



Improving the Effectiveness of Land Resource Management in Kazakhstan for Achievement of Sustainable Development Principles

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ABSTRACT

The issue of sustainable development in agrarian economies is rooted not in the scarcity of land resources, but in the quality of their legal and administrative governance. While possessing a substantial land fund and being characterized by a high dependence of rural territories on the agricultural sector, Kazakhstan demonstrates the vulnerability of land-use planning due to large-scale land degradation. The objective of the study is to identify which elements of legal regulation and institutional framework constrain the effectiveness of land resource management in Kazakhstan, and which changes may be most significant for sustainable territorial planning. The empirical basis was formed through a structured survey of 44 experts from the scientific community, public administration, and land-use practice. The responses were analyzed using measures of agreement (Kendall's *W*) and non-parametric group comparison procedures. The results indicate the predominance of institutional barriers: weak enforceability of land regulations and a low level of accountability, fragmentation of interdepartmental data, and the insufficient integration of digital cadastral and remote sensing tools into managerial decision-making, as well as limited access of small land users to support and financing for land restoration. The significance of the study lies in the fact that the identified bottlenecks are amenable primarily to legal and administrative measures (strengthening law enforcement, standardizing data exchange, developing public-private partnerships, and financial mechanisms), which directly enhance the sustainability of development and the quality of land-use planning.

Keywords: Central Asia, Digitalization of the cadastral register, Institutional management, Land degradation, Land policy, Public-private partnership

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INTRODUCTION

Inefficient land resource management remains one of the key problems of agrarian economies on a global scale, affecting the achievement of sustainable development principles. The causes of inefficient management may lie in the weakness of the legal framework (Kuandykova *et al.*, 2024), the need to improve cadastral systems (Tuleyeva *et al.*, 2024; Hao *et al.*, 2025), and the insufficiency of state support mechanisms and other features often associated with national conditions and the level of development of a particular country (Klimova *et al.*, 2024; Mussatayeva *et al.*, 2024). Ultimately, inefficient management leads to planning disruptions, reduced agricultural productivity of land plots (Mukhametov *et al.*, 2024), and undermines the sustainability of territorial development (United Nations Convention to Combat Desertification [UNCCD], 2022; Eliseev,

2024). In Central Asian countries, one of the important characteristics is the difficulty of transforming established traditions, namely, their shared past. About 35 years ago, they all applied socialist approaches to agricultural management. However, since then, each country has developed its own model of land policy while accumulating specific managerial constraints (Petyukova & Dereglazov, 2024).

Our study aims at understanding how the efficiency of land resource management can be improved under the constraints of land policies that are always present in one form or another in any country.

The modern concept of land policy generally considers three principles. The first is orientation toward the concept of sustainable development, which establishes a normative benchmark: effective land management must simultaneously ensure environmental, economic, and social sustainability (Akhmetshin *et al.*, 2024; Food and Agriculture Organization, 2024). The second is land degradation neutrality, which defines an objective that can be monitored through measurable target

indicators of land condition (Akramkhanov *et al.*, 2018; Rafikov *et al.*, 2024; Nagesh *et al.*, 2025). The third is institutional economics, which explains why, even when appropriate goals and instruments exist, formal and informal norms, administrative incentives, and the distribution of authority across levels of government determine the actual outcomes of policy (Julamanov *et al.*, 2024; Damaševičius *et al.*, 2025). The interaction of these three levels (normative, target-oriented, and institutional) forms the foundation of modern land resource management policy.

Kazakhstan is of particular interest for the study of land resource management: possessing one of the largest land funds in the region (more than 272 million hectares of agricultural land), the country faces a growing gap between the resource and the effectiveness of its administrative and economic utilization (Julamanov *et al.*, 2024). Agriculture in Kazakhstan forms a significant share of GDP and employs a large number of people in rural areas (Alipbeki *et al.*, 2024), which makes the quality of land resource management a direct factor in food security and regional development.

The scale of the problem in Kazakhstan is significant: according to available estimates, more than 75%-90% of the country's agricultural land is affected to varying degrees by degradation processes, while the area of degraded pastures exceeds 27-29 million hectares (Food and Agriculture Organization, 2024; Huber *et al.*, 2025; United Nations Development Programme [UNDP] Kazakhstan, 2025).

However, land degradation is not only a consequence of natural conditions but primarily of governance failures: the absence of effective control over land use, weak incentives for investments in soil restoration, and ineffective interaction between the state and business in this sphere (Akramkhanov *et al.*, 2018; Saparov *et al.*, 2024; Solokov, 2024; Salem *et al.*, 2025).

In the academic literature on land resource management in Kazakhstan, a persistent gap is recorded between the declared goals of land policy and its practical outcomes. Scientists explain this gap primarily through institutional factors: the incompleteness of the land cadaster, fragmentation of land-use monitoring, and the weakness of advisory infrastructure (Julamanov *et al.*, 2024; Novak & Jelic, 2025). The need for land resource management, combined with weak law enforcement mechanisms, further limits access of small farms to subsidies and state support (Erkin *et al.*, 2022; Alipbeki *et al.*, 2024; Kwatra *et al.*, 2024).

