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Regulation of Mechanisms for Management of Environmental Issues of Rational Use of Natural Resources and Pastures

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ABSTRACT

To improve the efficiency of the use of territories, it is necessary to develop legal mechanisms for environmental regulation of the use of pastures as one of the types of agricultural land in general. Underestimation of the depletion of natural resources and environmental damage leads to a distortion of indicators of economic development and progress in agricultural production, which ultimately affects the efficiency of agricultural land management. Based on the identified problem, the purpose of the article is to propose mechanisms for improving the regulation of the rational use of natural resources and pastures. The main method for collecting data is the analysis of documents and sources in the field of regulation of environmental legislation and state statistics of the Republic of Kazakhstan. To regulate the rational use of natural resources, we propose a set of measures in five areas. To improve the efficiency of pasture lands, we propose organizational, economic, legal, and special measures (regulation of property rights, introduction of a system for the restoration of natural pastures at a systematic level, development of a forage base, development of special maps of the ecological state of natural resources). According to the authors of the article, the proposed measures should be systematic and become mechanisms that will have an impact on improving the efficiency of the use of agricultural areas.

1. INTRODUCTION

In recent years, a comprehensive assessment of natural bioresources and environmental protection has been given increasing importance [1]. Despite this, the underestimation of the economic value of these resources, particularly pasture ecosystems, has led to their degradation [2]. This degradation not only diminishes their ecological value but also their utility for human economic activity. As a result, the sustainability of these ecosystems, which are vital for the agricultural sector, is at risk [3].

In the recent past, meadow forage production carried out first an economic, and then an agro-energy assessment of technologies and methods of feed production in various pasture ecosystems [4, 5]. Currently, there is an urgent need to determine the real value (value) of natural services and resources that are provided by pasture ecosystems [6]. Considering the economic value of hayfields and pasture ecosystems is essential for environmental protection and the use of natural resources, adequate determination of the value of natural resources [7]. The absence or underestimation of the value of natural goods leads to a deliberate decrease in the benefits of their conservation compared to traditional estimates of the development of meadow fodder production giving easily obtained results [8]. Economic assessment is also necessary to determine the effectiveness of investments in preserving and increasing the productivity of natural pasture ecosystems [9], it is the basis for the distribution of limited material resources [10], a necessary condition for obtaining financial resources [11].

Some work has been carried out in Kazakhstan to assess the impact on the environment, in particular, the biodiversity of nature. However, the research mainly used such biological resources that had a consumer value [12], and the calculations of the economic assessment were based on the available prices for a particular type of product – hunting, fishing, collecting forest gifts, logging, peat processing, recreational activities [13]. There have been no studies on the development of

methods of ecological and legal assessment of natural meadow ecosystems. This served as the basis for this work (Figure 1).

Kazakhstan's unique geographical and ecological landscape, combined with its economic reliance on agriculture, makes it a critical case study for understanding the challenges and opportunities in natural resource management. The country's vast pasturelands are not only a key resource for livestock farming but also play a significant role in maintaining biodiversity and ecological balance [14]. However, these resources are under threat due to overuse, mismanagement, and inadequate legal frameworks. By focusing on Kazakhstan, this research highlights the urgent need for more robust regulatory mechanisms to ensure the sustainable use of natural resources [15], which is vital for the country's economic and environmental well-being. Despite some existing research on environmental impact assessments in Kazakhstan, there is a lack of studies focusing on the ecological and legal assessment of pasture ecosystems, particularly in the context of their rational use.

