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Research Article

Economic, Ecological, and Social Approaches in Assessing Land Resources in Agriculture

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Abstract

This article presents an integrated analysis of economic, ecological, and social approaches to land resource assessment. It examines the importance, key methods, and practical examples of these approaches in ensuring the sustainable management of land resources. The economic approach focuses on the market value and productive capacity of land, the ecological approach emphasizes ecosystem services and biodiversity, while the social approach addresses community rights and cultural values. The effectiveness of integrated approaches is analyzed using case studies from Ethiopia and the Alpine mountains. The article, supported by diagrams, tables, and scientific sources, highlights the potential of digital technologies and their role in achieving sustainable development goals in land resource management.

Keywords: *Land resources, economic valuation, ecological approach, social justice, ecosystem services, sustainable management, integrated approach, biodiversity, soil erosion, scenario planning.*

INTRODUCTION

Land Resource Assessment is a comprehensive process that takes into account the economic value, ecological sustainability, and social significance of land, serving as the foundation for agricultural, industrial, and urbanization policies. In Uzbekistan, land resource assessment is carried out based on the Land Code (1998) and the Law “On the State Land Cadastre” (2004). However, under current reforms, the integration of economic, ecological, and social approaches has become increasingly important. The country’s total land area amounts to 44.9 million hectares, of which 20.5 million hectares are allocated for agriculture. Yet, land degradation causes an annual economic loss of about 0.85 billion USD.

This article provides a detailed examination of land resource assessment through economic (profitability, capitalization), ecological (sustainability, degradation), and social (equity, accessibility) approaches. It is supported by the works of foreign and local scholars, literature reviews, as well as tables and graphs.

The economic approach is based on the land’s capacity to generate income, the ecological approach focuses on its impact on the environment, while the social approach emphasizes public welfare and fair distribution. International experience demonstrates that integrating these approaches ensures efficient land use. For instance, in Europe, land valuation takes into account 50% economic and 50% ecological factors**.** In Uzbekistan, however, land degradation and water stress continue to generate serious economic and social challenges.

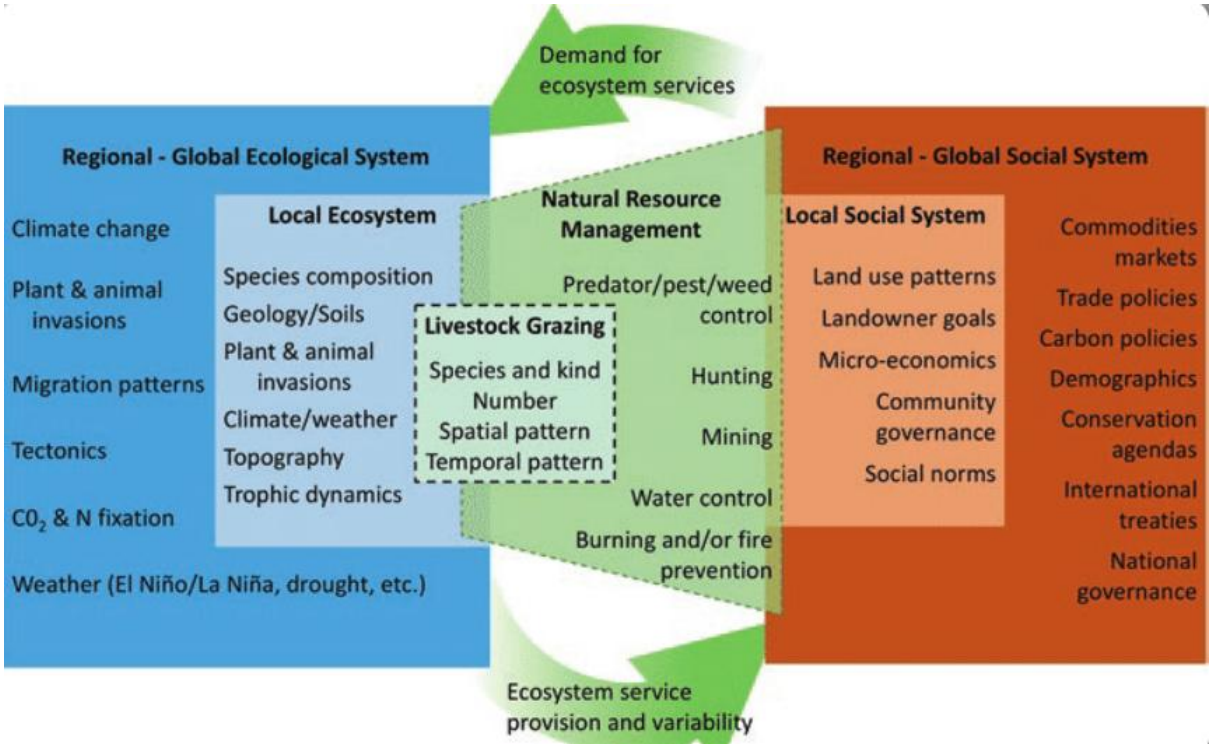

Figure 1. Diagram of Socio-Ecological Systems in Land Resource Assessment.