In accordance with the outlined problem and the conceptual justification of the study, we formulated the following research tasks: (1) to identify the problems and barriers in the functioning of land resource management in Kazakhstan; (2) to conduct research to find possible directions for improving the application of land resource management methods; (3) to formulate practical recommendations for improving the land resource management system in Kazakhstan.

Literature review

We have determined that effective methods of land resource management in Kazakhstan should combine:

Improving the legal framework of land use to achieve the principles of sustainable development (Kuandykova *et al.*, 2024; Kuanyshbayeva *et al.*, 2025);

Digitalizing cadastral systems and regulating interdepartmental coordination (Gileva, 2024);

Developing public-private partnerships in the field of restoration of land resources necessary for maintaining ecosystems and ensuring food security (Erkin *et al.*, 2022; Alipbeki *et al.*, 2024).

The need to develop each of the identified directions for land resource management in Kazakhstan can be explained as follows.

1. The legal regulation of land use serves as a system-forming condition for sustainable land resource management since the regulatory environment determines incentives for land users, control mechanisms, and the distribution of responsibilities across levels of governance (Fedchenko *et al.*, 2025). In Kazakhstan, the existing regulatory framework is characterized as formally comprehensive. However, in practice, it functions poorly: enforcement mechanisms in the sphere of land use remain weak, and liability for violations of land legislation is largely nominal (Tulenova *et al.*, 2024). In particular, with regard to pasture lands, it has been established that the underestimation of the economic value of natural resources and environmental damage caused by their degradation creates systemic incentives for overexploitation of land while simultaneously reducing pressure in favor of legal enforcement (Kuandykova *et al.*, 2024). As a result, large-scale degradation occurs. According to FAO estimates, about 90 million hectares of the country's agricultural land are at risk of further deterioration, while desertification processes cover a significant portion of territories for which current legislation does not provide effective incentives for restoration (Erkin *et al.*, 2022; Food and Agriculture Organization, 2024).

International comparative analysis allows us to advance the hypothesis that the barriers to sustainable land resource management in Kazakhstan are primarily institutional rather than technical: even when properly formulated regulations exist, their implementation is hindered by unclear distribution of powers, weak horizontal coordination, and insufficient enforcement control (Akramkhanov *et al.*, 2018).

2. The transition to digital cadastral systems is considered in modern literature as one of the key tools for increasing the transparency of land administration, reducing corruption risks (Nejmyshev, 2023; Zairkhanova *et al.*, 2024), and accelerating land registration procedures (Ponamorenko, 2024; Akshalova *et al.*, 2025). The use of GIS technologies allows for a significant improvement in the accuracy of arable land accounting, the identification of unused and degraded areas, and the provision of dynamic monitoring that cannot be achieved through traditional field survey methods (Tuleyeva *et al.*, 2024; Abdullayev *et al.*, 2025; Nguyen *et al.*, 2025).

At the same time, data on the qualitative condition of Kazakhstan's land resources indicate significant discrepancies between official reports and the actual scale of land degradation, which points to systemic failures in the functioning of cadastral mechanisms (Julamanov *et al.*, 2024; Yesmagulova *et al.*, 2026). The decisive limitation in this case is not technological but institutional: the fragmentation of departmental information systems and weak horizontal coordination between relevant ministries hinder the creation of a unified information space for managerial decision-making (Akramkhanov *et al.*, 2018; Aksoy & Akaydin, 2024). As a result, monitoring remains fragmented, i.e., a significant portion of land plots remains outside systematic remote monitoring, and the data collected by different agencies are not integrated into a

single analytical system (Grankina & Vasilyev, 2024). Thus, realizing the potential of digitalization requires primarily institutional solutions: standardization of data formats, clear distribution of departmental responsibilities, and the creation of mechanisms for interagency information exchange (Abdullayev et al., 2025).

3. Public-private partnership in the restoration of degraded lands is becoming important as a mechanism for mobilizing private investment to address tasks that the state is unable to finance unilaterally. In the agricultural context of Kazakhstan, it has been established that access to markets and credit resources is a necessary condition for investing in the restoration of land productivity. However, small farms are objectively limited in their ability to achieve the economies of scale required for such investments (Tulenova et al., 2024). Without targeted state mechanisms (subsidies, cooperative development, and affordable agricultural lending), market incentives alone do not ensure a transition to sustainable land use, which is confirmed by data from several districts of the East Kazakhstan region (Conrad et al., 2023). An additional factor weakening the potential of private investment in agriculture is intensive labor migration: the outflow of qualified personnel from agricultural areas reduces the institutional and human resource capacity for implementing partnership programs (Bobkov & Shichkin, 2024; Jannath et al., 2024; Klimova et al., 2024).

