NATURAL PASTURES OF THE REPUBLIC OF KAZAKHSTAN: MONITORING AND CONSERVATION OF PRODUCTIVITY

ҚАЗАҚСТАН РЕСПУБЛИКАСЫНЫҢ ТАБИҒИ ЖАЙЫЛЫМДАРЫ: ӨНІМДІЛІКТІҢ МОНИТОРИНГІ ЖӘНЕ САҚТАЛУЫ

ПРИРОДНЫЕ ПАСТБИЩА РЕСПУБЛИКИ КАЗАХСТАН: МОНИТОРИНГ И СОХРАНЕНИЕ ПРОДУКТИВНОСТИ

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Abstract. The *goal* is to identify problems and find ways to solve the rational use of pastures in Kazakhstan. *Methods* - analytical for studying legislative and regulatory acts on pasture management, monographic - when familiarizing yourself with profile studies and publications on the regulation of pasture resources of the Republic, statistical-on the basis of official information of the Ministry of Agriculture of the Republic, cartographic and abstract - logical-to summarize the results of the tasks set. *Results* - the legislative and regulatory support for pasture farming was analyzed, the dynamics of a decrease in the intensity of its development during the period of land reform in the country was shown. Large pasture areas have been found to be degraded, as evidenced by space monitoring data - 87% are not covered with vegetation. Despite the fact that the cadastre is maintained in digital format, land use plans do not indicate the boundaries of lands that are not fixed, which, in turn, complicates their visual location for drawing up pasture turnover schemes and making decisions on the organization of pasture territories. *Conclusions* - it was found that when there is a sufficient number of pastures in the Ereymentau district, the population feels a shortage of them for grazing. Based on the map of agricultural land, a forecast of the need for pasture land

Environmental economics

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is presented here. Obstacles limiting the further production of forage crops were identified, including the lack of systematic subsidies in accordance with the impact on the environment, secondary heredity on unused plots and the low level of practical knowledge of farmers on the management of forage agricultural land. Recommendations were given to coordinate the loads on feed biocenoses and increase their productivity. Kazakhstan has a huge potential for natural forage landscapes, which are not used enough to create a sustainable forage base and obtain environmentally friendly and cheap livestock products.

Аңдатпа. *Мақсаты -* проблемаларды анықтау және Қазақстанда жайылымдарды ұтымды пайдалануды шешу жолдарын іздеу. *Әдістер –* жайылымдық жерлерді басқару жөніндегі заңнамалық және нормативтік актілерді зерделеу үшін талдамалық, монографиялық - республиканың жайылымдық ресурстарын реттеу жөніндегі бейіндік зерттеулермен және жарияланымдармен танысу кезінде, статистикалық - ҚР АШМ ресми ақпараты негізінде, картографиялық және дерексіз-логикалық - қойылған міндеттердің қорытындыларын қорыту үшін. *Нәтижелері* - жайылымдық шаруашылықты жүргізуді заңнамалық-нормативтік қамтамасыз ету талданды, елдегі жер реформасы кезеңінде оның даму қарқындылығының төмендеу серпіні көрсетілді. Үлкен жайылымдық алқаптардың деградацияға ұшырағаны анықталды, мұны ғарыштық мониторинг деректері дәлелдейді - 87% - ы өсімдіктермен жабылмаған. Кадастрды сандық форматта жүргізуге қарамастан, жерді пайдалану жоспарларында бекітілмеген жерлердің шекаралары көрсетілмейді, бұл өз кезегінде жайылым айналымының схемаларын жасау және жайылымдық аумақтарды ұйымдастыру бойынша шешімдер қабылдау үшін олардың көрнекі орналасуын қиындатады. *Қорытындылар* - Ерейментау ауданында жайылымдардың жеткілікті мөлшері болған кезде халықтың мал жаю үшін олардың тапшылығы сезілетіні анықталды. Ауыл шаруашылығы жерлерінің картасы негізінде осы жерде жайылымдық жерлерге қажеттілік болжамы ұсынылған. Жемшөп дақылдарын одан әрі өндіруді шектейтін кедергілер, оның ішінде қоршаған ортаға әсерге сәйкес жүйелі субсидиялардың болмауы, пайдаланылмайтын учаскелердегі қайталама тұқым қуалаушылық және фермерлердің жемшөп ауыл шаруашылығы алқаптарын басқару жөніндегі практикалық білімінің төмен деңгейі белгіленді. Жемшөп биоценоздарына жүктемелерді үйлестіру және олардың өнімділігін арттыру бойынша ұсыныстар берілді. Қазақстанда табиғи азықтық ландшафттардың орасан зор әлеуеті бар, ол орнықты азықтық базаны құру және экологиялық таза және арзан мал шаруашылығы өнімдерін алу үшін жеткіліксіз пайдаланылады.