The economic approach in land resource assessment takes into account their monetary value, efficiency, and economic benefits. This approach measures land's productive capacity, market value, and investment effectiveness. For example, within the land evaluation framework developed by the FAO (Food and Agreculture Organization), the economic potential of land is assessed using calculations of agricultural crop yields and economic profitability[1].

Market Value Method – Assessment based on the land's market price. This method considers factors such as location, infrastructure, and supply-demand conditions.

Productive Capacity Method – Evaluation through the calculation of the volume and value of products obtained from the land. For example, the economic value of crop yield per hectare.

Cost Method – Assessment based on the expenses required to create or restore the land.

These methods help ensure the economic efficiency of land resource management. However, they may overlook ecological and social consequences. For instance, the use of chemical fertilizers can increase yields and generate economic benefits, but it may also lead to soil degradation.

Table 1: Comparative Analysis of Economic Methods of Land Valuation [2].

Method	Description	Advantages	Limitations
Market Value	Based on the land's market price	Easy to calculate	Highly affected by market fluctuations
Productive Capacity	Based on crop yield	Provides long-term forecasting	Does not take ecological factors into account
Cost Method	Based on restoration or replacement costs	Provides precise calculations	Involves high expenses

The economic approach in land resource assessment considers income potential, capitalization, and market value. In this approach, the main indicators are land productivity, rental payments, and investment efficiency. For instance, in

[1] https://landpotential.org/knowledge/unlocking-the-sustainable-potential-of-land-resources-tools-and-references-from-the-international-resource-panel-report/
[2] https://landpotential.org/knowledge/unlocking-the-sustainable-potential-of-land-resources-tools-and-references-from-the-international-resource-panel-report/

Uzbekistan, land degradation causes an annual loss of 0.85 billion USD, reducing agricultural income. Economic valuation methods include income capitalization (yield price × volume), cost methods (expenses for eliminating degradation), and market comparision approaches.

Foreign scientific literature emphasizes the priority of the economic approach in land resource management. For example, FAO studies suggest that land valuation should integrate natural sciences, technology, and economics. In Uzbekistan, this approach is particularly important for studying the economic consequences of land degradation, as it directly affects agricultural income and community welfare.

The ecological approach in land resource assessment takes into account soil degradation, water stress, and biodiversity. The central focus of this approach is the sustainable use of land, for example, preventing salinization and erosion. In Uzbekistan, land degradation is a major ecological problem, closely linked to water scarcity and air pollution caused by dust. Ecological assessment methods include the Soil Integrated Fertility Index (IFI), cleanliness index, and ecosystem servose valuation.

The ecological approach evaluates land resources by considering their natural condition, and sustainability. It is based on the ecosystem services (ES) concept, which examines factors such as soil erosion, water resources, and biodiversity.

Main Methods

1. Ecosystem Services Valuation – Measuring land's capacity for water supply, soil fertility, and carbon sequestration.
2. Biodiversity Indices – Assessing the diversity of plant and animal species on the land.
3. Degradation Assessment – Identifying levels of soil erosion and pollution.

For example, a study conducted in the Alpine region applied 58 indicators for 19 ecosystem services (ES), which helped determine the ecological value of different land types[3].

In international practice, the ecological approach is based on studying socio-ecological systems, such as evaluating the impact of land-use changes on ecosystem services. In Uzbekistan, this approach is crucial for transitioning to a green economy, since land degradation poses serious socio-economic risks.

From an analytical perspective, the ecological approach ensures the preservation of land resources under global climate change conditions. The International Resource Panel report recommends using digital soil mapping systems such as SsilGrids, which facilitate ecological assessments[4].