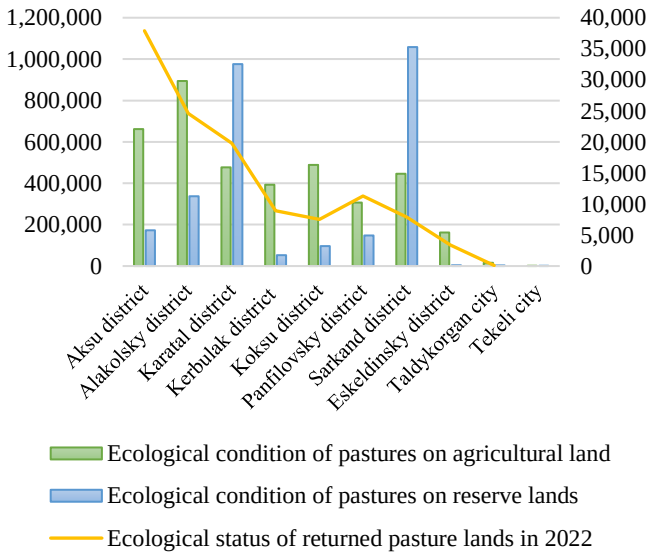

Figure 1. Ecological condition of pasture lands in Zhetysu region of the Republic of Kazakhstan

2. LITERATURE REVIEW

Currently, ecology as a doctrine of the relationship between organisms and their environment has turned into a science of life phenomena in nature. This definition includes the study of the influence of the external environment on organisms and, accordingly, the reverse effect exerted by organisms on their environment, these functions are interrelated and changeable [16]. From a variety of complex phenomena, ecology first tries to identify certain processes and dependencies to find out the degree of influence of individual factors and thereby learn to understand further broader relationships in the landscape. Along with the development and formation of the general ecology, there was a process of formation of its applied directions, among which the key place belongs to agricultural ecology [17]. Agricultural ecology has become increasingly important as it focuses on the relationship between agricultural practices and the environment. This branch of ecology investigates the impact of human activities, particularly farming, on natural ecosystems, and seeks to develop methods that minimize environmental damage while optimizing agricultural productivity. The shift towards agricultural ecology reflects the growing recognition that traditional farming methods, if left unchecked, can lead to significant environmental degradation, including soil erosion, loss of biodiversity, and water contamination.

This happened primarily due to the fact that for quite a long time many researchers studied only landscape forms that were not exposed to human influence or were less affected by it. The objects of close attention were caves, swamps, dunes, deserts, steppes, forests, and tundra, and only relatively recently many scientists turned to the study of agricultural landscapes [18].

The rapid development of industry over the past century has significantly altered agricultural landscapes [19], leading to a range of environmental challenges. One of the most pressing issues is soil degradation, which has been exacerbated by industrial agriculture practices such as intensive tillage, monoculture cropping, and the excessive use of chemical fertilizers and pesticides. Studies have shown that these practices deplete soil nutrients, reduce soil organic matter, and lead to the erosion of topsoil, which is critical for plant growth and agricultural productivity [20]. For example, research conducted in Kazakhstan's agricultural regions has highlighted the severe degradation of soils due to overgrazing and unsustainable farming practices, emphasizing the need for better land management strategies [21].

In addition to soil degradation, industrial agriculture has also contributed to widespread pollution of both terrestrial and aquatic ecosystems. Studies have documented the presence of pesticide residues in agricultural soils, which not only affect soil health but also pose risks to human health through the consumption of contaminated food [22]. Moreover, the runoff of these chemicals into rivers and lakes has caused the eutrophication of water bodies, leading to the loss of aquatic biodiversity and the disruption of freshwater ecosystems.

Additionally, the intensification of livestock farming, for instance, has created conditions that are conducive to the spread of infectious diseases. Large concentrations of animals in confined spaces, combined with the use of antibiotics and growth hormones, have led to the emergence of antibiotic-resistant bacteria and zoonotic diseases—diseases that can be transmitted from animals to humans [23].

Similarly, the increased use of monocultures—growing a single type of crop over large areas—has made agricultural systems more vulnerable to pests and diseases. Studies have shown that the lack of crop diversity in industrial agriculture can lead to significant crop losses due to disease outbreaks, which can have devastating effects on food security [24].

