ECOSYSTEM APPROACH TO LAND MANAGEMENT

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Abstract

This study examines the environmental aspects of land management, with a focus on sustainable land use, environmental risk reduction and regional development strategies. The paper emphasizes the importance of integrating environmental, economic and social principles into territorial management and emphasizes the need for innovative approaches to preserve land resources for future generations. Particular attention is paid to the impact of urbanization, industrialization and intensive agriculture on land degradation and practical recommendations for sustainable practices are provided.

Located near Kharkiv, the Pisochyn territorial community has unique opportunities for economic integration while addressing environmental challenges. The strategic suburban location creates conditions for a balance between industrial growth, agricultural production and environmental preservation. The study highlights the potential of developing industrial parks, logistics infrastructure and sustainable agricultural practices to stimulate economic growth without harming the environment.

Key strategies include attracting enterprises from Kharkiv to set up local branches, supporting small and medium-sized businesses and developing a transport and logistics network. Agricultural initiatives focus on peri-urban farming to meet urban demand, including vegetable, dairy and floriculture production. This integrated approach is aimed at creating a sustainable model of regional development that integrates industrial, agricultural and environmental goals.

***Keywords**:* territorial community, spatial development, land management, urbanization, ecosystem approach, sustainable development.

Introduction

Sustainable development is increasingly recognized as a global priority, with land resources playing a pivotal role in achieving environmental balance, food security, and socio-economic resilience. Land supports essential ecosystem services such as water regulation, carbon sequestration, biodiversity conservation, and agricultural productivity. However, anthropogenic pressures including climate change, rapid urbanization, and unsustainable land exploitation have significantly disrupted land systems worldwide.

Climate change contributes to shifts in precipitation patterns, more frequent and severe weather events, and degradation of soil fertility, all of which undermine land productivity. Urban expansion leads to the conversion of agricultural and natural landscapes into built environments, increasing environmental stress and fragmenting habitats. Moreover, intensive farming and industrial activities result in soil depletion, contamination, and loss of ecosystem integrity (Lavrov et. al., 2021; Shevchenko et. al., 2020).

Given these growing threats, traditional land management models, which often prioritize short-term economic gains over environmental stability, are no longer sufficient. There is an urgent need to adopt an ecosystem approach to land management a holistic and adaptive framework that integrates ecological principles into territorial governance and spatial planning.

The ecosystem approach promotes:

- Preservation of ecosystem services by supporting natural processes such as nutrient cycling, water filtration, and climate regulation.
- Sustainable land use that balances economic development with ecological sustainability in agriculture, urbanization, and industrial sectors.
- Climate adaptation and mitigation through afforestation, erosion control, and resilient land use practices.
- Technological innovation, particularly the use of geospatial tools (GIS), remote sensing, and data-driven decision-making (Environmental Monitoring ...2023; FAO, 2021)

This paradigm shift is echoed in key international agreements and initiatives, such as the Paris Climate Agreement (UNFCCC, 2015) , the European Green Deal (European Commission, 2019) and the UN's Land Degradation Neutrality Initiative (United Nations Convention …, 2020), which underscore the strategic importance of land resource protection at all governance levels.

In Ukraine, this approach is gaining traction amid increasing ecological challenges. National and regional authorities are gradually transitioning from intensive land exploitation to more balanced strategies focused on restoration, monitoring, and sustainable (Environmental Monitoring..., 2023, Methodological Guidelines for Comprehensive…, 2022). As such, there is a need for in-depth local case studies to illustrate how these global and national frameworks are implemented in practice.

This paper presents an analysis of the Pisochyn territorial community in the Kharkiv region as a model for applying the ecosystem approach in a peri-urban setting. The study assesses the current state of land use, identifies critical environmental and spatial development issues, and formulates strategic recommendations for sustainable territorial management.

Research object and methods

The object of this study is the land resources of the Pisochyn territorial community in the Kharkiv region—an area characterized by dynamic urban development, agricultural activity, and increasing ecological pressures. This community provides a relevant case for assessing how the ecosystem approach can be applied in practice to achieve balanced spatial development.

In accordance with the research aim and objectives, the study employs a set of interdisciplinary research methods designed to assess land use structure, identify sustainability challenges, and formulate strategic land management recommendations:

- Analytical method – used to evaluate the spatial distribution and functional composition of land resources, including comparative analysis of land categories and their environmental significance.
- Monographic method – applied for an in-depth examination of existing land management practices in Pisochyn and their alignment with sustainable development goals.
- Abstract and logical method – enabled the conceptualization of ecosystem-based strategies, identifying interdependencies between land use types, ecological risks, and socio-economic development.

