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Ijtimoiy, iqtisodiy, texnologik, ilmiy, ommabop jurnal

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The role of international investments in greening and ecological rehabilitation of the aral sea region	392
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THE ROLE OF INTERNATIONAL INVESTMENTS IN GREENING AND ECOLOGICAL REHABILITATION OF THE ARAL SEA REGION

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Abstract: The article examines the role of international investments in the greening and ecological rehabilitation of the Aral Sea region, one of the most environmentally vulnerable areas in Central Asia. It analyzes investment directions, the scale of projects implemented in Karakalpakstan, and their impact on biodiversity restoration, combating desertification, and improving living conditions for local populations.

Key words: Karakalpakstan, Aral Sea region, international environmental investments, greening, ecological rehabilitation, desertification, biodiversity restoration, sustainable development, saksaul plantations.

Annotatsiya: Maqolada Markaziy Osiyodagi ekologik jihatdan eng zaif hududlardan biri bo'lgan Orol dengizi mintaqasini ko'kalamzorlashtirish va ekologik sog'lomlashtirishda xalqaro investitsiyalarning roli ko'rib chiqiladi. Unda investitsiya yo'nalishlari, Qoraqalpog'istonda amalga oshirilayotgan loyihalar ko'lami, ularning bioxilma-xillikni tiklash, cho'llanishga qarshi kurashish, mahalliy aholi turmush sharoitini yaxshilashga ta'siri tahlil qilinadi.

Kalit so'zlar: Qoraqalpog'iston, Orolbo'yi mintaqasi, xalqaro ekologik investitsiyalar, ko'kalamzorlashtirish, ekologik reabilitatsiya, cho'llanish, bioxilma-xillikni tiklash, barqaror rivojlanish, saksovl plantatsiyalari.

Аннотация: В статье рассматривается роль международных инвестиций в озеленении и экологической реабилитации Приаралья, одного из самых экологически уязвимых регионов Центральной Азии. Анализируются направления инвестиций, масштабы проектов, реализуемых в Каракалпакстане, их влияние на восстановление биоразнообразия, борьбу с опустыниванием и улучшение условий жизни местного населения.

Ключевые слова: Каракалпакстан, Приаралье, международные экологические инвестиции, озеленение, экологическая реабилитация, опустынивание, восстановление биоразнообразия, устойчивое развитие, саксауловые насаждения.

INTRODUCTION

The desiccation of the Aral Sea is one of the largest environmental disasters of the 20th century, altering both the natural landscape of Central Asia and the livelihoods of millions. By the mid-20th century, the Aral Sea was the world's fourth-largest inland water body. However, due to unsustainable water use primarily excessive withdrawals from the Amu Darya and Syr Darya rivers for irrigation the sea began to shrink rapidly. Today, most of its former bed has become the lifeless saline desert of Aralkum.

The consequences of the sea's desiccation are acutely felt in the Republic of Karakalpakstan, where ecological degradation has led to significant socio-economic challenges. These include climatic shifts, frequent dust storms, soil salinization, freshwater shortages, reduced agricultural yields, deteriorating public health, and rising chronic diseases.

Against this backdrop, the Aral Sea region has drawn global attention. Since the 1990s, international organizations such as the United Nations Development Programme (UNDP), World Bank, Global Environment Facility (GEF), UNEP, USAID, and the Asian Development Bank have actively engaged in the region. Their projects focus on: greening saline and desertified lands through drought-resistant plants like saksaul; restoring



biodiversity and establishing protected areas; reducing air and soil pollution; promoting sustainable agriculture and water-efficient technologies; and raising environmental awareness among local communities.

Uzbekistan's national strategy for the sustainable development of the Aral Sea region, endorsed on international platforms and supported by donors, has gained particular relevance. A key initiative is the establishment of the Multi-Partner Human Security Trust Fund for the Aral Sea region (MPHSTF) under UN auspices in 2018, funded by multiple countries and agencies. Thus, the Aral Sea region has become not only a site of ecological crisis but also a testing ground for international cooperation in sustainable development, desert greening, and ecological restoration. Amid escalating global climate change, Karakalpakstan's experience may serve as a model for adaptive resource management and mitigating environmental crises.

This article investigates the scope and direction of international investments in greening and ecological rehabilitation of the Aral Sea region, analyzing their effectiveness in improving environmental, climatic, and socio-economic conditions.