As a result, there was a need for the greening of agriculture, i.e., the application of environmental laws for the successful functioning of agricultural ecosystems [25]. Agricultural ecology is the science of the relationship of living organisms with each other and the environment (inorganic), as well as with humans, about the structure, connections, and functional activity of artificially created landscapes. Ensuring sustainable agricultural production, preserving and reproducing the natural resource base of the agricultural sector, and minimizing the impact on the environment are the main tasks facing this science [26].

To ensure sustainable agricultural production and effective management of territories, it is necessary to increase the efficiency of the regulation of agricultural land [27, 28]. For Kazakhstan, such issues as incorrect recognition of land ownership rights, improper use of land, and privatization are

among the most important [29]. The unresolved problems of agricultural land regulation exacerbate land management [28]. Researchers record that the amount of abandoned land in Kazakhstan is increasing every year [30]. The reduction of land suitable for agriculture has an impact on the development of pasture farms in Kazakhstan, which directly affects the difficulties in the field of cattle breeding [31]. As a result, the need to solve environmental and legal issues and issues in the management of rural areas will be able to improve the country's food security [32], which will undoubtedly have an impact on increasing the sustainability of the development of the Central Asian region and improve the quality of life of the population of Kazakhstan. Despite the critical importance of sustainable pasture management, there remains a significant gap in the existing legal and regulatory frameworks in Kazakhstan. Current legislation often fails to adequately address the unique environmental needs of pasturelands or to enforce sustainable practices that could mitigate the damage caused by industrial agriculture. This gap highlights the need for comprehensive research that not only explores the ecological impacts of current practices but also seeks to identify and propose legislative improvements that can support the rational use of natural resources. Based on this, in this study, under the research question, we understand the identification of how it is necessary to improve legislation in the field of environmental and legal regulation of the rational use of natural resources.

The purpose of the article is to propose mechanisms for improving the regulation of the rational use of natural resources and pastures.

3. METHODS

This study employs a systematic and rigorous approach to the analysis of legal frameworks and ecological data related to the rational use of natural resources and pasture management in Kazakhstan. To ensure transparency and reproducibility, we utilized a PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework adapted to the specific needs of this research. The PRISMA method is traditionally used in systematic reviews to outline the process of selecting and analyzing studies; however, it has been adapted here to guide the comprehensive selection, screening, and inclusion of relevant legal documents, governmental reports and academic literature (Table 1).

Table 1. Use of PRISMA model in the study

Steps	Step Name	Description of the Procedure
Step 1.	Identification of Sources	Authors conducted a search thorough using citation databases such as Scopus, Web of Science, and Google Scholar. The keywords used in this search included terms such as "pasture management," "natural resource regulation," "environmental law," "sustainable agriculture," "Kazakhstan land use," and "legal framework for ecology." In addition to academic literature, we identified key governmental legal documents and reports that are central to the regulation of natural resources in Kazakhstan. These included the Land Code of Kazakhstan, the Environmental Code, and specific legislative acts related to pasture management and environmental protection. Governmental sources were accessed through official repositories and websites of the Ministry of Ecology, Geology, and Natural Resources of Kazakhstan.
Step 2.	Screening for Relevance	Following the identification phase, a thorough screening of the collected documents was conducted to ensure their relevance to the study's focus on pasture management and environmental regulation in Kazakhstan. The screening process involved evaluating each document for its direct relevance to key topics such as sustainable land use, ecological impact, and the legal frameworks governing natural resources in Kazakhstan. Documents that were found to lack a significant focus on these areas or that addressed unrelated environmental or agricultural contexts were excluded from further consideration.
Step 3.	Assessment of Eligibility	In the eligibility phase, the full texts of the screened documents were assessed more rigorously to determine their applicability to the research question. This phase involved applying specific criteria, including: • Direct Relevance to Pasture Management • Ecological Impact • Enforceability of Legal Provisions Documents that met these criteria were deemed eligible for inclusion in the final analysis.
Step 4.	Inclusion in Analysis	The selected documents were subjected to qualitative content analysis, allowing for the identification of themes, regulatory gaps, and areas for improvement.