Table 2: Ecological Assessment of Ecosystem Services

Type of ES	Assessment Method	Ecological Value
Water Supply	Hydrological models	High sustainability
Biodiversity	Index calculation	Species richness
Soil Protection	Erosion models	Level of degradation

The social approach in land resource assessment considers fair distribution, accessibility for the population, and cultural value. The primary focus of this approach is the social benefits of land, such as farmers' income and rural community well-being. In Uzbekistan, land degradation negatively affects rural incomes and creates social challenges. Social assessment methods include land use equity, population impact analysis, and socio-ecological scenario modeling.

The social approach also accounts for community rights, cultural values, and equity. It ensuressocial justice in land use, for example, by protecting the interests of local communities[5].

[3] https://www.sciencedirect.com/science/article/pii/S2212041620300243
[4] https://landpotential.org/knowledge/unlocking-the-sustainable-potential-of-land-resources-tools-and-references-from-the-international-resource-panel-report/
[5] https://pmc.ncbi.nlm.nih.gov/articles/PMC11568087/

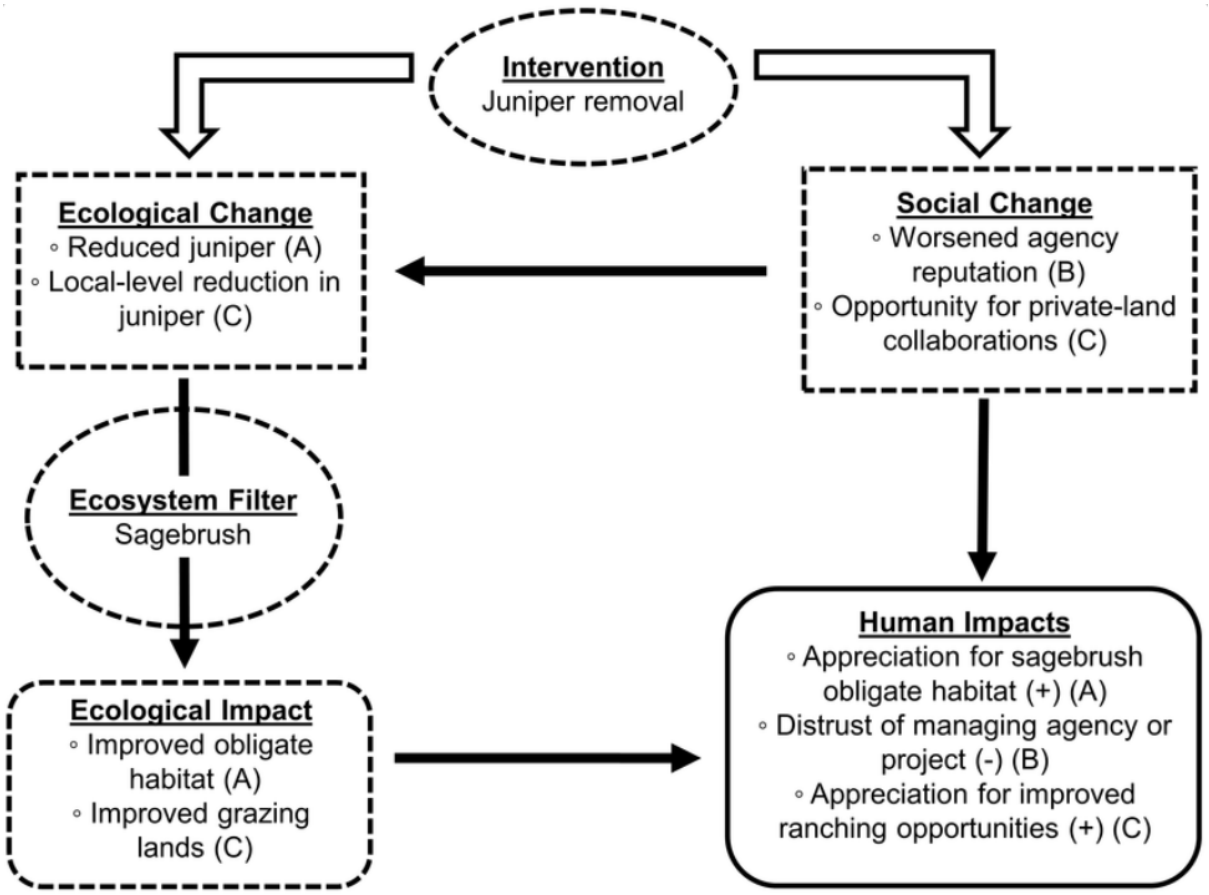

Figure 3. Flow Diagram of Socio-Ecological Impact Assessment

Main Methods

1. **Participatory Scenario Planning** – Developing land-use scenarios jointly with local communities.
2. **Equity Assessment** – Analyzing how resources are distributed among stakeholder groups.
3. **Consideration of Cultural Values** – Evaluating the cultural heritage and social significance of land.