Аннотация. *Цель* – выявление проблем и поиск путей решения рационального использования пастбищ в Казахстане. *Методы* – аналитический для изучения законодательных и нормативных актов по управлению пастбищными угодьями, монографический - при ознакомлении с профильными исследованиями и публикациями по регулированию пастбищными ресурсами республики, статистический – на основе официальной информации МСХ РК, картографический и абстрактно-логический – для обобщения итогов поставленных задач. *Результаты* – проанализировано законодательно-нормативное обеспечение ведения пастбищного хозяйства, показана динамика снижения интенсивности его развития за период земельной реформы в стране. Определено, что большие пастбищные площади деградированы, об этом свидетельствуют данные космического мониторинга - 87% не покрыты растительностью. Отмечается, что, несмотря на ведение кадастра в цифровом формате, на планах землепользования не отражаются границы незакрепленных земель, это, в свою очередь, затрудняет их наглядное расположение для составления схем пастбищеоборотов и принятия решений по организации пастбищных территорий. *Выводы* – установлено, что при наличии достаточных размеров пастбищ в Ерейментауском районе ощущается их нехватка для выпаса скота населения. На основе карты сельхозземель в данной местности представлен прогноз потребности пастбищных угодий. Обозначены барьеры, ограничивающие дальнейшее производство кормовых культур, в том числе отсутствие системных субсидий, соизмеримых с воздействием на окружающую среду, вторичная наследственность на неиспользуемых участках и низкий уровень практических знаний фермеров по управлению кормовыми сельхозугодьями. Даны предложения по координации нагрузок на кормовые биоценозы и повышению их продуктивности. В Казахстане имеется огромный потенциал естественных кормовых ландшафтов, который в недостаточной мере используется для создания устойчивой кормовой базы и получения экологически чистых и дешевых продуктов животноводства.

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Табиғат пайдалану экономикасы

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Introduction

Effective use of pasture lands plays a crucial role in ensuring the country's food security. The solution to this problem is possible by attracting investments in the agricultural sector, considering land as an "element of investment attractiveness" (President Kassym-Jomart Tokayev's State…) [1]. According to him, this approach will create favorable conditions for the rural population by ensuring stable employment and the development of rural areas.

To promote the effective use of pastures, the Law "On Pastures" was adopted, introducing the new concept of "public pastures", defined as state-owned pasturelands located near settlements to provide grazing land for the local population's livestock (Law of the Republic of Kazakhstan…) [2]. The issue of pasture shortage was first raised in 2016 when it was revealed that nearly all land surrounding rural settlements was in private ownership, leaving no space for locals to graze their animals. Since the adoption of the Pasture Law, it has been amended eight times, but these changes have not been effectively implemented and have failed to resolve the critical issues of pasture quality and access for rural livestock farmers. A key limiting factor remains the poor ecological condition of these lands.