In addition, a comparative legal analysis was performed to benchmark Kazakhstan's legislative framework against international best practices. This involved comparing the identified legal provisions with those from other countries known for effective pasture management and environmental protection. The goal was to highlight potential gaps in Kazakhstan's legislation and to propose improvements based on successful models from other jurisdictions.

4. RESULTS

The analysis conducted in this study led to several key findings and recommendations for improving the regulation of natural resource use and pasture management in Kazakhstan. These results are grounded in the detailed document analysis and are further contextualized by comparisons with existing literature and international best practices.

The document analysis revealed significant gaps in the current regulatory framework governing pasture management

in Kazakhstan. Key areas where the legislation is lacking include:

Insufficient Legal Protections for Pasturelands: The analysis of Kazakhstan's Land Code and Environmental Code indicated that while there are provisions for land use and environmental protection, these are often too general and lack specific guidelines for the sustainable management of pasturelands. This finding is consistent with previous studies, such as those by Yerkinbayeva [33] and Baidalina et al. [7], which also highlighted the need for more targeted regulations.

Weak Enforcement Mechanisms: The legal documents frequently cited enforcement as a major challenge, with limited mechanisms in place to ensure compliance with environmental regulations. This weakness in enforcement is not unique to Kazakhstan; similar challenges have been documented in other post-Soviet states where legal frameworks have struggled to adapt to the complexities of modern environmental management [34].

Lack of Integration between Ecological and Economic Policies: The analysis also found that existing regulations often fail to integrate ecological considerations with economic policies effectively. For example, the laws governing land privatization and agricultural subsidies do not adequately account for the long-term ecological impact of these policies on pasturelands. This lack of integration is a critical issue, as highlighted by Nasiyev et al. [6], who argue that sustainable land management requires a holistic approach that balances economic incentives with environmental stewardship.

In the mechanism of legal regulation of the use and protection of these agricultural lands in Kazakhstan, a large place is occupied by land, agricultural, and environmental legislation, the norms of which do not fully ensure their rational use and protection to achieve the principles of sustainable economic development.

In our opinion, it is necessary to improve the efficiency of regulation of the use of seasonal pastures occupying a significant share in cattle breeding. First, it is a natural resource whose fruits are used mainly by people who own herds of different types of livestock. However, such a view does not fully reflect the importance of pasture for the life of mankind. Being an organic part of the mountain, foothill, steppe, and other local ecological systems, pasture spaces are places of growth of many species of grasses, shrubs, and forests, as well as the habitat of wild animals and a source of mineral resources.

Thus, we believe it is necessary to change the criteria and requirements for the organization of seasonal pastures. In Kazakhstan, pastures, along with the forest fund, are the main repository of biodiversity. Pasture as a natural resource also has an exceptional environmental protection value, both in mountainous districts and in low-forest and treeless areas. It is the herbaceous and shrubby ecosystems used as pastures that ensure the maintenance of the water balance of catchments in these areas, prevent soil erosion, and control local geochemical cycles. The pasture acts as an important source of wildlife, provides a significant part of the honey collection, and contains resources of medicinal, food, and ornamental plants.

Territories of seasonal pastures are rich in mineral ores, as evidenced by the results of exploration work carried out by scientific centers and their qualified specialists. In the mountains with extensive pastures, there are rich deposits of minerals, most of which have not yet been developed. The existing approach to the organization of seasonal pastures indicates a consumer attitude toward natural resources. On the one hand, when using a territory, economic tasks are solved to ensure the supply of meat, milk, and wool to the market. On the other hand, serious damage is caused to the ecological system. The deterioration in the quality of pastures eventually has a negative impact on the same economic indicators. Nevertheless, the interdependence of environmental and economic factors remains out of sight of statesmen, who do not consider the maximum permissible pastures of the republic, where no more than 7-8 million heads of cattle and sheep can be kept on an extensive basis under conditions of extensive breeding.

