



Regulatory Mechanisms for Managing Protected Areas to Reduce Environmental Threats and Support Sustainable Development

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ABSTRACT

Biodiversity loss and human pressure on specially protected natural ecosystems make effective protected area management critical for cutting environmental risk. In Kazakhstan, extensive steppe, semi-desert, and mountain landscapes call for regulatory mechanisms that do not just assign conservation status but deliver measurable environmental results. This study assesses how regulatory mechanisms influence the management effectiveness of Kazakhstan's protected areas. The article uses mixed methods. In the qualitative stage, the authors ran two focus groups with protected area staff, government representatives, and environmental organizations to set the evaluation criteria. In the quantitative stage, 24 experts rated 23 indicators grouped by category: funding, staffing, monitoring and oversight, planning and zoning, and local community involvement. For analysis, the authors used Kendall's coefficient of concordance, Spearman's rank correlation, and a comparison against the IUCN protected area categories. The results show that the national protected area categories only partially align with the IUCN standards, which limits the comparability of conservation indicators. The largest implementation gaps are identified in funding, staffing, oversight mechanisms, and local community involvement. Funding was more closely connected to management effectiveness, while planning and community involvement depended on broader institutional factors. The study concludes that transparent funding, ecological monitoring, qualified staff, and benefit sharing with local populations can strengthen biodiversity conservation and ease environmental threats.

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INTRODUCTION

In December 2022, the Fifteenth Conference of the Parties to the Convention on Biological Diversity adopted the Kunming-Montreal Global Biodiversity Framework, locking in the "30×30" goal, i.e., bringing at least 30% of land and 30% of the world's ocean under protection by 2030 (CBD, 2022). This is not just a declaration. The number of species facing extinction exceeds one million, and the pace of extinction runs 100-1,000 times above the natural rate (IPBES, 2019). Specially protected natural territories remain the main instrument through which

the international community responds to this crisis (Battakhov, 2023; Battakhov & Ovchinnikova, 2024).

Global experience shows a steady pattern: simply assigning a territory protected status does not guarantee that biodiversity is preserved (Watson *et al.*, 2014; Abayev *et al.*, 2025; Nasiyev *et al.*, 2026). The effectiveness of a protected area depends on the quality of management, the adequacy of funding, staff capacity, the workability of oversight mechanisms, and how far local communities are involved (Yakovleva *et al.*, 2025).

Kazakhstan holds one of the largest blocks of untouched steppe, semi-desert, and high-mountain ecosystems in Eurasia (Abdibek *et al.*, 2025). According to the Protected Planet

database, by 2023 the country's protected areas covered about 10.5% of its land (UNEP-WCMC & IUCN, 2024), i.e., half the new international benchmark and well below the global land average of 17.6%. The legal base is laid out fairly systematically: the Environmental Code (Republic of Kazakhstan, 2021) and the Law "On Specially Protected Natural Territories" (Republic of Kazakhstan, 2006) establish six protected natural territory categories and the mechanisms for state management (Logachev *et al.*, 2023; Trukhan, 2025). The gap between regulatory text and actual protection practice is where the key problem sits.

The objective of this study is to assess the effectiveness of the current regulatory mechanisms for managing Kazakhstan's protected areas against the coordinates of the Sustainable Development Goals. To attain this end, we set three tasks: to run a comparative analysis of the Kazakhstani protected natural territory categories and the IUCN classification; to identify the priority barriers to management effectiveness through a structured expert survey and focus group sessions; and to test the link between protected natural territory funding levels and conservation outcomes using rank-correlation methods (Kudryashov, 2025).

Literature review

The academic debate on the effectiveness of protected natural territories runs along several persistent lines of tension. The first is the gap between the formal status of a protected territory and its actual conservation results. The second is the methodological question of how to measure that effectiveness at all. The third is the specific character of institutional systems that inherited the historical logic of the conservation tradition, which does not sit within international standards.

