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Venera TORENIYAZOVA,

Acting Associate Professor, Nukus Branch of Samarkand State University, Nukus, Uzbekistan

E-mail: toreniyazova.vera@inbox.ru, ORCID: <https://orcid.org/0009-0005-0229-0966>

Gulsinay KURBANİYAZOVA,

Assistant teacher, Nukus Branch of Samarkand State University of Veterinary Medicine, Nukus, Uzbekistan

E-mail: gulsinaykurbaniyazova@gmail.com, <https://orcid.org/0009-0008-8859-972X>

Parizod JUMANOVA,

Student, Nukus Branch of Samarkand State University of Veterinary Medicine, Nukus, Uzbekistan

E-mail: parizodjumanova@gmail.com, <https://orcid.org/0009-0006-3756-1532>

Based on the review by Toreniyazova S.E., Associate Professor of Karakalpak State University, Doctor of Philosophy (PhD) in Agricultural Sciences.

LIVESTOCK AND ECOLOGICAL ENVIRONMENT IN THE REPUBLIC OF KARAKALPAKSTAN: INTERACTION AND PROSPECTS FOR SUSTAINABLE DEVELOPMENT

Annotation

This article provides a scientific analysis of the impact of the livestock sector on the environment, environmental problems, and ways to address them in the Republic of Karakalpakstan. Natural, economic, social, and environmental factors influencing the development of the livestock industry have been comprehensively studied. Pasture degradation in the region, the impact of the Aral crisis on livestock farming, the problem of water resources, and the prospects for sustainable development are examined.

Keywords: animal husbandry, environment, Karakalpakstan, ecology, pasture degradation, Aral crisis, water resources.

ЖИВОТНОВОДСТВО И ЭКОЛОГИЧЕСКАЯ СРЕДА В РЕСПУБЛИКЕ КАРАКАЛПАКСТАН: ВЗАИМОДЕЙСТВИЕ И ПЕРСПЕКТИВЫ УСТОЙЧИВОГО РАЗВИТИЯ

Аннотация

В данной статье приводится научный анализ влияния животноводческого сектора на окружающую среду, экологических проблем и путей их решения в Республике Каракалпакстан. Комплексно изучены природные, экономические, социальные и экологические факторы, влияющие на развитие животноводства. Рассматриваются деградация пастбищ в регионе, влияние Аральского кризиса на животноводство, проблема водных ресурсов и перспективы устойчивого развития.

Ключевые слова: животноводство, окружающая среда, Каракалпакстан, экология, деградация пастбищ, Аральский кризис, водные ресурсы.

QORAQALPOG'ISTON RESPUBLIKASIDA CHORVACHILIK VA EKOLOGIK MUHIT: O'ZARO TA'SIR VA BARQAROR RIVOJLANISH ISTIQBOLLARI

Annotatsiya

Ushbu maqolada Qoraqalpog'iston Respublikasida chorvachilik tarmog'ining atrof-muhitga ta'siri, ekologik muammolar va ularni hal etish yo'llari ilmiy jihatdan tahlil qilingan. Chorvachilik sohasi rivojlanishiga ta'sir etuvchi tabiiy, iqtisodiy, ijtimoiy va ekologik omillar atroflicha o'rganilgan. Mintaqadagi yaylovlar degradatsiyasi, Orol inqirozining chorvachilikka ta'siri, suv resurslari muammosi hamda barqaror rivojlanish istiqbollari ko'rib chiqilgan.

Kalit so'zlar: chorvachilik, atrof-muhit, Qoraqalpog'iston, ekologiya, yaylovlar degradatsiyasi, Orol inqirozi, suv resurslari.

Introduction. Livestock plays an important role in the economy of Uzbekistan, accounting for 13 percent of GDP and half of agricultural production. This sector not only ensures food security but also provides jobs for the population in rural areas. The Republic of Karakalpakstan, with its unique natural-geographical location in the Aral Sea region, is a territory of particular scientific value for studying the relationship between livestock and the ecological environment.

Livestock farming in the republic has been forming for centuries as one of the traditional sectors of the economy. The vast expanses of the Karachul and Ustyurt plateaus, along the banks of the Amu Darya, and other territories served as a favorable natural base for livestock farming. However, in recent decades, the environmental crisis caused by the drying up of the Aral Sea, as well as the degradation of pastures due to improper use, have exacerbated the problems in this area.

The relevance of the topic lies in the fact that it is impossible to ensure the socio-economic stability of the region without the sustainable development of livestock farming. At the same time, long-term efficiency cannot be achieved without environmental management of the industry. This article is dedicated to a comprehensive review of the relationship between livestock and the environment in the context of Karakalpakstan and the proposal of solutions aimed at sustainable development.