These methods were chosen to provide both descriptive insight and strategic foresight, allowing for a comprehensive understanding of the land use system and the formulation of actionable recommendations.

A key component of the analysis involved quantifying land use by category to evaluate how land resources are currently allocated and what implications this has for future sustainability. Table 1 summarizes the land use structure of the Pisochyn territorial community as of January 1, 2025.

Table 1. Land use structure of the Pisochyn territorial community of Kharkiv region, as of 01.01.2025

Land category	Area, hectares	Share of total area, %
Agricultural land	3802.94	48.16
including: arable land	2555.44	32.36
including: hayfields	123.94	1.57
including: pastures	390.88	4.95
including : perennial plantations	732.67	9.28
Forests and forested areas	1305.26	16.53
Built-up areas	2618.43	33.16
Water	109.32	1.38
Swamps	14.69	0.19
Other territories	45.12	0.57
Total	7895.75	100.00

The table reveals that agricultural land constitutes nearly half of the total area (48.16%), with arable land making up the largest portion. Built-up areas account for 33.16%, indicating a significant level of urbanization. The remaining land includes forests (16.53%), water bodies, swamps, and miscellaneous zones (Kuzmenko, 2022).

Such a distribution reflects both development potential and ecological risk. For instance, a high proportion of plowed land contributes to soil erosion and biodiversity loss. Meanwhile, forested zones play a vital role in maintaining ecological balance, offering opportunities for carbon sequestration and landscape protection.

This spatial diagnosis provides the empirical foundation for assessing land use pressures and defining sustainable management strategies tailored to the environmental, social, and economic realities of the Pisochyn community.

Research results and discussion

The Pisochyn territorial community, situated along major international transport corridors, possesses a number of strategic advantages: strong connectivity to national and cross-border markets, favorable geography for industrial growth, and proximity to the large urban center of Kharkiv. These factors create fertile ground for industrial zones, logistics hubs, and agricultural integration, attracting investment and driving local entrepreneurship.

However, the rapid socio-economic transformation of Pisochyn has also brought significant challenges. The area is experiencing accelerated urbanization, leading to the overdevelopment of land, pressure on natural systems, and gradual loss of ecological stability. Despite opportunities for sustainable development, no comprehensive strategy has been fully implemented to manage land use in an ecologically balanced way problem statement.

The central problem addressed in this study is the lack of an integrated ecosystem-based land management framework in the Pisochyn territorial community. While urban, industrial, and agricultural growth continues, insufficient attention is being paid to the long-term environmental consequences, such as soil degradation, biodiversity loss, and imbalance in spatial land allocation. The current model of development favors economic priorities, often at the cost of ecological resilience.

Causes and Consequences of the Identified Problem

Several underlying factors contribute to this imbalance:

- Unregulated urban sprawl, which has led to the rapid conversion of agricultural and forested lands into built-up areas.
- High intensity of land exploitation without systematic measures to restore or protect ecosystems.
- Lack of protected areas and insufficient ecological zoning that could mitigate human impact.
- Fragmentation of green infrastructure, including disrupted forest belts and absence of landscape buffering functions.

The consequences are already visible:

- Decline in soil quality, particularly due to erosion and nutrient depletion from over-ploughing.
- Increased air and water pollution in zones adjacent to industrial operations.
- Pressure on biodiversity and loss of natural habitats, threatening ecosystem functionality and regional sustainability.

Recreational and Spatial Potential Analysis

Despite these issues, Pisochyn holds high potential in both economic and recreational domains. The territory includes valuable assets such as the cardiology sanatorium "Roshcha" and sources of siliceous mineral waters in Rai-Olenivka, which can be revitalized for sustainable recreational tourism. This sector, if developed responsibly, could help diversify the economy and reduce pressure on overused land areas.

Forecasting Spatial Development

Data on projected construction and land allocation (Table 2) shows a growing demand for industrial and transport infrastructure, with long-term plans involving the development of air transport facilities and logistics centers. Simultaneously, Table 3 indicates a planned expansion of recreational facilities—especially after 2030—demonstrating interest in non-industrial land use diversification.