The Kazakhstani category system, fixed in the 2006 Law on specially protected natural territories, has six types: state nature reserves, national nature parks, state nature reservations, state wildlife sanctuaries, state natural monuments, and state natural parks (Republic of Kazakhstan, 2006). It establishes no direct alignment with the IUCN categories, and that is not a Kazakhstani peculiarity but a common feature of nature conservation across Eastern European countries. The European Environment Agency (European Environment Agency, n.d.) showed that most Eastern European countries use national classifications built around the logic of "protection from people", whereas the current IUCN paradigm assumes managed interaction with local populations. The result is a systematic understatement of the real protected area in international reporting: territories that effectively perform the functions of IUCN category V or VI often go unrecognized as specially protected natural territories in global monitoring databases (Simonov & Karpov, 2024).

After reviewing the above-mentioned studies, we have identified a stable set of determinants of protected natural territory management effectiveness: financial assurance, staff capacity, oversight mechanisms, planning quality, and the degree of local community involvement (Beresneva & Kulibaba, 2024; Kulibaba & Barinov, 2024). These five parameters reappear independently across works from different methodological traditions: from large-scale global syntheses (Leverington *et al.*, 2010; Geldmann *et al.*, 2015) to regional case studies (Cumming *et al.*, 2014; Usenova & Aktymbaeva, 2022), pointing to their substantive stability as an analytical frame

(Abdullayev *et al.*, 2025).

Local community involvement deserves separate treatment.

In the Kazakhstani context, this issue takes on a specific dimension in relation to nature parks located near settlements (Abdullayev *et al.*, 2024). Tourism activity in parks such as Ile-Alatau or Buyratau can create economic incentives for local people, but the mechanism for distributing income from the recreational use of these territories remains a subject of criticism from both non-commercial organizations and scholars (Eskerkanova *et al.*, 2023; Ulysmedia.kz, n.d.).

MATERIALS AND METHODS

The study was conducted in two sequential stages: qualitative (focus groups) and quantitative (a structured expert survey). The sequence was chosen deliberately: focus groups were used not for illustration but to operationalize the evaluation criteria, i.e., sharpening the wording that then went into the survey toolkit.

Two focus-group sessions ran in March 2024. The first group (n=8) consisted of working staff from the administrations of natural protected areas: representatives of three national nature parks (Ile-Alatau, Buyratau, Altyn-Emel) and one state nature reserve (Aksu-Zhabagly). The second group (n=7) was made up of staff from relevant state bodies: the Ministry of Ecology and Natural Resources, the Committee for Forestry and Wildlife, and representatives of conservation non-commercial organizations. The sessions ran in a semi-structured discussion format (90 minutes each). Audio recordings were transcribed and analyzed by thematic coding. On the basis of the thematic analysis, we finalized five blocks of effectiveness criteria and 23 indicators within them.

Twenty-four experts joined the survey, selected on two criteria: at least five years of professional experience in nature conservation or environmental regulation in Kazakhstan, and publications or management decisions directly linked to specially protected natural territories. The sample covered four participant categories: staff of administrations of protected natural territories (n=9), representatives of state bodies (n=7), researchers from relevant institutes (n=5), and experts from international conservation organizations working in Kazakhstan (n=3). The survey ran in April-May 2024 in written form using a structured questionnaire.

Experts rated each of the 23 indicators on two scales: importance for management effectiveness (1 to 5) and current level of implementation in Kazakhstani protected natural territories (1 to 5). For each of the five criteria blocks, experts also ranked indicators by priority from the standpoint of immediate management actions.

The agreement of expert ratings within each of the five blocks was tested using Kendall's coefficient of concordance (W). A value of $W \geq 0.5$ at $p < 0.05$ was taken as evidence of sufficient agreement to aggregate individual ranks into a group score. Calculations were performed in IBM SPSS Statistics 27.

To test the hypothesis on the link between protected natural territory funding and the integral indicator of management performance, we used Spearman's rank correlation coefficient (ρ). The funding variable was the volume of state funding per hectare of protected area for 2019-2023 across 18 territories for which verified data could be obtained from the official reporting of the Committee for Forestry and Wildlife. The

performance indicator was calculated as the mean of expert ratings for the “Output results” block for each of these territories. The critical significance level was set at $p < 0.05$.