The Aral Sea crisis and mitigation measures have been extensively studied by domestic and international scholars. Reports by UNEP (2020), UNDP (2022), and the World Bank (2019) detail the global implications of the sea's desiccation, biodiversity loss, and public health impacts. Micklin (2007) comprehensively analyzes the causes and socio-economic consequences, while Glantz (1999) emphasizes the need for international cooperation. Domestic researchers, including S. Yunusov, B. Matkarimov, Z. Sharipova, and J. Khudoiberganov, explore the effects of ecological degradation in Karakalpakstan and strategies for sustainable development. Yunusov (2021) evaluates the efficacy of ecological projects, while Matkarimov (2020) examines changes in the region's forest cover. However, existing literature often overlooks the specifics of international funding, financial parameters, and community involvement. This article addresses these gaps by focusing on the practical impact of investments on ecosystem restoration and local livelihoods.

METHODOLOGY

The study employs: content analysis of reports from international organizations (UNDP, World Bank, GEF); qualitative analysis of ecological projects in Karakalpakstan; comparative analysis of afforestation and biorehabilitation programs; and cartographic reviews using FAO and UNCCD data. National strategies and reports from Uzbekistan's Ministry of Ecology were also examined.

RESULTS

Since 2018, international investments in the Aral Sea region have significantly increased, reflecting the growing global recognition of the region's environmental crisis. A major focus has been afforestation efforts. With the support of the United Nations Development Programme (UNDP), the World Bank, and the Global Environment Facility (GEF), over 1.7 million hectares of the desiccated seabed now known as the Aralkum Desert have been planted with drought-resistant species such as *Haloxylon aphyllum* (sacsaul), *Tamarix*, and *Calligonum*. These species help stabilize loose sand, prevent erosion, reduce toxic dust storms, and create favorable conditions for habitat regeneration.

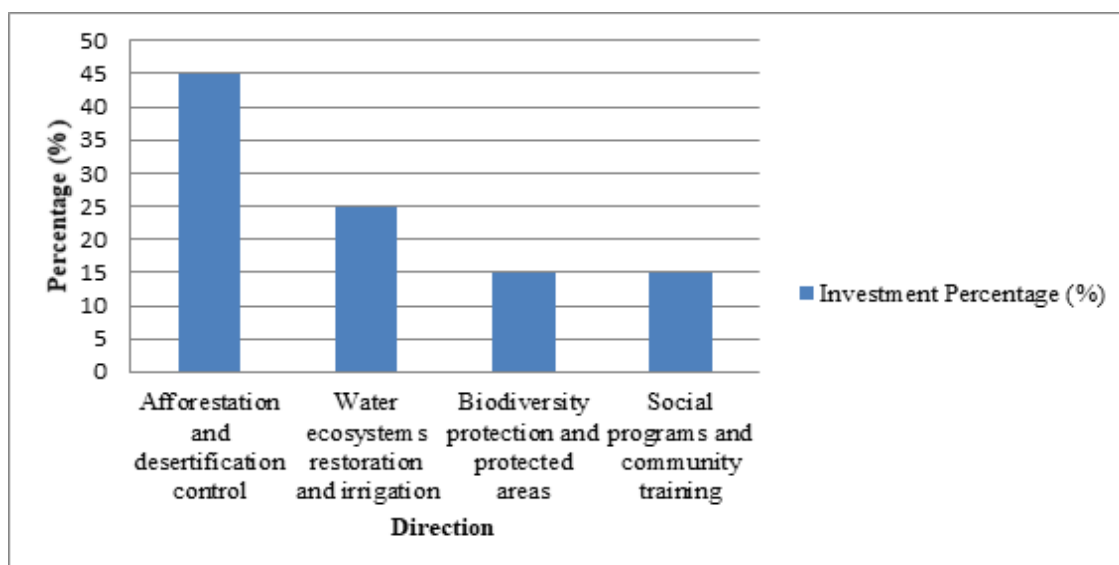


Figure 1. Investment distribution by direction (%)



The majority of funding (45%) is directed towards afforestation and desertification control, reflecting a strong commitment to reversing land degradation and addressing the environmental challenges of desertification. This likely includes measures such as planting drought-resistant trees (e.g., saxaul) and improving land use practices.

Water ecosystems restoration and irrigation receives the second-largest portion of investments (25%), underlining the importance of improving water management systems and rehabilitating aquatic environments critical for both agricultural productivity and ecosystem health.