In this regard, projects implemented on the basis of international cooperation are considered proven models of partnership. A joint project between the UNDP and the Ministry

of Agriculture of the Republic of Kazakhstan provides for the use of agroecological incentives and financial instruments to support sustainable agricultural production and the restoration of pastures in four regions of Northern Kazakhstan (Nokusheva et al., 2025; United Nations Development Programme [UNDP] Kazakhstan, 2025). The climatic context further increases the relevance of public-private partnership mechanisms: rising temperatures and precipitation instability reduce the time horizon for management decisions, while climate adaptation tools remain weakly integrated into Kazakhstan's land policy (Conrad et al., 2023; Chandrasekhar et al., 2025; Krasnova et al., 2025). Innovations in sustainable land management, including partnership-based models for the restoration of degraded lands, are recognized in the Central Asian regional context as a priority direction capable of delivering systemic effects under limited public resources (Mirzabaev, 2016; Beresneva & Kulibaba, 2024; Logachev & Goncharov, 2024).

MATERIALS AND METHODS

In the period from September to November 2024, a structured survey of 44 experts was conducted using purposive sampling. The sample was formed based on two primary criteria: the presence of peer-reviewed publications on land resource management in journals indexed in Scopus or Web of Science, or confirmed practical experience working in relevant public or economic organizations. The composition of the sample is presented in Table 1.

Table 1. Characteristics of the expert sample

Group	Inclusion criteria	n	%
Researchers and scientists	Peer-reviewed publications (Scopus/WoS)	22	50.0
Representatives of government agencies	Experience in relevant government agencies ≥ 3 years	14	31.8
Representatives of farms and agricultural enterprises	Land use practice ≥ 5 years	8	18.2
TOTAL		44	100.0

The questionnaire included 38 statements grouped into five blocks in accordance with the research tasks: (1) assessment of the legal and institutional framework of land use; (2) administrative and economic barriers to effective land use; (3) effectiveness of specific policy instruments (subsidies, monitoring, cadastral digitalization, and advisory support); (4) socio-economic factors influencing land user behavior; (5) integration of climate adaptation tools into the land resource management system. Responses were recorded using a seven-point Likert scale. Participant anonymity was ensured at all stages of the study.

Data were processed using IBM SPSS Statistics 27. The consistency of expert judgments within the entire sample was evaluated using Kendall's coefficient of concordance (W);

statistical significance was tested using the chi-square test (χ^2) ($p < 0.05$). To test the hypothesis regarding whether the assessments differ depending on the professional profile and work experience of the experts, intergroup comparisons were conducted: the Mann-Whitney U test was used for comparing two groups, while the Kruskal-Wallis test was applied when comparing three or more groups.

RESULTS AND DISCUSSION

The internal consistency of expert judgments was assessed before the analysis of the substantive results. The corresponding indicators are presented in Table 2.

Table 2. The Kendall's coefficient of concordance (W) for thematic blocks of the questionnaire

No.	Block topic	Kendall's W	χ^2	df	p
1	Legal and institutional framework for land use	0.61	112.4	37	<0.001
2	Administrative and economic barriers	0.57	104.9	37	<0.001
3	Effectiveness of specific political instruments	0.68	125.1	37	<0.001
4	Socio-economic factors	0.53	97.5	37	<0.001
5	Integration of climate adaptation instruments	0.59	108.6	37	<0.001

All statements (n=38)	0.60	109.7	37	<0.001
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Note: df=37 for all blocks; p calculated using the χ^2 test. Values of W>0.5 are interpreted as satisfactory agreement between expert assessments.

High consistency across all blocks confirms the reliability of the data and allows proceeding to the substantive analysis of each

of the three directions. The results of assessing the legal and institutional framework of land use are presented in **Table 3**.

Table 3. Expert assessments of the legal and institutional framework for land use in Kazakhstan (block 1, n=44)

Statement (Block 1 — Legal framework)	Median	IQR	Agreement level*
Current land legislation ensures effective control over agricultural land use	3.0	2.0	Low
Land use enforcement mechanisms are functioning properly	2.0	2.0	Low
The current regulatory framework provides sufficient incentives for the restoration of degraded lands	3.0	1.5	Low
The existing monitoring system allows for the timely recording of violations of land legislation	3.0	2.0	Low
The rights of small land users are reliably protected by current legislation	3.5	2.0	Moderate
Administrative penalties for violating land legislation are proportionate and effective	2.5	1.5	Low
The land use regulatory framework requires significant revision	6.0	1.0	High

Note: Responses were recorded on a 7-point Likert scale (1=completely disagree, 7=completely agree). Agreement levels: low=Me≤3.5; moderate=3.6-4.9; high=Me≥5.0. IQR=interquartile range.

Alongside legal barriers, experts also identify insufficient digitalization of land administration as an independent limiting

factor. The corresponding assessments are presented in **Table 4**.

Table 4. Expert assessments of the state of digitalization of cadastral systems and interdepartmental coordination (block 3, n=44)

Statement (Block 3 – Political instruments: digitalization)	Median	IQR	Agreement level*
Electronic cadastral systems cover the majority of agricultural land in Kazakhstan	3.0	2.0	Low
Remote sensing data is regularly used in managerial decision-making	3.5	2.0	Low
Proper exchange of land cadastral data is ensured between agencies	2.0	1.5	Low
GIS technologies can significantly improve the accuracy of land records	6.0	1.0	High
Cadastral digitalization is hampered primarily by institutional, rather than technical, barriers	6.0	1.5	High
Existing digital platforms are sufficient for land degradation monitoring	3.0	2.0	Low
Interdepartmental coordination in land administration is effective	2.0	1.5	Low

Note: scale and levels of agreement are the same as in **Table 3**.