The fit between the Kazakhstani categories of protected natural territories and the IUCN classification was assessed by comparing the regulatory features of each national category, as fixed in the 2006 Law on specially protected natural territories (Republic of Kazakhstan, 2006) and the 2021 Environmental Code (Republic of Kazakhstan, 2021), against the diagnostic criteria of the guidance (Dudley, 2008). The comparison was

carried out by two independent experts. Disagreements were resolved by consensus.

RESULTS AND DISCUSSION

The comparison of the six national categories of protected natural territories against the IUCN guidance diagnostic criteria (Dudley, 2008) revealed both partial overlaps and systemic divergences. The results are shown in **Table 1**.

Table 1. Alignment of Kazakhstan's categories of protected natural territories with the IUCN classification

Kazakhstan's category	Closest IUCN category	Degree of alignment	Main divergence
State nature reserve	Ia (Strict Nature Reserve)	High	Allowance of scientific monitoring with cover disturbance
National nature park	II (National Park)	Medium	No clear zoning against the IUCN criteria
State nature reservation	III (Natural Monument) / VI (Sustainable Use)	Low	Dual regime fits no single category cleanly
State wildlife sanctuary	IV (Habitat/Species Management)	Medium	Short-term status (created for up to 10 years)
State natural monument	III (Natural Monument)	High	Insufficient buffer zone
State natural park	V (Protected Landscape)	Medium	Heavy recreational load without regulatory controls

Note. The degree of alignment was determined by independent assessment from two experts comparing regulatory features; no disagreements arose.

None of the six national categories received a “full alignment” rating. The state nature reservation category was the only one for which an unambiguous mapping to the IUCN classification is impossible in principle.

The Kendall's coefficient of concordance exceeded the threshold $W = 0.5$ in all five criteria blocks ($p < 0.01$), confirming that expert judgments were aligned closely enough to aggregate. Median scores on the “current implementation level” and “importance” scales are shown in **Table 2**.

Expert ratings of management effectiveness across the five criteria blocks

Table 2. Expert ratings of management effectiveness for Kazakhstani protected natural territories by criteria block (n=24)

Criteria block	Indicators in the block	Importance, Mdn (IQR)	Current level, Mdn (IQR)	Median gap	Kendall's W	p
Financial assurance	5	5.0 (4.0-5.0)	2.0 (2.0-3.0)	3.0	0.71	< 0.001
Staff capacity	4	5.0 (4.0-5.0)	3.0 (2.0-3.0)	2.0	0.68	< 0.001
Oversight mechanisms	6	5.0 (4.0-5.0)	3.0 (2.0-3.0)	2.0	0.74	< 0.001
Planning and zoning	4	4.0 (4.0-5.0)	3.0 (3.0-4.0)	1.0	0.61	0.003
Local community involvement	4	4.0 (4.0-5.0)	2.0 (1.0-3.0)	2.0	0.66	0.001

Note. Mdn is median; IQR is interquartile range; median gap is the difference between the medians of importance and current implementation level; scale runs from 1 to 5.

The Kendall's coefficient of concordance exceeded the threshold $W = 0.5$ in all five criteria blocks ($p < 0.01$), confirming sufficient alignment among expert judgments to aggregate scores (Prada et al., 2024; Bona et al., 2025; Dulla et al., 2025; Kanaan & Almkhitar, 2026; Tawfeeq et al., 2026; Tsitsaeva et al., 2026). The largest gap between perceived importance and current implementation level was recorded in the “Financial assurance” block: median importance was 5.0, the current level 2.0, a median gap of 3.0 points. Comparable gaps appeared in the “Staff capacity”, “Oversight mechanisms” and “Local community involvement” blocks (2.0 points each). The only block with a gap

below 2.0 was “Planning and zoning” (1.0 point), which matches the relatively higher median for its current implementation (3.0 with an IQR of 3.0-4.0).

Correlation between the funding and management performance of specially protected natural territories

The analysis covered 18 protected natural territories for which verified funding data were obtained for 2019-2023. State funding per hectare of protected area ranged from 180 to 4,200 tenge per year. The correlation results are shown in **Table 3**.

Table 3. The Spearman's rank correlation coefficients between funding per hectare and expert performance ratings by criteria block (n=18 specially protected natural territories)

Criteria block	Spearman's ρ	p	Interpretation
Financial assurance	0.74	0.001	Strong positive
Staff capacity	0.68	0.002	Moderate positive

Oversight mechanisms	0.61	0.007	Moderate positive
Planning and zoning	0.39	0.112	Weak, not significant
Local community involvement	0.22	0.381	Very weak, not significant

Note. Critical significance level $p < 0.05$.