As a result, the issue of efficient pastureland utilization is becoming increasingly urgent due to the growing population and the corresponding need for food supply. At the same time, Kazakhstan's economy is currently facing challenges due to financial instability and rising prices for goods and services, which in turn drive up the cost of agricultural products. Statistical data confirm a significant decline in livestock numbers, which is attributed to various factors, including a lack of accessible pastureland, high feed prices, weak legal protection for agricultural producers, and more. Nevertheless, Kazakhstan possesses all the necessary resources to improve the rational use of pastures through enhanced legal frameworks and well-organized grazing practices. Pasturelands account for 73% of all agricultural land, and 95% of reserve lands are comprised of pastures.

Despite these challenges, Kazakhstan possesses immense resource potential. Rangelands account for approximately 70% of Kazakhstan's land area, covering over 186 million hectares – the majority of which consists of pasture and hay land – and represent a significant share of reserve and grazing territory. If these extensive reserves are mobilized through infrastructure modernization, digital cadastral mapping, and implementation of rotational grazing systems, they can form the foundation for sustainable livestock production and national food security. With robust legal frameworks, institutional coordination, and organizational support, this potential can be harnessed to strengthen the country's long-term food resilience and rural development strategy.

Literature Review

Improving the efficiency of pasture use relies heavily on their ecological condition and the level of utilization, which is increasingly assessed through the use of unmanned aerial vehicles (UAVs) and the implementation of precision agriculture technologies (Nicola Furnitto J., Ramírez-Cuesta M., Intrigliolo Diego S. et al.) [3]. The classification of agricultural lands varies across countries. For instance, in Poland, pasturelands include both meadows and permanent pastures. Permanent pastures in Poland are essential for the rational use of fodder resources and environmental protection.

Their primary function is the production of roughage for ruminant animals, yet the ecological importance of pastures extends far beyond nutritional aspects. Properly managed grasslands support plant and insect biodiversity, regulate climate through carbon storage, control erosion, cycle nutrients, facilitate pollination, and offer cultural and recreational benefits, enriching agricultural landscapes and enhancing ecosystem resilience (Richter F.J., Suter M., Lüscher A. et al.; Pergola M., De Falco E., Cerrato M.) [4,5]. In Polish conditions, permanent grasslands cover a total of 3.8 million hectares, which accounts for 20.1% of agricultural land. The area of permanent meadows is approximately 2.3 million ha, while pastures cover around 1.5 million ha (Central Statistical Office…) [6]. According to the current definition, permanent pastures are lands covered with forage vegetation (grasses and legumes) that have been continuously used for at least five years.

Despite their multifunctionality, since the 1990s, TUZ have declined, mainly due to land abandonment, secondary succession, and conversion into arable land.

The productivity of TUZ is measured by dry matter (DM) yield per hectare. High-yielding meadows with hybrid alfalfa and perennial

ryegrass produce 5–10 tons/ha, and in some cases, more than 10 tons/ha. The average yield ranges from 2.5 to 5.0 tons/ha, whereas extensive pastures-often located in mountainous or wetland areas-produce less than 2.5 tons/ha (Kozłowski S.) [7].

From a habitat perspective, pastures are predominantly found on soils that are difficult to plough. These include organic soils (peat and clay soils) located in river valleys and lake districts, weak mineral soils (podzols, pseudo-gley soils), as well as brown and alluvial soils (silts). Their soil quality classification (bonitation) typically ranges from Class IV to VI, with the exception of river silts and chernozems, which may be used intensively under favour-able water conditions.

The use of pastures is subject to restrictions imposed by current EU and national regulations, particularly the so-called GAEC (Good Agricultural and Environ-mental Conditions) standards. Of particular relevance are GAEC 6 – the requirement for minimum soil cover – and GAEC 9, which prohibits the conversion of permanent grasslands, especially in Natura 2000 areas. Since 2023, due to a decrease in the share of grasslands in the structure of agricultural land below the control threshold, any conversion of grassland without the consent of Agency for Restructuring and Modernization of Agriculture (ARMA) has been prohibited (Regulation (EU) 2021/2115 of the European Parliament…) [8].

