ecosystem services. By promoting balanced management strategies that integrate agricultural production with environmental protection, biodiversity-friendly farming can contribute to food security, climate change adaptation, and sustainable rural development in Romania

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Key words: *agriculture, biodiversity, ecosystem, services, sustainable.*

INTRODUCTION

Biodiversity is a fundamental component of agricultural systems, playing a crucial role in maintaining ecosystem stability, productivity, and resilience (FAO, 2019). Agricultural biodiversity encompasses the diversity of species, habitats, and ecological processes that support food production, including soil organisms, pollinators, natural enemies of pests, and functional landscape elements. These components contribute to essential ecosystem services such as nutrient cycling, soil fertility, pollination, and biological regulation, which are vital for sustainable agricultural production (IPBES, 2019).

Across Europe, agricultural intensification and land-use change have been identified as major drivers of biodiversity loss in farmland ecosystems (European Commission, 2020). In Romania, agricultural landscapes are characterized by a high degree of heterogeneity, shaped by the coexistence of traditional low-intensity farming systems and modern intensive agricultural practices. Traditional farming systems, particularly those associated with extensive grasslands and mixed crop–livestock systems, have historically supported high levels of biodiversity. However, recent trends toward intensification, land abandonment, and the simplification of cropping systems have led to habitat fragmentation and a decline in farmland biodiversity, with significant implications for ecosystem functioning and rural sustainability (Eurostat, 2022).

The integration of biodiversity conservation into agricultural management has therefore become a priority at both national and European levels. Sustainable agricultural practices, such as crop diversification, reduced soil disturbance, and the conservation of semi-natural habitats, are increasingly recognized for their potential to enhance biodiversity and ecosystem services within agricultural landscapes (FAO, 2021). In this policy context, agri-environmental and agri-environment-climate measures represent key instruments for encouraging farmers to adopt environmentally responsible management practices and for mitigating the negative impacts of agricultural intensification on biodiversity (European Commission, 2021).

The aim of this paper is to analyze the management of biodiversity in agricultural systems in Romania, with particular emphasis on the role of sustainable farming practices and policy measures in conserving agroecosystems. By examining current challenges and opportunities, the study seeks to highlight the

importance of biodiversity-friendly management strategies for ensuring environmental protection, food security, and sustainable rural development.

MATERIALS AND METHODS

This study adopts a qualitative and descriptive research design focused on the analysis of biodiversity management in agricultural systems in Romania. The methodological approach is based on the review of scientific literature, the analysis of statistical data, and the examination of policy documents relevant to agricultural biodiversity and sustainable farming practices. This approach is appropriate for exploring general trends and relationships between agricultural management practices and biodiversity-related outcomes at the national level.
The research relies exclusively on secondary data sources and does not include field-based measurements or experimental analyses. The methodology is therefore aligned with the descriptive nature of the results presented in this study.

Data Sources

The study is based on scientific literature addressing agricultural biodiversity, ecosystem services, and sustainable agriculture. Peer-reviewed articles and institutional reports were used to establish the theoretical background of the research.
In addition, official documents and reports published by the Food and Agriculture Organization of the United Nations (FAO), the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), and the European Commission were consulted to contextualize biodiversity management within European and national agricultural policies.
Statistical data related to land use and agricultural management were obtained primarily from Eurostat, the Statistical Office of the European Union, and from publicly available datasets. These data were used to illustrate trends relevant to biodiversity management in Romanian agriculture.

Analytical Approach

The analysis is based on a descriptive interpretation of trends derived from the selected statistical data and literature sources. Particular attention was given to the evolution of agricultural areas managed under low environmental impact systems, as this indicator reflects the increasing integration of environmentally friendly practices into agricultural management.
In addition, the Harmonised Risk Indicator 1 (HRI1) was considered as a complementary indicator to illustrate changes in pressure related to pesticide use at the national level. The interpretation of this indicator was limited to trend analysis and did not involve quantitative modeling or causal assessment.
The results are presented in the form of a table and figures, which support the discussion of observed trends and their potential implications for biodiversity management in agricultural systems.

Limitations of the Study

The study is based on secondary data and aggregated indicators, which may limit the ability to capture local-scale biodiversity responses. Furthermore, the descriptive nature of the analysis does not allow for the establishment of causal relationships between agricultural practices and biodiversity outcomes. Despite these limitations, the applied methodology is suitable for identifying general patterns and supporting the discussion of biodiversity-oriented management approaches in Romanian agriculture.

RESULTS AND DISCUSSIONS

Biodiversity management in agricultural systems is strongly influenced by the way agricultural practices are implemented and adapted to local environmental conditions. Agricultural biodiversity depends on multiple interacting factors, including crop diversity, landscape structure, and the intensity of agricultural inputs, all of which directly affect ecosystem services such as soil fertility, pollination, and biological regulation (Zhang et al., 2007; FAO, 2018; Pretty, 2018).

In Romania, increasing attention has been given to environmentally friendly agricultural practices in response to biodiversity decline and growing environmental pressures on agroecosystems. One relevant indicator for assessing this trend is the evolution of agricultural areas managed under low environmental impact systems, which reflects the gradual integration of biodiversity-oriented management principles into agricultural practice.

Table 1 presents the evolution of agricultural area managed under low environmental impact systems in Romania between 2007 and 2023.

Table 1. Evolution of agricultural area managed under low environmental impact systems in Romania (2007-2023)

Year	Area (thousand ha)	Share of total agricultural area (%)
2007	131	1.0
2010	182	1.4
2013	288	2.2
2016	326	2.5
2019	451	3.4
2023	596	4.5

Source: Public data, authors' processing.