The assessments of public-private partnership mechanisms and economic barriers hindering sustainable land use are systematized in **Table 5**.

Table 5. Expert assessments of public-private partnership mechanisms and economic barriers (Blocks 2-3, n=44)

Statement (Blocks 2-3 — Barriers and public-private partnership mechanisms)	Median	IQR	Agreement level*
Existing subsidies cover the majority of land users in need of support	2.0	1.5	Low
Small farms have effective access to subsidized agricultural loans for land restoration	2.5	2.0	Low
Public-private partnerships are used systematically in land restoration	2.0	1.5	Low
Government advisory services are accessible to most land users	3.0	2.0	Low
International partnership projects (FAO, UNDP) significantly influence land use practices	5.0	2.0	Moderate
Highland ownership concentration limits smallholder access to government support	6.0	1.0	High
Expanding public-private partnership mechanisms is necessary to restore degraded lands	6.5	1.0	High

Note: scale and levels of agreement are the same as in **Table 3**.

To determine whether the evaluations of key indicators differ depending on the professional profile of the expert, an analysis

was conducted using the Kruskal-Wallis test. Its results are presented in **Table 6**.

Table 6. Intergroup differences in expert assessments by professional profile (the Kruskal-Wallis test)

Direction/indicator	Me scientists	My state agencies	Me farms	H	p	Significance of differences
Effectiveness of the legal framework (average for Block 1)	3.0	4.0	2.0	9.84	0.007	Significant (p<0.01)
Level of interagency coordination	2.5	3.5	2.0	7.23	0.027	Significant (p<0.05)
Availability of digital cadastral tools	4.0	3.0	2.5	6.11	0.047	Significant (p<0.05)
Availability of subsidies for small farms	2.0	3.0	2.0	4.18	0.124	Insignificant

Need to expand public-private partnership mechanisms	6.5	6.0	7.0	2.34	0.310	Insignificant
Need to reform the legal framework	6.0	5.5	6.5	3.02	0.221	Insignificant

Note: Me is the group median; H is the Kruskal-Wallis statistic; df=2 for all comparisons. The significance threshold is $p < 0.05$

The results obtained confirm the initial research hypothesis: barriers to effective land resource management in Kazakhstan are predominantly institutional rather than technical or resource-based. In the global context, improving the legal framework is recognized as a necessary condition for achieving land degradation neutrality within the framework of the UN Sustainable Development Goals, while its implementation requires not so much the adoption of new regulatory acts as the improvement of the enforceability of existing norms (United Nations Convention to Combat Desertification [UNCCD], 2022; Benhmida & Trabelsi, 2024). The economic efficiency of land resource management and food security in Kazakhstan are directly determined by the quality of legal and administrative mechanisms, and not solely by natural conditions (Tleshpayeva *et al.*, 2025).

High consistency of expert assessments across all five blocks ($W=0.53-0.68$, $p < 0.001$) indicates that the identified constraints are perceived as systemic by specialists with fundamentally different professional experience, regardless of whether they work in the scientific field, public administration, or directly in the agricultural sector (Damaševičius *et al.*, 2025; Hao *et al.*, 2025; Nagesh *et al.*, 2025).

Low median assessments of the effectiveness of existing legal mechanisms ($Me=2.0-3.5$), alongside consensus regarding the necessity of reforms ($Me=6.0$), reflect a well-documented discrepancy between the formal completeness of Kazakhstan's regulatory framework and its weak enforcement capacity (Dobrzynski *et al.*, 2024; Julamanov *et al.*, 2024). There are significant intergroup differences in the evaluation of the effectiveness of the legal framework ($H=9.84$; $p=0.007$): representatives of government bodies systematically evaluate the current legislation more positively than researchers, which may indicate information asymmetry between levels of governance (Huber *et al.*, 2025; Salem *et al.*, 2025). Legal reforms should be aimed not at creating new regulatory acts, but at improving the enforceability of existing norms (Akramkhanov *et al.*, 2018).

The gap between high assessments of the technological potential of GIS ($Me=6.0$) and low assessments of actual cadastral coverage and interagency data exchange ($Me=2.0-3.5$) reproduces the pattern observed in regional studies (Seitkazy *et al.*, 2024; Tuleyeva *et al.*, 2024). The consensus assessment that digitalization is constrained by institutional rather than technical barriers ($Me=6.0$) is consistent with findings on systemic failures of cadastral mechanisms: a significant portion of land remains outside systematic remote monitoring, and data from different agencies are not integrated into a unified analytical system (Alipbeki *et al.*, 2024). Significant intergroup differences in the assessment of coordination levels ($H=7.23$; $p=0.027$) indicate that scientists perceive departmental fragmentation more acutely than government officials. Realizing the potential of digitalization requires institutional solutions: the standardization of data formats and clear distribution of departmental responsibilities (Food and Agriculture Organization [FAO], 2025).

