Current Status Of Rainfed Land Use In The Republic Of Uzbekistan

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ABSTRACT

This article analyzes the current state of rainfed land use in the Republic of Uzbekistan, including the regional distribution of rainfed areas, soil bonitet scores, the degree of land degradation, and their economic efficiency. The study employs statistical data, cartographic analysis, and economic valuation methods based on normative land value. The results show that the efficiency of rainfed land use remains insufficient, with declining soil productivity and a high risk of erosion. The article concludes with recommendations for ensuring sustainable use of rainfed land resources.

Keywords: rainfed lands, land resources, bonitet score, erosion, normative valuation, agriculture of Uzbekistan.

Introduction. Rainfed lands constitute an essential part of the land fund of the Republic of Uzbekistan and are regarded as strategic resources that contribute significantly to the stability of the national agricultural sector. These lands are mainly located in foothill, piedmont and dry steppe zones, where annual precipitation ranges between 200–350 mm. The sharply continental climate, moisture scarcity during the growing season, low organic matter content in soils, and irregular topography make crop production in these areas highly challenging.

Despite these limitations, crops such as wheat, barley, peas, flax, sainfoin, and pistachio are widely grown in rainfed zones and play a significant role in meeting domestic agricultural demand.

Over the past decade, global climate change, irregular precipitation patterns, and increasing frequency of droughts have had negative impacts on rainfed farming systems. Studies indicate that droughts observed between 2010 and 2023 have caused yield reductions of up to 30–60% in rainfed areas of Uzbekistan. In addition, improper agricultural practices - inefficient plowing, insufficient soil loosening, burning of crop residues, and limited use of organic fertilizers - further exacerbate soil degradation. One of the most severe processes affecting rainfed areas is wind and water erosion. In some regions, 40–60% of rainfed lands are subject to erosion. The removal of fertile soil layers results in lower bonitet scores, yield instability, and reduced economic value of land. For instance, in several regions, bonitet scores of rainfed lands have decreased by an average of 5 - 7 points over the past 20 - 25 years, posing long-term risks for sustainable agricultural production.

Recent agrarian reforms in Uzbekistan - including land inventory, standardization of agro - technical measures, introduction of water-saving technologies, and the development of the national strategy to combat land degradation - have increased the importance of rainfed land management. Moreover, international organizations such as FAO, ICARDA, and GIZ are implementing projects aimed at promoting resource-efficient technologies in rainfed zones. However, practical evidence shows that the productive potential of rainfed areas is still not fully utilized. Assessing the efficiency of rainfed land

use requires evaluation of natural-climatic conditions, soil bonitet scores, soil structure, erosion severity, application of agro-technical measures, and the economic valuation of land. A comprehensive analysis at the farm level provides insights not only into current usage but also the rehabilitative potential of these lands. The widening gap between land productivity and normative land value indicates systemic problems in rainfed land management. Therefore, conducting a detailed scientific analysis of the current condition of rainfed lands in Uzbekistan, assessing their degradation level, evaluating their economic performance, and developing recommendations for sustainable use is an essential scientific and practical task. This study aims to address these issues by analyzing regional characteristics of rainfed land use, agro-economic indicators, and land valuation based on normative standards.

Materials and Methods. This study was conducted to assess the current status of rainfed land use in the Republic of Uzbekistan. The analysis was based on official statistical data, land cadastre indicators, and cartographic materials. Initial data were obtained from the Statistics Agency of Uzbekistan, the Ministry of Agriculture, and the Land Cadastre system. These data were processed to determine the total area of rainfed lands, bonitet scores, crop structure, and yield indicators at the farm level. All indicators were organized into comparable statistical formats by regions.

A key component of the study involved determining the economic value of rainfed lands using the normative valuation method. For each farm, the normative value of 1 hectare of land was multiplied by the total area of rainfed land under its management. Farms with higher bonitet scores showed higher normative land values, while farms with lower bonitet scores revealed lower economic valuation. This enabled the assessment of the relationship between soil quality and economic efficiency.