To solve this problem, it is necessary that agricultural departments with the involvement of experts take part in decision-making on the regulation of the use of seasonal pastures by livestock farms. In Kyrgyzstan, decisions on the rational use of pastures, the premise of this result, were outside the sphere of influence of livestock breeders, since pastures were the responsibility of agricultural specialists who determined the time and place for grazing [35].

The territories where seasonal pastures are organized are so unique that it is necessary to develop mechanisms for their conservation and restoration. Among these mechanisms, for example in Kazakhstan, assumptions have even been expressed about the need to make greater use of pack animals during migrations to reduce the negative impact of vehicles on grazing areas.

However, in our opinion, the use of pasture restoration in a complex of legal and production regimes contributes to the preservation of large areas with such a vital natural resource for many years. For comparison, in Kazakhstan and Germany, vast territories of fertile pastures were turned into a sandy desert as a result of overgrazing without seasonal rotation of pastures and the tendency to keep only animals of one species in the herd. Therefore, German legislation restricts the transfer of agricultural lands to lands of other categories and determines the need for measures to combat the depopulation of mountainous territories and territories unfavorable for agriculture. To prevent land degradation, the experience of Norway is interesting, in which the possibility of fragmentation of land plots in unfavorable areas of the north and center of the country is legally limited to consolidate the population in these regions [36], which contributes to an even distribution of the population.

The protection of agricultural land in the USA is manifested primarily in the fact that in the most developed agricultural regions, a ban on the purchase of agricultural land by persons who are not farmers has been introduced [34].

This provision is due to the desire of the state to prevent the purchase of land for further use outside of agricultural turnover. This prohibition does not prevent farmers from forming an association in the form of a family corporation, i.e., the owners of the farm must be family members.

Another important tool for the conservation of pasture biodiversity is to use intensive methods of animal husbandry based on strengthening and sustainable provision of the feed base.

The rational use of pasture lands, which are provided with the cheapest and highest quality animal feed, and most importantly the availability of livestock to easily digestible nutrients of natural pastures. Pasture animal husbandry has received the greatest development in Kazakhstan, therefore, in the context of the revival of domestic animal husbandry, the tasks of introducing new advanced scientific, technological

[37, 38], and other innovative technologies and developments were set [6, 39, 40].

Unlike seasonal pastures, which are based on a naturally grown forage base, cultivated pastures contain forage vegetation, often distributed by species. This indicates the possibility of a different nature of the use of such lands, i.e., the presence of special purposes of economic use – animal grazing, and hence a special procedure for regulating such land use. Thus, pastures are a special object of rights [33].

The main role in the mechanism of legal regulation of the use and protection of land belongs to land law since the norms of this branch determine the foundations of the legal regime of all lands.

However, there are no special norms in the land legislation regulating the procedure for the provision and use of pastures, fixing the methods of their rational use and protection. So far, the issues of technology for the use of tundra, forest tundra, and northern taiga lands in reindeer husbandry have been studied only in the works of biologists and representatives of agricultural science. In the theory of land law, the issue of the need to determine the specific rights and obligations of land users on individual agricultural land has been raised for a long time. However, there is no shortage of theoretical works reminding us that the most important function of the land is its fulfillment of the role of the main means of production in agriculture. Agricultural lands are subject to special protection. The use of these lands for purposes not related to agricultural production is allowed in exceptional cases. Agricultural lands include arable land, fallow land, lands occupied by perennial plantings, hayfields, and pastures. According to the Land Code, pastures are land plots provided and used for year-round or seasonal grazing of farm animals. When grazing farm animals on pastures, haymaking is allowed for the purpose of forage harvesting in cases when the productivity of pastures exceeds the need for feed for grazed farm animals while observing the maximum permissible load standards for the total area of pastures [41].