Low assessments of subsidy accessibility ($Me=2.0$) and credit availability ($Me=2.5$), combined with high consensus regarding

the need to expand public-private partnership mechanisms ($Me=6.5$), are consistent with data showing that small farms, which dominate Kazakhstan's agricultural sector, are objectively limited in their ability to achieve the economies of scale required for investments in land restoration (Nuralina *et al.*, 2023). Without targeted state mechanisms (subsidies, cooperatives, and affordable agricultural lending), market incentives alone do not ensure a transition to sustainable land use (Tleshpayeva *et al.*, 2025). Notably, the need to expand public-private partnerships is the only direction where intergroup differences are statistically insignificant ($p=0.221-0.310$): all three professional groups share this position, which creates a real foundation for forming intersectoral consensus.

The level of education and accessibility of agronomic knowledge also have a direct impact on the quality of land use: where advisory infrastructure is weakly developed, land users are forced to rely on outdated practices regardless of their readiness for change (Akramkhanov *et al.*, 2018; Akhmetshin *et al.*, 2024; Abdykadyrov *et al.*, 2025). The experience of East Kazakhstan demonstrates that sustainable rural development requires consideration not only of agronomic factors but also of demographic factors (population outflow, workforce aging, and shortages of qualified specialists) (Nuralina *et al.*, 2023). Climate adaptation is included in Kazakhstan's land policy agenda, but the gap between strategic documents and real implementation tools remains significant: subsidy mechanisms for water-saving technologies and support for conservation agriculture cover only a small share of land users and are implemented inconsistently (Conrad *et al.*, 2023).

Thus, the results of the study apply the theoretical framework defined by three conceptual principles of sustainable land management: normative (the concept of sustainable development), target-oriented (land degradation neutrality), and institutional. This confirms that the institutional sphere is the determining factor for Kazakhstan.

CONCLUSION

The study confirms that barriers to effective land resource management in Kazakhstan are predominantly institutional in nature. High consistency of expert judgments across all three directions indicates the systemic nature of the identified constraints: legal norms are poorly enforced, digital tools are not integrated due to departmental fragmentation, and public-private partnership mechanisms and state support instruments are practically inaccessible to small farms. At the same time, the need to expand public-private partnerships is the only issue where full intergroup consensus was recorded, which creates a real entry point for political decisions.

The practical value of the results lies in the fact that eliminating the identified barriers does not require fundamentally new resources: it requires administrative consistency in law enforcement, standardization of departmental data, and the creation of accessible financial instruments for land users. The data obtained can serve as an empirical basis for adjusting state programs of sustainable land use in the context of achieving land degradation neutrality.

A limitation of the study is the purposive nature of the sample, which does not allow the findings to be generalized to the entire population of land users in Kazakhstan.