Literature review and the extent to which the topic has been studied. The issue of the relationship between animal husbandry and the environment is being widely discussed within the international scientific community. According to FAO data, on a global scale, livestock production accounts for approximately 14.5% of greenhouse gas emissions and consumes a significant portion of the world's water resources (Gerber et al., 2013). The issue of the interconnection of livestock and environmental problems in the Aral Sea basin is of particular scientific interest. In studies on Uzbekistan and Karakalpakstan, G. Arifdjanov, Kh. Tolipov, T. Mukimov, and S. Sattarov highlighted issues regarding the improvement of pasture land use (2023). Yuldashev D.K.

(2022) analyzed the dynamics of livestock production in Uzbekistan. Moameri and Ghorbani (2024) examined the issue of regional livestock cooperatives in their research.

According to data from the Republican Statistics Agency (2024), the number of farms specializing in livestock farming has reached 9,688. Furthermore, the total area of pastures and hayfields in Uzbekistan increased from 20,756.1 thousand hectares in 2011 to 21,190.4 thousand hectares in 2024. The analysis of these indicators using the example of Karakalpakstan forms the basis of the topic.

Research methods. The following scientific methods were used in the study:

- Monographic analysis: study of scientific literature and statistical data on the topic;
- Statistical analysis: Assessing the dynamics of livestock numbers, pasture areas, and environmental indicators based on data from the Statistics Committee of the Republic of Karakalpakstan;
- Comparative analysis: comparison of livestock indicators across different periods and regions;
- Systematic approach: considering the interdependence between livestock, ecology, and socio-economic factors as a holistic system.

Results and Discussion

1. Factors influencing the placement and development of the livestock industry

Along with natural factors, economic and social factors also play a significant role in the territorial placement and development of livestock farming. In the conditions of the Republic of Karakalpakstan, these factors include environmental factors arising from the Aral Sea crisis. The table below presents the main factors influencing the placement and production of livestock industries.

Table 1. Factors influencing the placement and development of livestock sectors in the Republic of Karakalpakstan

Factors	Description	Influence of livestock farming on the distribution of Karakalpakstan
Natural sharoitlar	Climate (temperature, precipitation), relief (mountain, plain), soil quality, availability of water sources.	It defines the types of livestock (karakul sheep breeding, camel breeding, etc.) and the location of farms.
Economic factors	Food prices, land prices, credit accessibility, investment opportunities.	In cases where costs are high, production is concentrated in economical areas.
Social factors	Availability of labor, living standards of the rural population, cultural traditions	Increasing demand for high-quality products stimulates the formation of specialized farms.
Transport infrastructure	Roads, proximity to the market, warehouses, cold storage facilities.	Improves logistics and increases competitiveness by quickly delivering products to the market.
Environmental factors (Aral crisis)	Salt and dust storms, soil salinization, and a decrease in the water volume of the Amu Darya.	Accelerates pasture degradation and reduces livestock productivity.
Legislative aspects	Standards on ecology, veterinary medicine, and animal protection.	It may limit or encourage the development of certain areas
Scientific and technical progress	Breeding, automation, diagnostics, and innovative feeding systems.	Increases production efficiency and reduces the need for labor.
Climate change	Changes in the temperature regime, increased drought, and extreme weather conditions.	It has a negative impact on pasture and water resources, altering livestock conditions.

Source: by the author FAO (2013), Arifdjanov et al. (2023), compiled based on data from the Republican Statistics Agency (2024).

As seen from the table, in addition to traditional factors, the environmental pressure caused by the Aral Sea crisis holds a special place for Karakalpakstan. Salt and dust storms and soil salinization reduce pasture productivity, which narrows the fodder base for livestock. At the same time, climate change and drought are making livestock conditions in the region even more difficult.

2. State of pastures and hayfields in the Republic of Karakalpakstan

The development of pasture livestock farming is directly linked to the fodder base of pastures. In Uzbekistan, desert and semi-desert pastures occupy 23.3 million hectares and serve as the primary fodder base for sheep farming. The Republic of Karakalpakstan holds a leading position among the republics in this indicator.

There are a number of features in the use of pastures and hayfields: natural pastures in deserts and foothills; cultivated and improved pastures; supplementary fodder grown on irrigated lands. Today, 40 percent of arid pastures are degraded, and their productivity has decreased by 20 percent.

Table 2. Distribution of hayfields and pastures by Republic of Karakalpakstan and regions (thousand ha)

Names of regions	Total hayfields and pastures (thousand ha)		Of which irrigated (thousand ha)	
	2014 year	2025 year	2014 year	2025 year
Republic of Uzbekistan (total)	20 756,1	21 190,4	43,0	42,0
Republic of Karakalpakstan	4 780,9	5 261,8	36,6	35,8
Andijan region	21,3	21,0	0,9	0,8
Bukhara region	2 579,6	2 550,3	—	—

Names of regions	Total hayfields and pastures (thousand ha)		Of which irrigated (thousand ha)	
	2014 year	2025 year	2014 year	2025 year
Jizzakh region	758,0	702,0	—	—
Kashkadarya region	1 455,8	1 405,2	0,1	0,1
Navoi region	8 763,6	8 887,6	—	—
Namangan region	152,6	163,8	—	—
Samarkand region	793,8	793,2	—	—
Surkhandarya region	861,2	824,5	—	—
Syrdarya region	22,0	19,9	—	—
Tashkent region	433,7	442,5	1,4	—
Fergana Region	23,5	9,5	4,0	3,9
Khorezm region	110,1	109,1	—	—

Source: Statistics Agency under the President of the Republic of Uzbekistan, 2024.