Similarly, in Kazakhstan, pastures are characterized by low quality. According to data from the National Company "Ghalysh Sapary", 87% of pastures lacked vegetation in 2023 (More than 87% of pastures…) [9]. A number of issues have also been identified that hinder further utilization of pastures, including the absence of systematic subsidies commensurate with environmental impact, secondary succession on unused plots, and a decline in farmers' practical knowledge of pasture management (Agency for Restructuring and Modernisation…) [10]. Due to their multiple functions, pastures are an important factor in mitigating environmental threats and supporting ecological balance (Knozowski P., Nowakowski J.J., Stawicka A.M. et al.) [11].

Materials and methods

In the writing of this article, the following research methods were used: the legal method – in order to study and analyze the legislative and regulatory framework for the use of agricultural land; the monographic method – for the study of scientific works by foreign and domestic scholars on the issues of pastureland use; the statistical method – to present statistical data on the use of agricultural lands and to jus-

tify their efficiency; and the cartographic method – which includes the method of remote sensing, allowing for the collection of objective information based on satellite imagery, and linking the necessary information about the use of land resources in agriculture to specific land plots in real time. Existing technologies make it possible to promptly analyze information on land use, and the results of the analysis can be interpreted in various formats.

At present, to reflect the qualitative condition of pastures, satellite monitoring of land is carried out using information technologies, satellite images, and other tools. In order to obtain an accurate assessment of the current situation, multiple measurements and the collection of necessary data from various sources are carried out. All of this ensures the collection of information in real time within a clearly defined timeframe for analysis by combining satellite and statistical data for comparison and identification of changes and dynamics. According to FAO and national statistics, approximately 15% of all pasturelands - roughly 27 million hectares - are currently affected by degradation, highlighting an urgent need for effective restoration and sustainable management measures.

Results

An analysis of the dynamics of pastureland in the Republic has shown that during the years of reform, the area of utilized pastures has sharply decreased (figure 1).

As shown in figure 1, the area of pastures has sharply decreased since 1991 due to their reclassification into reserve lands. Currently, 35% of pastures are concentrated in reserve lands and remain unused, despite widespread reports in the media about a shortage of pastureland. In the course of the study, an analysis was conducted on the dynamics of pasture degradation from 2020 to 2023. According to statistical data, the qualitative condition of pastures is low and continues to deteriorate each year (figure 2).