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REFERENCES

- Abdullayev, I., Rozhok, A., Levichev, O., Litwinowa, M., Trubcheninova, A., & Levicheva, S. (2025). Digital transformation in agricultural cluster management: Interrelated factors and model applicability. *Journal of Global Innovations in Agricultural Sciences*, 13(4), 1301–1308. doi:10.22194/JGIAS/25.1840
- Abdykadyrov, A., Marxuly, S., Mechsheryakova, T., Tastemirova, B., Tolen, G., Kulshikova, E., Duissenov, N., & Uzak, M. (2025). Scientific foundations of industrial engineering and geoeological utilization of water resources. *Water Conservation and Management*, 9(4), 742–748. doi:10.26480/wcm.04.2025.742.748
- Akhmetshin, E., Abdullayev, I., Kurikov, V., Khadasevich, N., Shichiyakh, R., & Severyanova, M. (2024). Opportunities for socio-economic development in Russia: Integration of education, science, and business through the University 4.0 model. *Relações Internacionais no Mundo Atual*, 4(46), 639–656.
- Akhmetshin, E., Makushkin, S., Abdullayev, I., Yumashev, A., Kozachek, A., Shichiyakh, R., & Shakhov, D. (2024). Opportunities to increase the efficiency of universities' research and innovation activities: Scientometric evaluation of researchers' work under external information constraints. *Qubahan Academic Journal*, 4(1), 240–249. doi:10.48161/qaj.v4n1a258
- Akramkhanov, A., Djanibekov, U., & Nishanov, N. (2018). Barriers to sustainable land management in Greater Central Asia. In V. R. Squires & L. Qi (Eds.), *Sustainable land management in Greater Central Asia* (pp. 113–129). Routledge.
- Akshalova, R., Teleuyev, G., Bondarenko, T., Rakhmetova, G., Avazova, S., Zhelayeva, M., Nikiforova, E., & Noeva, E. (2025). Possibilities of land management planning and development to achieve the principles of sustainable development: The relationship between legal regulation and institutional support models in the context of digitalization development. *International Journal of Sustainable Development and Planning*, 20(8), 3503–3512. doi:10.18280/ijstdp.200830
- Aksoy, C., & Akaydin, A. (2024). The impact of strategic leadership on employee performance: A study of the aviation industry. *Journal of Organizational Behavior Research*, 9(2), 42–53. doi:10.51847/3xix5orUCJ
- Alipbeki, O., Grossul, P., Rakhimov, D., Alikan, E., Augambayev, K., Alipbekova, C., Begaliyeva, M., & Ravshanov, A. (2024). Spatiotemporal analysis and identifying the driving forces of land use change in the Abay District (Karagandy Region, Kazakhstan). *E3S Web of Conferences*, 590, 04007. doi:10.1051/e3sconf/202459004007
- Benhmida, S., & Trabelsi, H. (2024). Fatty acid composition in bone fluid from knee osteoarthritis patients. *Journal of Biochemical Technology*, 15(2), 23–26. doi:10.51847/UNhuTqp51
- Beresneva, Y., & Kulibaba, I. (2024). Simulation model of crop yield on individual land plot. *BIO Web of Conferences*, 130, 01019. doi:10.1051/bioconf/202413001019
- Bobkov, V., & Shichkin, I. (2024). Labour and forced migration into post-Soviet Russia. In R. Delgado Wise, B. Likic-Brboric, R. Munck, & C.-U. Schierup (Eds.), *Handbook on migration and development* (pp. 281–298). Edward Elgar Publishing. doi:10.4337/9781789907131.00027
- Chandrasekhar, K., Nastro, R. A., Narayana, A. V., Rao, A. R., Singh, M., & Chennaiah, A. (2025). Microbial cell factory engineering for scalable production of bio-commodities: Emphasis on robustness. *Journal of Biochemical Technology*, 16(3), 19–29. doi:10.51847/6z0mtOiyyc
- Conrad, C., Schmidt, G., & Kussainova, M. (2023). Current and potential conflicts for ecosystem services caused by agricultural land use in Central Asia, and essential implications for research on sustainable land management in the region. *Central Asian Journal of Sustainability and Climate Research*, 2(1), 1–21. doi:10.29258/CAJSCR/2023-R1.v2-1/1-21.eng
- Damaševičius, R., Maskeliūnas, R., & Blažauskas, T. (2025). Enhancing virtual medical history taking: Effects of customized guidelines in two serious games for medical education. *Annals of Pharmacy Education, Safety and Public Health Advocacy*, 5, 39–49. doi:10.51847/kNshKQSF5t
- Dobrzynski, W., Szymonowicz, M., Wiglus, R. J., Rybak, Z., Zawadzka-Knefel, A., Janecki, M., Lubojanski, A., Kurek, K., Dobrzynski, M., & Zakrzewski, W., et al. (2024). Nanotechnology in orthodontics: Current applications and future perspectives. *Asian Journal of Periodontics and Orthodontics*, 4(1), 24–33. doi:10.51847/pRV7a8ayHa
- Eliseev, V. S. (2024). Correlation of agricultural and legal regulation in agricultural horticulture. *Lobbying and Legislative Process*, 3(4), 22–28. doi:10.33693/2782-7372-2024-3-4-22-28
- Erkin, A., Lei, J., Wang, Y., Mazbayev, O., Myrzaliyeva, Z. K., & Tazhekov, A. Z. (2022). Analysis of the distribution and formation of desertification processes in Kazakhstan and measures for prevention. *Journal of Geography and Environmental Management*, 67(4), 126–134. doi:10.26577/JGEM.2022.v67.i4.10
- Fedchenko, E., Gusarova, L., Alekseeva, I., Rudneva, D., Maksimov, A., & Znovyuk, N. (2025). Assessing the effectiveness of the controlling system in the public sector: An analytical review of modern approaches. *Journal of Sustainable Competitive Intelligence*, 15, 1–12. doi:10.37497/eagleSustainable.v15i.526
- Food and Agriculture Organization of the United Nations. (2024, December 20). *90 million hectares of land in Kazakhstan at risk of degradation: Experts propose solutions*. <https://www.fao.org/in-action/pesticides-central-asia/news/90-million-hectares-of-land-in-kazakhstan-at-risk-of-degradation--experts-propose-solutions/>