Another important part of the research was the application of GIS-based cartographic analysis. Using GIS technologies, spatial data on the distribution of rainfed lands, topographic characteristics, slope gradients, and land cover were processed. Based on this analysis, areas with high erosion risk were identified. The results also enabled the identification of regions with severe degradation and regions where land quality remains relatively stable. Slope steepness, soil depth, and vegetation cover were found to be major factors influencing erosion processes.

The combination of statistical, economic, and cartographic data provided a comprehensive assessment of the current condition of rainfed lands in Uzbekistan, forming a reliable basis for drawing scientific conclusions on land quality, degradation level, and economic efficiency.

Results and Discussion. The results show significant regional variation in the condition of rainfed lands in Uzbekistan. Statistical analysis indicates that although some regions possess large areas of rainfed land, their low bonitet scores correspond to lower crop yields. In contrast, districts with relatively high bonitet scores demonstrated more stable yields due to more favorable natural conditions. This confirms the direct relationship between soil quality and economic efficiency.

Normative valuation analysis revealed that farms with higher bonitet scores have proportionally higher total land value. In some farms, even average bonitet scores resulted in high total value due to large land area. However, in many regions, low bonitet scores led to low land valuation regardless of land area, indicating the decisive role of soil quality and erosion level in economic assessment.

GIS analysis showed that the degradation level of rainfed lands varies depending on natural-geographical conditions. Stronger erosion was observed in foothill and piedmont areas with steep slopes. These areas showed medium to severe erosion risk, causing a gradual reduction in bonitet scores. In low-slope plains, erosion risk was relatively lower, ensuring more stable long-term land productivity.

Increased erosion has direct negative effects on crop yields. Due to soil loss, reduced vegetation cover, and decreased moisture retention capacity, yields of wheat, barley, and other crops in highly eroded areas were 15–30% lower than in low-erosion areas. This confirms the need for urgent soil conservation measures in erosion-prone regions.

Overall, the findings show that a significant portion of Uzbekistan's rainfed lands require improved agro-technical, meliorative, and soil conservation measures. Differences between natural soil quality and economic valuation highlight the need for a comprehensive approach to managing rainfed farming systems. The identification of high-risk zones through GIS analysis emphasizes the importance of taking erosion-control measures such as contour plowing, organic fertilization, planting perennial crops, establishing windbreaks, and implementing water-retention technologies.

The study suggests that enhancing the efficiency of rainfed agriculture in Uzbekistan requires the introduction of modern agro-technologies, strengthening environmental sustainability, and translating scientific recommendations into practice. These results are valuable for regional planning and rational land resource management.

Conclusion and Recommendations. The study demonstrates that the condition of rainfed lands in Uzbekistan varies significantly due to regional, ecological, and economic factors. Low bonitet scores, intensified erosion, and moisture deficits hinder stable crop yields. Normative valuation results confirm that the economic value of rainfed land is closely linked to its natural productivity and total land area. GIS analysis shows that erosion risk is particularly high in foothill and piedmont zones. To ensure sustainable use of rainfed lands, the following measures are recommended:

- Strengthen erosion-control practices such as contour plowing, optimized crop arrangement, perennial vegetation planting, and establishment of protective forest belts.
- Increase organic and mineral fertilization, including the use of compost, manure, green manure, and crop residue incorporation.
- Introduce moisture-saving agro-technologies, including mulching, minimum tillage, and moisture-retention techniques.
- Promote drought-resistant crop varieties, including barley, flax, peas, sainfoin, and pistachio.
- Implement continuous GIS-based land monitoring to track erosion, slope changes, and vegetation cover.
- Revise normative land valuation based on regional soil quality differences and updated bonitet scores.
- Strengthen farmer training and agro-technical extension services designed specifically for rainfed zones.

In general, the sustainable use of rainfed lands requires resource-efficient, environmentally sound, and science-based approaches. If these recommendations are implemented, the productivity and economic return of rainfed lands in Uzbekistan can be significantly improved.

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