The figure shows, that 87% of pastures in Kazakhstan are not covered with vegetation, and this indicator is also low in the Akmola region, amounting to about 83%. At the same time, there is a nationwide shortage of pastureland, particularly near settlements where households need to graze livestock. Research has shown that pastures are mainly used within and around settlements, while remote pastures remain underutilized. Grazing on distant and seasonal pastures is hindered by the lack of pasture infrastructure. As a result, overgrazing occurs on the same land areas within a 5–6 km radius of settlements, leading to severe land degradation.
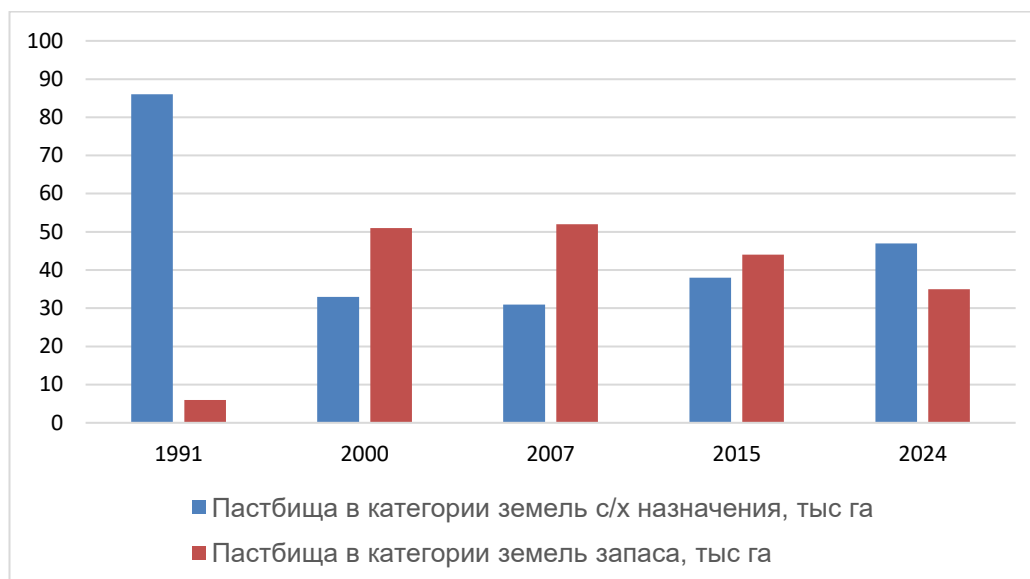
Note: data from the Committee for Land Resources Management of the Ministry of Agriculture of the Republic of Kazakhstan (Consolidated analytical report ...) [12]
Figure 1 – Dynamics of Pastureland Area in the Republic of Kazakhstan
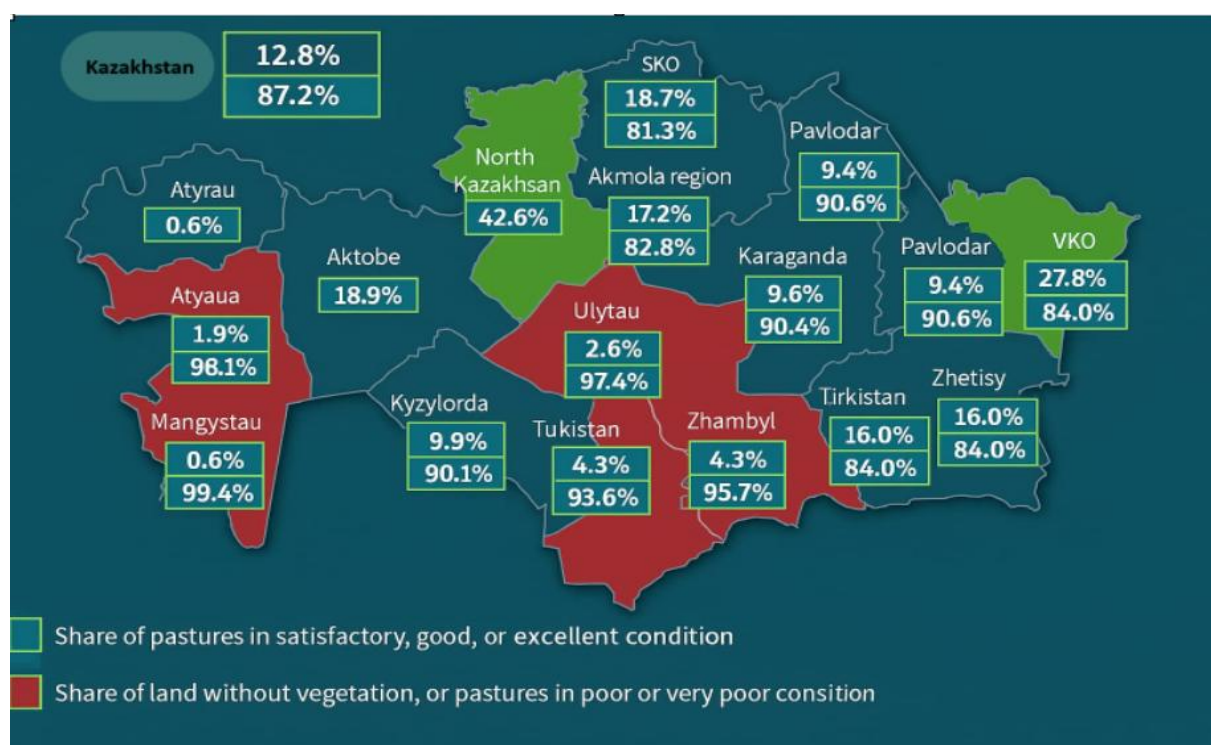
Note: source (More than 87% of pastures…) [9]
Figure 2 - Proportion of pastures covered by vegetation by region