- Food and Agriculture Organization of the United Nations. (2025, April 23). *Identification of priority areas for project intervention in Kazakhstan: Application of technologies for land degradation neutrality*. <https://www.fao.org/>
- Gileva, T. A. (2024). Territory's innovation ecosystem: Tools for managing development in the digital environment. *Economic Problems and Legal Practice*, 20(4), 174–183. doi:10.33693/2541-8025-2024-20-4-174-183
- Grankina, V., & Vasilyev, D. (2024). Digital transformation modeling for agricultural land irrigation. *BIO Web of Conferences*, 141, 02005. doi:10.1051/bioconf/202414102005
- Hao, C., Fang, L., & Lin, Z. (2025). Autonomous AI agent for QSAR modeling with dataset curation, descriptor selection, and domain assessment. *Pharmacophore*, 16(4), 11–21. doi:10.51847/Bhyi6RjARA
- Huber, M. A., Bauer, S., Gruber, F. K., & Müller, E. W. (2025). Outcomes of everolimus combined with exemestane in HR-positive metastatic breast cancer after CDK4/6 inhibitor exposure. *Archive of International Journal of Cancer and Allied Science*, 5(2), 44–50. doi:10.51847/sjNxEiRZXn
- Jannath, A., Sivapragasam, S., Viswanathan, K., & Sundaram, R. (2024). Intentional replantation with simultaneous periapical surgery: A case report with one year of follow-up. *Annals of Dental Specialty*, 12(3), 23–27. doi:10.51847/JIs54FRstW
- Julamanov, T., Tokbergenova, A., Asanbayeva, A., Kozhakhmetov, B., & Levin, E. (2024). The qualitative state of the land resources of the Republic of Kazakhstan. *Izdenister Natigeler*, (2), 405–418. doi:10.37884/2-2024/40
- Klimova, T., Askarova, M., Sarin, K., Shaimerdenova, A., & Hakimov, N. (2024). Impact of transnational economic mobility on the regulation of international migration, human rights, and social policies. *Juridicas CUC*, 20(1), 179–203. doi:10.17981/juridcuc.20.1.2024.07
- Krasnova, T., Chalova, O., Kopytko, V., Bykov, V., Mamrukova, O., & Lebedev, K. (2025). The climate change divide: Differential impacts on economic growth, agriculture, and energy in developed and developing nations. *International Journal of Ecosystems and Ecology Science*, 15(6), 49–54. doi:10.31407/ijeess.15.606
- Kuandykova, E., Bekezhanov, D., Nessipbaeva, I., Rzabay, A., Jumabayeva, K., & Zhuldybayeva, A. (2024). Regulation of mechanisms for management of environmental issues of rational use of natural resources and pastures. *International Journal of Sustainable Development and Planning*, 19(11), 4509–4517. doi:10.18280/ijssdp.191138
- Kuanysbayeva, S., Rakhmetova, G., Abdullayev, I., Levichev, O., Levicheva, S., Aitkazina, M., & Shichiyakh, R. (2025). Integrating spatial planning and land use administration for sustainable development. *International Journal of Sustainable Development and Planning*, 20(3), 1337–1343. doi:10.18280/ijssdp.200339
- Kwatra, D., Venugopal, A., & Anant, S. (2024). Studying the efficacy of tolmetin radiosensitizing effect in radiotherapy treatment on human clonal cancer cells. *International Journal of Pharmaceutical Research and Allied Sciences*, 13(3), 1–8. doi:10.51847/WWPYUT4Nig
- Logachev, M., & Goncharov, D. (2024). Simulation model of crop yields. *BIO Web of Conferences*, 93, 02015. doi:10.1051/bioconf/20249302015
- Mirzabaev, A. (2016). Land degradation and sustainable land management innovations in Central Asia. In F. W. Gatzweiler & J. von Braun (Eds.), *Technological and institutional innovations for marginalized smallholders in agricultural development* (pp. 213–224). Springer. doi:10.1007/978-3-319-25718-1_13
- Mukhametov, A., Ansabayeva, A., Efimov, O., & Kamerova, A. (2024). Influence of crop rotation, the treatment of crop residues, and the application of nitrogen fertilizers on soil properties and maize yield. *Soil Science Society of America Journal*, 88(6), 2227–2237. doi:10.1002/saj2.20760
- Mussatayeva, F., Yermagambetova, K., Shamakhay, S., Baisarina, Z., & Mustafina, T. (2024). Possibilities of legal regulation of the conservation of sacred places within the cultural landscape: The case of the Republic of Kazakhstan. *Journal of Islamic Thought and Civilization*, 14(1), 92–103. doi:10.32350/jitc.141.06
- Nagesh, D., Lam Ip, C. Y. T., Li, K., Wong, H. S. L., & Chai, J. Y. H. (2025). Navigating support networks: A Somali woman's experience of social alignment to overcome isolation during pregnancy and early motherhood. *International Journal of Social Psychology Aspects of Healthcare*, 5(1), 35–48. doi:10.51847/iJoPhqpXaV
- Nejmyshev, L. A. (2023). People's control as a method of countering corruption. *Lobbying and Legislative Process*, 2(2), 41–44. doi:10.33693/2782-7372-2023-2-2-41-44
- Nguyen, T. T., Dinh, V. T., & Vu, L. H. (2025). An integrated FAHP–TOPSIS approach for evaluating and prioritizing medical tourism service types in Vietnam. *Journal of Organizational Behavior Research*, 10(2), 20–31. doi:10.51847/lnWweTmyOd
- Nokusheva, Z., Nasiyev, B., Kantarbayeva, E., Zhanatalapov, N., Bekkaliyev, A., Khairush, A., & Okshebayev, A. (2025). Bio-organic fertilizer application for forage quality improvement and rangeland restoration in Northern Kazakhstan's steppe ecosystems. *International Journal of Design & Nature and Ecodynamics*, 20(10), 2363–2373. doi:10.18280/ij dne.201014
- Novak, H., & Jelic, P. (2025). Comparing self-learning skill stations and instructor-led courses for cardiopulmonary resuscitation skill retention among hospital nurses: A randomized controlled trial. *Journal of Integrative Nursing and Palliative Care*, 6(2), 185–191. doi:10.51847/MFRNxbMHX7
- Nuralina, K., Baizholova, R., Abenov, Y., Mukhiyayeva, D., & Moldakenova, Y. (2023). Development of a model of strategic priorities for sustainable development of rural areas in Kazakhstan until 2030: Example of the East Kazakhstan region. *Journal of Environmental Management and Tourism*, 14(5), 2290–2299. doi:10.14505/jemt.v14.5(69).10
- Petyukova, O. N., & Dereglazov, A. A. (2024). Transformation of the land use system in Russia in the late XIX–early XX centuries. *Gaps in Russian Legislation*, 17(3), 31–36. doi:10.33693/2072-3164-2024-17-3-031-036
- Ponamorenko, V. E. (2024). Integrated risk management in the financial system: International regulation and national