Meanwhile, biodiversity protection and protected areas and social programs and community training each account for 15% of total investments. These relatively smaller shares indicate a growing, though less prioritized, emphasis on preserving ecological diversity and strengthening the role of local communities through education and social engagement (figure 1).

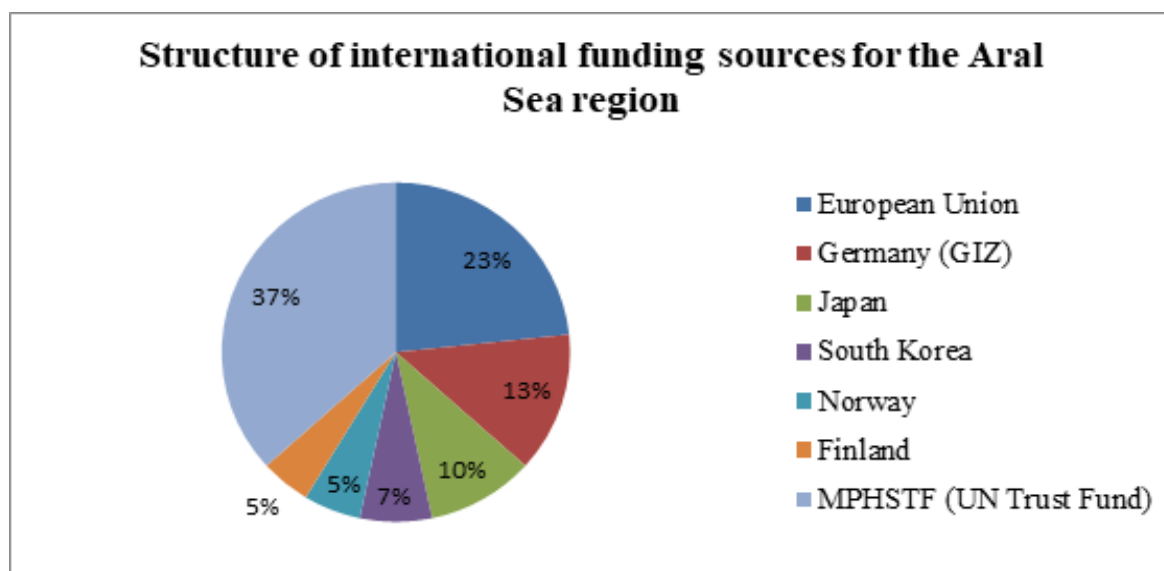


Figure 2. Structure of international funding sources for the Aral Sea region

The pie chart illustrates the distribution of international financial contributions allocated to the Aral Sea region from various donor organizations and countries. The largest share of funding comes from the MPHSTF (Multi-Partner Human Security Trust Fund – UN Trust Fund), accounting for 37% of the total. This highlights the central role of the United Nations in coordinating and supporting sustainable development initiatives in the region. The European Union is the second-largest contributor, providing 23% of the funds. Germany (GIZ) follows with 13%, demonstrating strong bilateral support. Other notable contributors include: Japan – 10%, South Korea – 7%, Norway and Finland – each contributing 5%. Overall, the chart shows a diversified structure of funding sources, combining multilateral and bilateral support. This diversity can enhance the stability and continuity of development programs in the Aral Sea region (figure 2).

Efforts to rehabilitate aquatic ecosystems have also intensified. In partnership with the Asian Development Bank (ADB) and the Swiss Agency for Development and Cooperation (SDC), modern irrigation canals and drip irrigation systems have been introduced to improve water efficiency in agriculture. Additionally, over 40 small water bodies, including seasonal lakes and wetlands, have been restored or constructed to support biodiversity and provide water sources for local communities and wildlife.

Biodiversity conservation has emerged as a priority area. With technical support from the United Nations Environment Programme (UNEP), several protected areas have been expanded or newly designated. For instance, the Lower Amu Darya State Biosphere Reserve now covers over 68,000 hectares and serves as a critical habitat for rare species such as the Bukhara deer (*Cervus elaphus bactrianus*), various migratory birds, and desert reptiles. Reintroduction programs for endangered species, supported by international grants, are underway, aiming to restore ecological balance in the region.