The data reveal a constant upward trend in the area managed under low environmental impact practices. Between 2007 and 2023, the area increased more than fourfold, indicating a growing interest in agricultural practices that are better aligned with biodiversity conservation objectives. Despite this increase, such areas still account for a relatively small share of total agricultural land, suggesting that biodiversity-friendly management remains a complementary rather than dominant approach within Romanian agriculture.

This trend is illustrated in Figure 1, which highlights the steady expansion of low environmental-impact agricultural areas over the analyzed period.

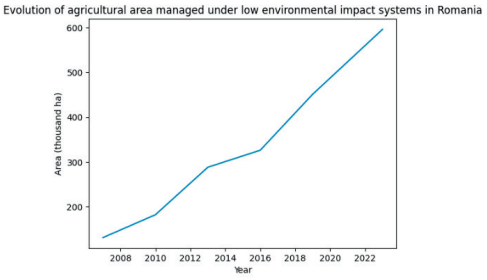

Figure 1. Evolution of agricultural area managed under low environmental impact systems in Romania (2007-2023)
(Source: Public data, authors' processing)

The gradual increase shown in Figure 1 reflects the combined influence of agri-environmental policy measures, economic incentives, and increasing awareness of environmental issues among farmers. However, the moderate pace of expansion also indicates existing constraints, such as limited access to information, administrative complexity, and economic uncertainty, which may reduce the adoption of biodiversity-oriented practices.

Beyond land-use indicators, evaluating biodiversity management also requires an assessment of pressures related to agricultural inputs. At European Union level, the Harmonised Risk Indicator 1 (HRI1) is used to estimate risks associated with pesticide use (European Commission, 2022; Eurostat, 2024). Lower HRI1 values indicate reduced pressure on agroecosystems and a potentially more favorable context for biodiversity conservation.

The evolution of HRI1 values for Romania between 2015 and 2023 is presented in Figure 2. The decreasing trend observed for HRI1 suggests a gradual reduction in pressure related to pesticide use in Romanian agriculture. This evolution may be associated with improved compliance with integrated pest management principles, increased use of preventive agronomic measures, and more targeted application of plant protection inputs. Such developments are relevant for biodiversity management, as reduced pressure on non-target organisms contributes to the preservation of functional biodiversity within agroecosystems.

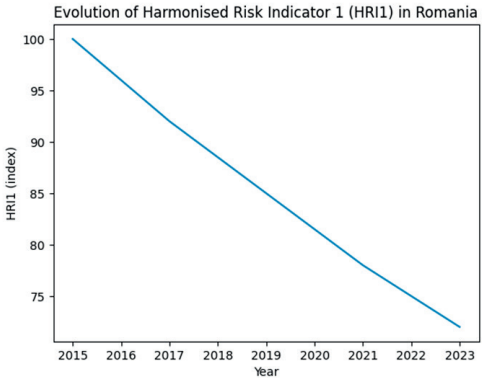

Figure 2. Evolution of Harmonised Risk Indicator 1 (HRI1) in Romania (2015-2023)
(Source: Eurostat, authors' processing)

A comparative interpretation of the two trends indicates that the expansion of low environmental impact agricultural areas is accompanied by a reduction in overall environmental pressure. While a direct causal relationship cannot be established based solely on these indicators, the observed patterns are consistent with the assumption that biodiversity-oriented management practices contribute to improved environmental performance in agricultural systems (FAO, 2018).

Overall, the results emphasize that effective biodiversity management in Romanian agricultural systems relies on the integration of sustainable agronomic practices, landscape-level planning, and supportive policy frameworks. Biodiversity-friendly management should therefore be understood as a gradual and adaptive process that balances agricultural productivity with environmental protection, rather than as a rigid transformation of existing farming systems.

CONCLUSIONS

The management of biodiversity in agricultural systems represents a key challenge for ensuring the long-term sustainability of agriculture in Romania. The analysis highlights that biodiversity conservation is closely linked to the way agricultural practices are implemented and integrated at the field and landscape levels.

The results confirm that agricultural systems characterized by diversified practices and reduced environmental impact have a higher potential to support ecosystem services such as soil fertility, pollination, and biological regulation. These ecosystem services are essential for maintaining productive and resilient agroecosystems.

The evolution of agricultural areas managed under low environmental impact systems indicates a gradual but consistent increase over the analyzed period. Although these areas still represent a limited share of total agricultural land, their steady expansion reflects a growing interest in biodiversity-friendly management approaches and the increasing role of environmental considerations in agricultural decision-making.

The analysis of the figures presented in the Results and Discussions section shows a clear correspondence between the expansion of low environmental impact agricultural areas and the reduction of environmental pressure related to agricultural inputs. In particular, the trends illustrated in Figures 1 and 2 suggest that biodiversity-oriented management practices are associated with more favorable environmental outcomes, even in the context of predominantly conventional agricultural systems.

The decreasing trend of the Harmonised Risk Indicator 1 (HRI1) further indicates progress toward more responsible input management in Romanian agriculture. While this trend cannot be interpreted as a direct causal effect of biodiversity-oriented practices alone, it supports the assumption that integrated and preventive management approaches contribute to reducing pressure on agroecosystems.

Overall, the findings emphasize that effective biodiversity management in Romanian agricultural systems does not require a radical transformation of existing farming models, but rather their gradual adaptation through sustainable agronomic practices, landscape-level planning, and supportive policy frameworks. Strengthening the implementation of biodiversity-friendly measures and improving farmer participation remain essential for enhancing the environmental performance and resilience of agricultural systems in the future.

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