- perspectives. *Economic Problems and Legal Practice*, 20(5), 116–122. doi:10.33693/2541-8025-2024-20-5-116-122
- Rafikov, T., Zhumatayeva, Z., Mukaliyev, Z., & Zhildikbayeva, A. (2024). Evaluating land degradation in East Kazakhstan using NDVI and Landsat data. *International Journal of Design & Nature and Ecodynamics*, 19(5), 1677–1686. doi:10.18280/ij dne.190521
- Salem, H. M., Watanabe, S., & Chang, A. H. (2025). Ethical concerns in managing anorexia nervosa: A content analysis of ethics consultation records. *Asian Journal of Ethics and Health Medicine*, 5(5), 25–35. doi:10.51847/oHEI6FgL3V
- Saparov, G., Dutbayev, Y. B., Amanzholykyz, A., Islam, K. R., Tireuov, K., Hakimov, N., Zudilova, E., Shichiyakh, R., Shoykin, O., & Ganiyev, B., et al. (2024). Assessing heavy metal contamination for soil reclamation: Implications for sustainable urban development. *International Journal of Design & Nature and Ecodynamics*, 19(6), 2197–2204. doi:10.18280/ij dne.190636
- Seitkazy, M., Beisekenov, N., Taukebayev, O., Zulpykharov, K., Tokbergenova, A., Duisenbayev, S., Sarybaev, E., & Turymtayev, Z. (2024). Forecasting land use dynamics in Talas District, Kazakhstan, using Landsat data and the Google Earth Engine (GEE) platform. *Sustainability*, 16(14), 6144. doi:10.3390/su16146144
- Sokolov, A. D. (2024). The term and principles of state geological control (supervision) as a way to ensure the safe, rational use and protection of the subsoil. *Gaps in Russian Legislation*, 17(5), 37–44. doi:10.33693/2072-3164-2024-17-5-037-044
- Tleshpayeva, D., Bondarenko, N., Leontev, M., Mashentseva, G., Plaksa, J., Zharov, A., Stepanova, D., & Karbozova, A. (2025). Assessment of economic management of land resources to enhance food security. *Qubahan Academic Journal*, 5(1), 159–168. doi:10.48161/qaj.v5n1a1048
- Tulenova, A. M., Bekturganova, A. E., Aigarynova, G., & Rysmakhan, G. B. (2024). Problems and tasks of improving the land management system in the Republic of Kazakhstan. *Bulletin of Turan University*, (1), 310–322. doi:10.46914/1562-2959-2024-1-1-310-322
- Tuleyeva, D., Shaimerdenova, A., Tesalovsky, A., Leontyev, V., Turutina, T., Shoykin, O., Gorovoy, S., Dmitrieva, O., & Danilova, E. (2024). GIS technology role in the management of arable lands in Kazakhstan. *SABRAO Journal of Breeding and Genetics*, 56(6), 2441–2450. doi:10.54910/sabrao2024.56.6.25
- United Nations Convention to Combat Desertification. (2022). *Global land outlook: Land restoration for recovery and resilience* (2nd ed.). United Nations Convention to Combat Desertification. <https://digitallibrary.un.org/record/3972338>
- United Nations Development Programme Kazakhstan. (2025, March 4). *UNDP launches project to enhance agricultural resilience and ecosystem conservation in Northern Kazakhstan*. <https://www.undp.org/kazakhstan/press-releases/undp-launches-project-enhance-agricultural-resilience-and-ecosystem-conservation-northern-kazakhstan>
- Yesmagulova, B., Jigildiyeva, Z., Tassanova, Z., Utegaliyeva, N., Assetova, A., Umbetkaliyev, N., Amangeldikyzy, Z., Ozhanov, G., Satayev, A., & Kainusheva, D. (2026). Remote sensing and GIS-based monitoring of land degradation in the Bokey Orda District, West Kazakhstan. *International Journal of Agriculture and Biosciences*, 15(1), 159–167. doi:10.47278/journal.ijab/2025.159
- Zairkhanova, L. N., Eremina, A. S., Burkhanov, R. R., Bersanova, M. M., Agerzhanokova, S. Z., Muskhadzheva, F. A., Ataeva, A. I., & Esyunin, V. V. (2024). Investigation of the effectiveness of silver-containing drugs for the treatment of tuberculosis in the respiratory system. *Journal of Advanced Pharmacy Education and Research*, 14(3), 31–35. doi:10.51847/zhfsdGkmQi