Consequently, large tracts of land remain unused, while the limited pastureland near settlements experiences excessive pressure, which prevents the growth of livestock numbers and corresponding livestock production. This makes livestock farming in the country economically unviable. Moreover, the unregulated use of the same grazing areas poses a serious threat of degradation to more than 27 million hectares of pastureland. Therefore, pasture management requires urgent legislative measures to prevent further degradation.

The object of this research is the Yereymentau district of Akmola region. This district was chosen due to the fact that pastures make up 80% of its total land fund. The total area of the district is 1.8 million hectares. Given the

vast pasture resources, a Pasture Management Plan for Yereymentau District was developed and approved in 2024 (Plan for the management and use…) [13]. To ensure sustainable livestock development and implement a rational pasture management system, rotational grazing schemes were developed for each settlement, taking into account access to water sources. This approach is expected to maintain the productivity of natural ecosystems, increase land-use efficiency, and improve resilience to climate change.

The analysis revealed a high level of pasture availability in the Yerementau district of the Akmola region. So, as of 01.01.2024, there were 44.0 thousand heads of cattle, 64.5 thousand heads of small cattle, 24.8 thousand horses in the region. In addition, 23.5 thousand heads of cattle, 38.8 thousand heads of small cattle and 10.0 thousand heads of horses are fixed in private subsidiary farms. The pasture utilization rate is 68.5%. Thus, 31% of the pasture area remains undeveloped, that is, it is used inefficiently. However, in the jerkarta, gharysh geoservice.kz through space monitoring in the Yerementau region, as of 2023, the need for pastures was determined at 72.6 thousand hectares (figure 3).
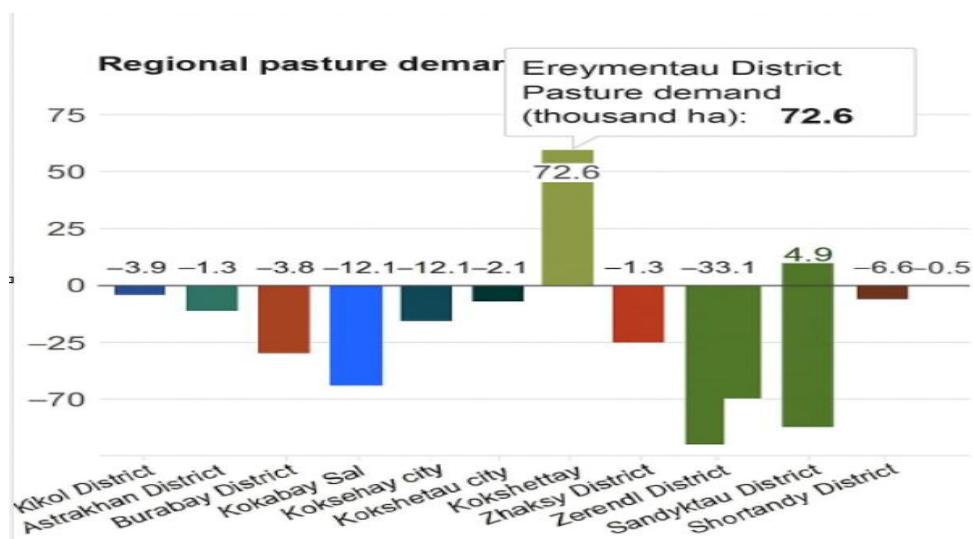
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Figure 3 – Pasture Demand in the Yereymentau District

It is possible that this indicated demand reflects a shortage of pastureland for grazing livestock owned by the local population. Meanwhile, an assessment of the actual grazing load reveals a contradiction, indicating an imbalance in the use of pasture resources. Although there are 974 thousand hectares of pastureland in the Yereymentau district, the livestock population totals 133 thousand heads, or 66.5 thousand livestock units, which require approximately 299. In our opinion, the reason is that livestock is concentrated near populated areas and this leads to congestion in some areas of pastures and idleness in others. In order to determine the actual condition of the agricultural sector and develop strategies to improve its efficiency, Kazakhstan plans to conduct an agricultural census from August 1 to October 20, 2025 (National Agricultural Census 2025) [14].