International funding has also targeted community-based environmental management. Training sessions on climate-smart agriculture, sustainable grazing, and soil salinity mitigation have been organized for thousands of farmers and rural residents. According to UNDP data, more than 25,000 people have participated in capacity-building programs between 2020 and 2023. Special emphasis has been placed on involving women and youth, with micro-grants supporting green entrepreneurship, such as eco-tourism, horticulture, and desert nursery enterprises. In terms of financial contributions, over \$150 million in international aid was allocated to ecological



rehabilitation between 2020 and 2023. Major donors include the European Union, Japan, South Korea, Norway, Finland, and international agencies under the Multi-Partner Human Security Trust Fund for the Aral Sea Region (MPHSTF). The fund currently supports more than 30 projects, covering areas such as environmental monitoring, health risk reduction, livelihood diversification, and education on sustainable development. These results signal a significant step forward in the revival of the Aral Sea region's environment, demonstrating how coordinated international support can address ecological degradation while also empowering local communities and fostering long-term resilience.

DISCUSSION

International investments play a crucial role in the ecological restoration of the Aral Sea region, serving as a foundation for reversing decades of environmental degradation. These investments not only finance large-scale environmental projects but also stimulate institutional reform, research innovation, and community resilience.

One of the most visible results of international support is the extensive afforestation of the Aralkum Desert using *Haloxylon aphyllum* (saksaul). These plantations are vital for stabilizing loose saline soils, reducing wind erosion, and mitigating toxic dust storms which can carry harmful salt and pesticide residues over hundreds of kilometers, even reaching parts of Kazakhstan and Turkmenistan. According to the Ministry of Ecology of Uzbekistan, more than 100 dust storm days per year have been recorded in some districts of Karakalpakstan, but afforestation has led to a measurable decline in storm frequency and severity in afforested areas.

Moreover, community engagement in ecological projects has proven to be a key success factor. Local populations particularly youth and women have been actively involved in planting operations, nursery management, and monitoring activities. This engagement not only creates temporary and permanent employment opportunities in rural areas suffering from high unemployment but also fosters environmental stewardship and local ownership of restoration efforts. Programs like the UNDP's Green Jobs Initiative have helped establish over 60 community-based enterprises, integrating environmental goals with social and economic development.

Despite the progress, the region faces serious challenges. One of the most pressing is extreme water scarcity annual precipitation is less than 100 mm, classifying the area as hyper-arid. The competing demands for water from agriculture, industry, and ecosystem restoration create a complex resource management dilemma. The declining flow of the Amu Darya River, exacerbated by climate change and upstream withdrawals, threatens the sustainability of many water-dependent projects.

Another persistent challenge is the fragmentation and limited coordination between various stakeholders—international donors, government agencies, local authorities, and NGOs. Although platforms like the Multi-Partner Human Security Trust Fund (MPHSTF) aim to streamline support, overlaps and gaps in project implementation still occur. Moreover, the lack of long-term ecological monitoring systems hinders the ability to evaluate project outcomes and adjust strategies accordingly. Establishing standardized indicators and independent evaluation mechanisms would improve accountability and facilitate learning.

Transparent allocation of funds remains vital. While major donors publish reports, community-level tracking of expenditures and outcomes is often insufficient. Enhancing financial transparency, including participatory budgeting and public dashboards, would boost trust and ensure more efficient use of resources.

To maximize long-term impact, adaptive management approaches should be institutionalized. This includes using GIS and remote sensing technologies for real-time monitoring of vegetation cover, water quality, and land degradation trends. Integration of traditional ecological knowledge with scientific methods can also enhance local relevance and sustainability of interventions.

CONCLUSION

Ecological rehabilitation of the Aral Sea region hinges on international collaboration. Investments in greening and ecosystem restoration are yielding tangible benefits: improved microclimates, stabilized landscapes, and enhanced livelihoods. A long-term sustainable strategy, integrating governments, donors, and communities, is essential for the region's future.

To ensure lasting impact, it is crucial to strengthen institutional capacity at the local and national levels, promote scientific research and innovation tailored to arid environments, and expand climate-resilient agricultural practices. Continuous monitoring and transparent reporting mechanisms will help assess progress and adapt strategies as needed. Moreover, empowering local populations especially women and youth through education, training, and employment opportunities will foster ownership and resilience. The future of the Aral sea region depends on a shared commitment to environmental stewardship, socio-economic development, and inclusive growth.

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