Agricultural lands are granted for private ownership to citizens of the Republic of Kazakhstan for the development of personal subsidiary farming, gardening, and suburban construction. Foreigners, stateless persons, foreign legal entities, as well as legal entities in whose authorized capital the share of foreigners, stateless persons, and foreign legal entities, is more than fifty percent, for temporary land use on lease terms for up to 25 years. However, this provision has been suspended. An important step in the sustainable use and protection of pasture lands was the adoption of the law, which regulates public relations related to the rational use of pastures and is aimed at improving the condition of pastures and their infrastructure, preventing the degradation of pastures [42, 30].

The innovations of this law were as follows.

Firstly, it legislatively fixed the following legislation on pastures, such as the rational use of pastures and their accessibility for individuals and legal entities; publicity of events related to the provision and use of pastures; participation of individuals and legal entities in resolving issues of pasture management and use.

Secondly, the powers of the Government, the authorized body, akimats of regions, districts and rural districts, district maslikhats, and the system of local self-government bodies are defined.

Thirdly, it provides for the development of standards for the maintenance of livestock, considering the climatic [43]. characteristics of the regions and the right to approve these standards by the authorized body. District and rural executive bodies, together with the local government system, should monitor pastures and develop plans that determine the area of pastures, their productivity, the number of permanent livestock, and the area of unused pastures. It is determined which lands contain livestock, and due to this, a system of pasture regulation is formed. The main plan is approved by the district maslikhat. After that, the plan will be a regulatory legal act. To implement the activities of the plan, it is planned to develop agreements on the use of pastures.

Fourthly, it provides for the conclusion of a quadripartite agreement with the akim of a rural district, the owner or user of a land plot, users of pastures, and a local self-government body.

Fifthly, there are articles defining the objects of pasture infrastructure and regulating the rational use of pastures. Sustainable pasture management is an integrated approach and means that the management of pasture productivity and capacity should be closely linked to the growth of livestock, its management, and feed production [44]. This approach complements the principles of the concept for the transition of the Republic of Kazakhstan to a green economy [45].

The concept of Kazakhstan's transition to the principles of the green economy is an element of the paradigm of a modern sustainable type of society [46] focused on economic achievements by improving the well-being, quality of life of the population of Kazakhstan and the country's entry into the top 30 most developed countries in the world while minimizing the burden on the environment and degradation of natural resources. An approach focused on minimizing the burden on the environment, the development of pasturelands, and other issues aimed at solving the problems of managing agricultural territories leads to the need for constant changes in environmental regulation and forming a more comprehensive, intersectoral regulatory framework based on a combination of direct, economic, and informational tools of legal regulation. This thesis is supported by the fact that since the adoption of the Environmental Code of the Republic of Kazakhstan in 2021, it has been amended 63 times (a significant part of which falls in the last three years) [47].

5. DISCUSSION

The results and recommendations presented in this study are closely aligned with the broader goals of sustainable development and environmental regulation in Kazakhstan. The country's transition to a "green economy," as outlined in its national strategy, emphasizes the need for sustainable agricultural practices that conserve natural resources while supporting economic growth [48]. The proposed mechanisms for improving the regulation of the rational use of natural resources and pastures contribute directly to these objectives by addressing the overuse and mismanagement of pasture lands, which are critical for maintaining biodiversity, ecological balance, and the long-term viability of agricultural production.

The results of the study allow us to confirm the initially put forward research question about the need to improve legislation in the field of environmental and legal regulation of the rational use of natural resources has been identified.

We believe that measures to improve legislation should be aimed at regulating the rational use of natural resources, with the allocation of a set of measures to regulate the use of

pastures.

To regulate the rational use of natural resources, we propose the following set of measures.