Table 2. Project production areas of Pisochyn territorial community in Kharkiv region, hectares

Territories	Total future construction	Including for:		
		short-term period (up to 5 years)	medium-term period (6-10 years)	long-term perspective (over 10 years)
Industrial enterprises	287.34	258.01	9.52	19.00
Engineering and cultural development	2.83	0.97	1.05	0.81
Transport and warehouse development	126.56	94.20	4.34	28.01
Road transport	0.21	0.21	0.00	0.00
Air transport	253.04	0.00	0.00	253.04
Transport companies	8.92	0.71	8.20	0.00
Logistics centers, warehouses and bases	69.75	20.63	21.46	27.65
Vehicle service establishments	9.82	9.82	0.00	0.00
Location of agricultural buildings and yards	20.55	11.63	6.44	2.48
Total	779.02	396.18	51.01	330.99

Table 3. Perspectives for the development of tourist and recreational facilities in the territory of the Pisochyn territorial community of the Kharkiv region

	Recreational facilities (thousand units)			
	currently	for the short term (up to 5 years) by the beginning of 2030	for the medium term (5-10 years) by the beginning of 2035	for the long-term perspective (over 10 years) after 2035
village of Pisochyn	0.3	0.55	1.65	1.9
village of Berezivka	-	-	0.52	1.92
village of Rai-Olenivka	-	0.2	0.4	0.8
village of Stara Moskovka	-	-	0.28	0.28
outside settlements	-	-	1.48	1.48
Total in the community	0.3	0.75	4.33	6.38

Strategic Response Through the Ecosystem Approach

To resolve the identified land management problem, this study recommends the adoption of an ecosystem approach, which aligns environmental protection with economic planning. Key measures include:

- Establishing ecological buffer zones and restoring forest belts to regulate climate and reduce erosion.
- Designating protected areas to conserve biodiversity and create landscape resilience.
- Integrating GIS and remote sensing into land monitoring and planning processes.
- Introducing precision agriculture to increase productivity while reducing land exhaustion.

By shifting from reactive land regulation to proactive ecosystem management, the community can mitigate current risks and guide its development toward sustainability.

Long-Term Vision and Strategic Goals

The Pisochyn territorial community has the potential to become a smart, environmentally sustainable locality with integrated transport, green infrastructure, and inclusive public services. To achieve this, the following strategic goals are proposed:

- Goal 1: Sustainable Economic Development Focus on attracting green investment, strengthening local budgets, and supporting eco-conscious small businesses.
- Goal 2: Social Well-being and Resilient Urbanization Ensure safety, comfort, and accessibility through SMART services, transparent spatial planning, and inclusive public spaces.
- Goal 3: Educational, Medical, and Cultural Advancement Invest in high-quality human capital infrastructure and cultural identity to foster long-term social cohesion.

This strategic direction, grounded in SWOT, TOWS, and sectoral analysis, offers a roadmap for aligning community needs with environmental constraints, setting the stage for a balanced and future-oriented spatial policy.

Conclusions

This study addressed the pressing issue of sustainable land management in the Pisochyn territorial community, with a focus on applying an ecosystem approach to balance environmental, economic, and social priorities in spatial development.

Based on the outlined research aim and objectives, the following conclusions have been drawn:

Objective 1: To assess the land use distribution and environmental condition of the Pisochyn community.

- The spatial structure of the community is dominated by agricultural land (48.16%) and built-up areas (33.16%), with significant urban pressure on arable soils and forested ecosystems. This pattern indicates an urgent need to reassess land allocation to maintain ecological functions and prevent degradation.

Objective 2: To identify and analyze the key ecological and socio-economic challenges facing the region.

- The key challenges include unregulated urban expansion, decline in soil fertility, reduced biodiversity, and the absence of ecological zoning. These trends threaten long-term sustainability and require strategic intervention based on spatial diagnostics and environmental risk assessment.

Objective 3: To propose strategic recommendations for land management based on the ecosystem approach.

- The research recommends adopting a comprehensive ecosystem approach, including:
  - Rationalization of land use through functional zoning and precision agriculture;
  - Creation of ecological buffer zones and restoration of forest belts;
  - Implementation of GIS-based monitoring for land-use changes;
  - Promotion of environmentally friendly agricultural technologies.

These measures align land productivity with ecological restoration and build resilience to future environmental stressors.

Objective 4: To evaluate the potential of recreational, industrial, and agricultural development under sustainability constraints.

- The community has clear development potential in recreational tourism and green industry. Strategic priorities include:
  - Development of industrial parks and logistics infrastructure;
  - Investment in medical, educational, and public service facilities;
  - Revitalization of mineral water-based sanatoria and natural recreation zones;
  - Smart spatial planning that integrates environmental values into economic expansion.

Final Statement. The integration of ecosystem principles into the planning and management of the Pisochyn territorial community represents a viable pathway toward balanced, climate-resilient, and inclusive regional development. The proposed measures foster long-term environmental sustainability while enhancing socio-economic opportunities for local residents. The study contributes to the growing body of evidence supporting localized implementation of the ecosystem approach within Ukraine's territorial planning framework.

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