It was also revealed that there is another problem in effective pasture management, which is that land use schemes do not specify the boundaries of reserve lands. Thus, 175 thousand hectares of pastures are concentrated in the Yerementau region in the reserve lands. These are lands that are not assigned to anyone and are not used, but are a reserve to meet the need for pastures. This makes it difficult to visualize the location of these lands for drawing up pasture turnover schemes and making other decisions on the use of pasture lands. For example, the exchange of land plots between land users to bring pastures closer to the settlement, and others.

In order to increase the efficiency of pasture management, the most urgent measures in the current conditions are to maintain a balance between the number of grazing livestock and the feed capacity of the land. This means that it is necessary to maintain an optimal level of load on pastures, but this principle is not observed when using pastures in the republic.

One of the most urgent measures in the current conditions is to maintain a balance between livestock and pasture feed production. Based on the analysis of modern international approaches to assessing the load on pastures (Wang Y., Huang H., Tian Y. et al.) [15], this

study adapted and clarified the classification of levels of anthropogenic load on pastures in the context of Kazakhstan. In other words, it is necessary to ensure an optimal level of load on the pastures. Depending on the ratio between the actual load on livestock and the productivity of pastures, the pasture load is classified as excessive, optimal or insufficient (table).

Table – Classification of Pasture Grazing Pressure

Zone types	Causes	Of Action	Expected effect
Excessive (leads to pasture degradation)	− as a result of overgrazing, vegetation is trampled and destroyed; − pasture productivity decreases; − pasture quality worsens; − feed value decreases.	to introduce restrictions on grazing, to establish seasonal prohibitions, to organize the restoration by "resting" the land through the introduction of a system of pasture turnover	restoration of herbage, reduction of pasture degradation
Optimal (ensures effective use)	− through uniform grazing of livestock; − ensures the preservation of biodiversity and sustainability of pastures; − is aimed at increasing the productivity of pastures.	motivate farmers to transfer grazing to these areas by creating infrastructure (by improving access, providing water sources, and organizing cattle runs)	reducing pressure on congested areas, ensuring uniform use of unused pastures
Insufficient (pastures are not fully used)	− insufficient number of livestock is grazed; − does not ensure the full use of the feed stock is not ensured; − land use is not rational.	implement natural regeneration programs or agrotechnical measures, including grass seeding	increasing pasture productivity
Note: compiled by the authors			

Table systematizes the types of pasture zones according to the degree of anthropogenic load, provides recommendations for restoring degraded territories, redistributing the load, involving unused areas, and suggests a differentiated approach to their management. The classification was developed based on the principles of adaptive land management and is aimed at substantiating management decisions.

In addition, it is necessary to improve the legislative framework for pasture management. The analysis showed that repeated amendments to the law on pastures have not yielded concrete results in their implementation, which suggests that specific measures are needed to improve legislative support. In 2025, the government is trying to provide subsidies for the purchase of livestock, however, this is not enough. It is necessary to stimulate land users by providing tax incentives, granting preferential loans, reducing the cost of feed, and creating a logistics system for the sale of products.

These measures are strategic in nature and can serve as a basis for further analysis of the effectiveness of various pasture management scenarios.

Discussions

The conducted research has shown that the problems of pasture land use in Kazakhstan are of a complex nature, affecting both natural and institutional aspects. Despite having vast pasture areas, their actual utilization remains limited due to underdeveloped infrastructure, spatial imbalance, and the lack of effective regulatory mechanisms. The case of the Yereymentau district clearly illustrates the discrepancy between the region's potential and the actual level of land use. Although formally well provided with pastureland, most of the grazing pressure is concentrated around settlements, while remote rangelands remain unused. This leads to localized pasture degradation and a decline in productivity. Such a situation arises from the lack of access to water sources, roads, communication systems, and insufficient incentives for agricultural producers to develop new areas.