Firstly, prepare a special strategic plan that will analyze the ecological state of natural resources, taking into account the laws in this are. There is a need for more detailed legal guidelines that address the unique requirements of pasture management. These guidelines should include clear definitions of sustainable grazing practices, limits on livestock density, and seasonal rotation requirements to prevent overgrazing;

Secondly, the definition and legislative consolidation of environmental safety standards in the use of natural resources. By clearly establishing these standards within the legal framework, the government can enforce consistent practices across various sectors, minimizing environmental degradation. This approach not only protects the ecological integrity of the country's diverse landscapes but also aligns with international environmental commitments [49].

Thirdly, the consolidation of ownership of land resources, the conservation and sustainable use of pastures, the approval of the form of ownership. The approval of specific forms of ownership tailored to pasture conservation will encourage practices that balance economic use with ecological preservation, ensuring that these vital ecosystems remain productive and resilient;

Fourthly, improving mechanisms for protecting the rights of users of natural resources. Strengthening these protections ensures that landowners, farmers, and local communities can access and utilize resources without undue interference, fostering a sense of security and responsibility;

Fifthly, legislative consolidation of the order and conditions of seasonal use of natural resources. It is necessary to develop a section on land management issues. Improvement in Kazakhstan of the practical mechanism of all receipts from environmental payments for emissions into the environment, fines, compensation for damage caused to the environment, and payments for environmental management. Local representative bodies have the right to raise the rates of environmental payments no more than twice, and in most regions of Kazakhstan, the maximum possible rates are set. The use of environmental payments for the main purpose of replenishing the budget, rather than stimulating effective measures to prevent and reduce harmful effects on the environment, deprives them of the function of a full-fledged instrument of economic regulation of environmental protection and environmental management, because it does not have any significant impact for the purpose of improving the environment, but only increases the cost of doing business in Kazakhstan.

To increase the regulation of pasture use, we grouped all proposed directions depending on the target affiliation.

Firstly, it is necessary to apply organizational, economic [50], regulatory, and legislative measures to regulate the use of pastures.

Secondly, to increase the efficiency of land use, it is necessary to increase the growth of high-yielding livestock to consolidate the available hay and pasture resources within the boundaries of land use.

Thirdly, further strengthening of the forage base, for which it is necessary to radically improve the productivity of natural pastures and hayfields, increase them through full irrigation and the creation of cultural irrigated pastures, and improve the technology of preparation and storage of feed to reduce their costs and improve the quality.

Fourthly, improving the ecological situation of pasture lands in connection with the formation of a shortage of green and coarse feed.

Fifthly, it is necessary to develop special maps of the ecological state of Natural Resources. With the map, the ability to manage the environmental situation increases. The ecological system of pasture lands is based on the use of vast areas, and to be economically sustainable, it is very important to reduce the costs of using fuel, feed, and fertilizers. Due to the low dependence on external costs, the impact on the environment is reduced and the stability of the environmental situation increases [51].

Adaptation of the rational use of natural resources to environmental conditions implies imitation of the functioning of ecosystems of wild herbivorous animals.

While this study provides a comprehensive analysis of the current state of pasture management and environmental regulation in Kazakhstan, limitation should be acknowledged to provide a balanced perspective. Te study's focus on Kazakhstan's specific context may limit the generalizability of the findings to other countries with different ecological and regulatory environments. However, the principles and recommendations discussed can serve as a model for other nations facing similar challenges in sustainable land use and environmental protection.

6. CONCLUSION

We proposed mechanisms to improve the regulation of the rational use of natural resources and pastures. The development of these mechanisms will increase the sustainability of agricultural development, rational management, and use of agricultural areas, which should increase Kazakhstan's food security and opportunities for international cooperation and trade.

Since the study was based on qualitative research methods, among the limitations of the study is the need for other researchers, managers, and stakeholders to consider that the conclusions were made without using collected quantitative data for each territorial subject of the country. Statistical data were used only from official open statistical sources published by the statistical authorities of the Republic of Kazakhstan.

Therefore, we consider it necessary to conduct separate studies on the environmental assessment of the most complex and promising areas (for example, the Zhetysu region) of the Republic of Kazakhstan in the future.

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