As seen from Table 2, the Republic of Karakalpakstan is the largest among the regions of Uzbekistan in terms of pasture and hayfield area - in 2024, it occupied 5,261.8 thousand hectares. This corresponds to 24.8% of the total indicator for the republic. However, the area of irrigated hayfields decreased from 36.6 thousand hectares to 35.8 thousand hectares, which indicates the direct impact of water resource shortages.

3. Livestock and Pasture Degradation: Environmental Relations

In overloaded pastures, the thinning of vegetation, soil compaction, and erosion are intensifying. Livestock grazing in Karashul and Ustyurt pastures, exceeding the grazing norm by 1.5–2 times, poses a serious threat to pasture ecosystems. Due to the unsatisfactory microclimate in the farms, the milk productivity of cows decreases by 10%, and the efficiency of feed use, especially during the winter season, by 20-30%.

As a result of the drying up of the Aral Sea, the old seabed - the Aralmuyak area - has become a source of salt and sand storms. These storms destroy nearby pasture grasses, salinizing the soil, and damaging livestock health. As a result, there is a decrease in livestock weight, a decrease in productivity, and an increase in susceptibility to diseases.

4. Water resources, air quality, and biodiversity

Livestock farming is one of the most water-intensive sectors. In Karakalpakstan, the Amu Darya delta is the main source of water, and the decrease in the flow of the Amu Darya is further exacerbating the water shortage. Livestock manure and washing products can enter groundwater and canal networks, causing biological pollution.

Methane gas, which is released during fermentation in the digestive system of sheep and cattle, is one of the important greenhouse gases. In addition, salt and dust storms in the Aral Sea region increase air pollution in livestock areas. The Badai-Tugay Nature Reserve and other protected areas in Karakalpakstan play a crucial role in preserving biodiversity.

5. Livestock cooperatives and prospects for sustainable development

One of the important solutions to problems such as low income from livestock farming, youth withdrawal from the sector, and fodder shortages is the creation of livestock cooperatives. Cooperatives will increase the financial and technical capabilities of livestock breeders, jointly purchase feed and veterinary services, and effectively sell products.

In the example of Uzbekistan, we can see that while livestock products worth 44,175.4 billion soums were produced in 2015, this figure reached 202,335.3 billion soums by 2023, representing a nearly 4.6-fold increase. The Republic of Karakalpakstan has similar growth potential, which requires the introduction of sustainable farming methods and modern technologies.

Suggested. Based on the research results and international experience, the following practical recommendations have been developed:

1. Implementation of a pasture rotation system: not allowing livestock to graze on a specific pasture plot for more than the specified time, ensuring the possibility of pasture self-recovery;
2. Establishment of livestock cooperatives: combining the financial and technical capabilities of farmers, joint procurement of feed, and joint sale of products;
3. Expansion of water-saving technologies: use of closed water systems for livestock drinking water supply, prevention of groundwater pollution;
4. Biological manure management: increasing soil fertility and reducing air pollution by processing manure into compost or biogas;
5. Strengthening pastures with forest protection lines: planting saxaul and other hardy plants to reduce the impact of salt and sand storms;
6. Updating livestock breeds with adaptive varieties: Widespread use of breeds that are resistant to the climatic conditions of Karakalpakstan and reduce water and feed consumption;
7. Strengthening the environmental monitoring system: implementing programs for the regular assessment of soil, water, and air quality in livestock areas.

Conclusion. In the Republic of Karakalpakstan, livestock farming is a socio-economically important sector and occupies one of the key positions in the well-being and food security of the population. As shown in Table 2, the republic ranks first among the regions of Uzbekistan in terms of the area of pastures and hayfields—5,261.8 thousand hectares. Proper management of this enormous potential will allow for the further development of livestock farming.

However, the impact of this industry on the environment is multifaceted and, in some cases, negative in nature. Pasture degradation (40 percent of pastures are moderately and severely degraded), pollution and depletion of water resources, greenhouse gas emissions, and the intensifying Aral Sea crisis - all of this is further exacerbating the conflict between livestock and the ecological environment.

At the same time, if proper management, livestock cooperatives, and advanced technologies are implemented, ecologically balanced livestock development is possible. A sustainable livestock model not only protects nature but also guarantees long-term income for farmers. The recommendations proposed in this article serve as a foundation for government programs and future research.

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