Moreover, pasture monitoring across the country confirms the high level of land degradation – over 87% of pastures are in poor or very poor condition, which increases the risk of ecological instability. In the context of growing livestock numbers, unregulated land use without rotation and recovery reduces forage capacity and heightens social tensions in rural areas. To improve the efficiency of pasture use, it is necessary to implement territorial planning that considers bioclimatic factors, as well as to develop digital tools for monitoring and management. The integration of remote sensing data, satellite imagery, and geoservices enables more accurate determination of

grazing pressure and regulation of land use. Equally important is the improvement of the legal and regulatory framework.

The current Law of the Republic of Kazakhstan on Pastures does not provide sufficient mechanisms for the equitable distribution of rangelands, particularly for personal subsidiary farms (PSFs). It is recommended to strengthen the role of local executive authorities, promote agricultural cooperation, and provide subsidies for pasture infrastructure development. Thus, sustainable pasture land use is impossible without comprehensive reform - technological, legal, and institutional. The implementation of scientifically grounded solutions based on modern data and an interdisciplinary approach will restore pasture productivity and ensure the country's food security.

Conclusions

1. In order to improve the efficiency of pasture use, it is necessary to enhance the implementation mechanism of the Law of the Republic of Kazakhstan on Pastures, with an emphasis on the actual allocation and restoration of public pastures for the needs of rural communities. It is proposed to strengthen control over the qualitative condition of pastures, stimulate the return of unused land into circulation, and develop state support measures aimed at reducing feed costs and increasing the legal protection of agricultural producers.

2. International experience, particularly the practice of Poland, demonstrates that effective pasture use is achievable under conditions of legal protection, promotion of ecological functions, and implementation of GAEC (Good Agricultural and Environmental Conditions) standards-such as minimum soil cover and the prohibition of pasture conversion in Natura 2 000 areas. In this regard, it is advisable for Kazakhstan to develop national ecological standards for sustainable pasture use, analogous to the GAEC framework, with a focus on preventing degradation, preserving biodiversity, and supporting natural ecosystems on agricultural lands.

3. It is necessary to conduct an inventory and digital mapping of reserve lands, with clear indication of the boundaries and areas of pasturelands, which would facilitate their inclusion in circulation and ensure a balanced distribution of grazing pressure. The digitalization of pastureland management should become a key element of the new land use model. The use of satellite monitoring, geoservices, and GIS systems will enable the timely tracking of actual grazing loads and the condition of pastures, identify zones of degradation, and support real-time decision-making.

4. It is important to implement a rotational grazing system and pasture turnover schemes at the level of each rural settlement, taking into account actual livestock demand and vegetation types, in order to preserve productivity. This is feasible through the development of infrastructure to access remote pasture areas - watering points, livestock driveways, roads, and communication systems – which will help reduce overgrazing around settlements and involve unused areas in productive use.

5. To ensure the sustainable development of the sector, a comprehensive institutional model for pastureland management must be introduced. This model should include centralized land inventory, strengthening the role of local akimats (municipal administrations), inter-farm cooperation, government programs for the restoration of degraded lands, and the training of farmers in rational grazing practices based on scientifically grounded norms.

Author's contribution: Kurmanova Gulnara Kenesovna: general coordination of research, development of methodology, formation of content, collection, analysis and generalization of data, interpretation of research results, referral of the article for publication; Bielska Anna: bibliographic review of the literature, evaluation of the research results, preparation of conclusions; Mutalipova Kuralay Kalikhankyzy: collecting, analyzing and summarizing data, writing a conclusion.

Conflict of interests: the authors declare no conflict of interest.

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Табиғат пайдалану экономикасы