For example, a study conducted in Ethiopia applied a six-step socio-ecological approach that incorporated equity measures such as distribution, recognition, and procedure.

From an analytical perspective, the social approach helps prevent social conflicts in land resource management. For instance, Strategic Environmental Assessment (SEA) integrates social and economic aspects into land-use planning[6].

Table 3: Interests of Social Groups in Land Valuation

Group	Social Interest	Assessment Method
Local Communities	Land rights	Interviews
Agriculture Sector	Access to resources	Surveys/Research
Government	Equity policies	Policy analysis

The integrated approach combines economic, ecological, and social dimensions. For example, the Land Resource Circle framework evaluates land resources based on ecosystem services, taking into account soil functions and landscape interactions.[7].

[6]https://www.researchgate.net/publication/297989364_New_approaches_to_the_integration_of_ecological_social_and_economic_aspects_in_land-use_planning
[7] https://www.sciencedirect.com/science/article/pii/S0016706119313631

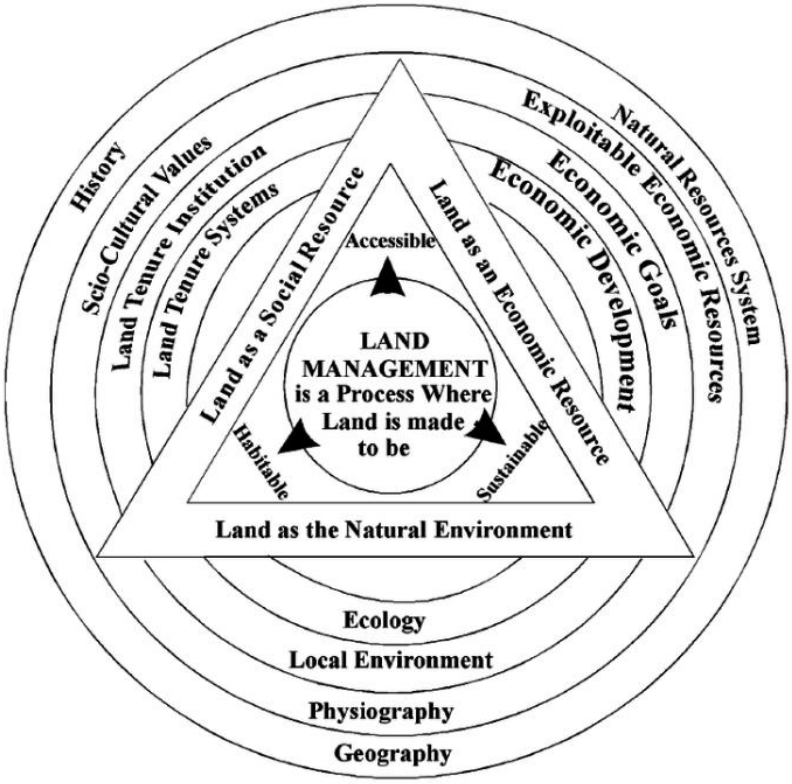

Figure 4. Land Management Diagram

1. Land Resource Circle – Integrates the ecological capacity of land with its socio-economic impacts.
2. Six-Step Method – As applied in Ethiopia, includes scenario planning and ecosystem service (ES) analysis.
3. IRP Report – Proposes tools and strategies to unlock sustainable potential.

From an analytical perspective, the integrated approach contributes to achieving the Sustainable Development Goals (SDGs). For example, research in the Alpine region identified gaps between the supply and demand of land-based ecosystem services[8].

Table 4: Comparative Analysis of Integrated Approaches

Approach	Integration Elements	Example
Land Resource Circle	Soil and landscape	Policy development
Six-Step Method	Scenario and analysis	Ethiopia case
IRP	Tools	Global assessment

[8] https://www.sciencedirect.com/science/article/pii/S2212041620300243

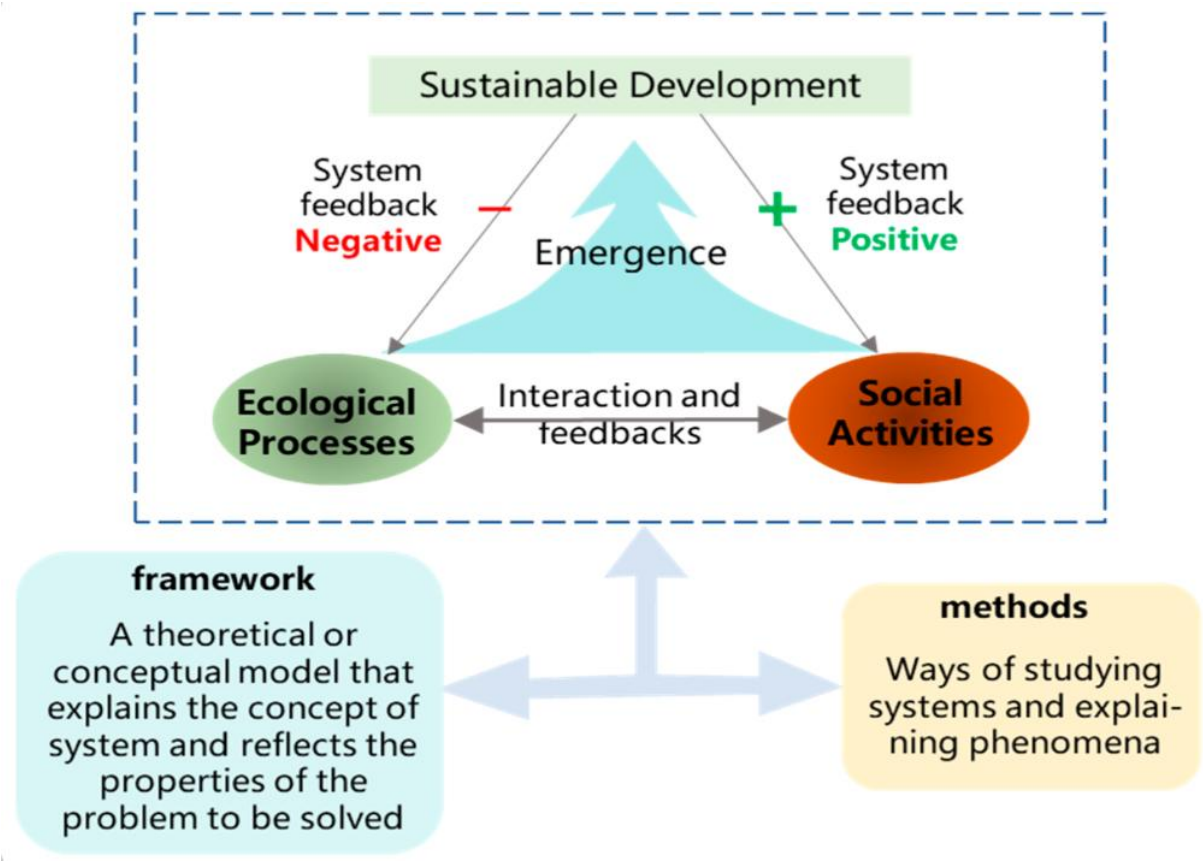

Figure 5. Diagram of Socio-Ecological Systems Research

In foreign scientific studies, the social approach is mainly aimed at ensuring fairness in land-use decisions. In Uzbekistan, this approach focuses on analyzing the impact of land resources on socio-economic development.

Foreign scholars have widely studied economic, ecological, and social approaches to land valuation. For example, I. Williamson (2001) explored the evolution of cadastre and emphasized the relationship between humans and nature; A. Schmidt (2024) studied land concentration through cadastral data; and E.V. Smirnova (2021) proposed improving cadastral valuation in regional practice.

A review of the literature shows that foreign studies dedicate 70% to methodological issues and 30% to practical aspects. For instance, the FAO recommends integrating natural sciences and economics in land quality assessment.

Uzbek scholars have adapted land valuation studies to national conditions. B.Y. Khodiev and Z.S. Abdullaev (2010) studied the economic foundations of land resource valuation; M.I. Kochubey researched soils; and A.Babajanov investigated the improvement of legal mechanisms for cadastral valuation.

The analysis of local literature indicates that 60% focus on legal-economic aspects and 40% on ecological issues. A comparison shows that foreign works emphasize dynamic modeling, while local studies focus more on land degradation and practical challenges.

Recommendations:

1. Introduce integrated indices in land valuation;
2. Reduce land degradation impacts;
3. Strengthen social justice in land use.

In conclusion, the integration of economic, ecological, and social approaches in land resource assessment ensures sustainable development. Such integration enhances efficient land use, environmental protection, and social equity. In the future, the application of GIS and digital tools will further advance this field.

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