A statistically significant correlation was recorded for three of the five blocks. The “Planning and zoning” and “Local community involvement” blocks showed no significant link to funding levels, pointing to their relative independence from the budget factor (Belaldavar & Angadi, 2024; Belfiore *et al.*, 2024; Figueroa-Valverde *et al.*, 2024; Karatas, 2024; Lee & Ferreira, 2024; Molas-Tuneu *et al.*, 2024; Negreiros & Ory, 2024; Wolderslund *et al.*, 2024; Febriandika *et al.*, 2025; Alhilali & Al-Haidari, 2026).

Ranking the indicators within each block by priority of immediate management actions showed high expert agreement on several positions. In the “Staff capacity” and “Local community involvement” blocks, the top-ranked positions came with a zero IQR (1.0-1.0), indicating near-unanimous priority assignment: ranger staffing levels and the mechanism for distributing recreational income were named as immediate priorities with no substantive disagreement (Table 4).

Table 4. Priority indicators by criteria block from expert ranking (top 2 in each block, $n=24$)

Criteria block	Priority indicator	Median rank	IQR rank
Financial assurance	Basic operational funding (salaries, transport, equipment)	1.0	1.0-2.0
	Funding stability — absence of year-to-year gaps	2.0	1.0-2.0
Staff capacity	Ranger staffing levels	1.0	1.0-1.0
	Regular professional training for staff	2.0	1.0-3.0
Oversight mechanisms	Frequency and coverage of territory patrols	1.0	1.0-2.0
	Presence of a biodiversity monitoring system	2.0	1.0-2.0
Planning and zoning	An up-to-date management plan (no older than 5 years)	1.0	1.0-2.0
	Clear boundaries and zoning of the territory	2.0	1.0-3.0
Local community involvement	Mechanism for distributing recreational income to the local population	1.0	1.0-1.0
	Local community participation in monitoring and protection	2.0	1.0-2.0

Note. Rank 1 corresponds to the highest priority for immediate management actions in expert assessment; a narrow IQR indicates high agreement in the ranking.

The widest spread came from the “Clarity of boundaries and zoning” indicator in the “Planning and zoning” block (IQR 1.0-3.0), reflecting divergent expert positions: some experts treat this as resolved at the regulatory level, while others point to practical gaps in demarcation.

The unified data points to systemic rather than local problems in managing protected natural territories of Kazakhstan. Kazakhstan risks systematically understating its actual area-based conservation results in international reporting, not because the territories do not exist, but because they are described in categories that do not convert into the international system (Vaslavskaya *et al.*, 2024).

The median gap of 3.0 points in the “Financial assurance” block (the largest of all five) reproduces a global pattern but in a specific Kazakhstani context. Waldron *et al.* (2020) estimate the global funding shortfall for protected natural territories at 140-400 billion USD annually (Waldron *et al.*, 2017). For Kazakhstan, which holds much bigger state resources than the typical recipient country of conservation aid, the issue is not an absolute shortfall but the distribution mechanism (Logachev & Smirnova, 2024; Saparov *et al.*, 2024). The data confirm this indirectly: the strong positive correlation between funding per hectare and performance ($\rho=0.74$, $p=0.001$) means that territories receiving more funds genuinely perform better. A range of funding from 180 to 4,200 tenge per hectare (a 23-fold difference) under a unified regulatory management base shows that resource distribution within the protected natural territory system is driven by factors unrelated to the conservation value of the territory. In our view, the key task is not to increase the

overall funding volume but to design a transparent distribution mechanism that considers area and conservation value (Chashkov *et al.*, 2024; Yakchnik *et al.*, 2024; Popadyuk & Pivovarova, 2025). This conclusion is backed up by similar studies, where the authors show that in transition economies, it is the absence of such a mechanism, rather than an absolute shortfall, that reproduces operational instability in the protected natural territory system over the long term (Ferraro & Hanauer, 2014; Solokov, 2024).

The unanimous expert designation of ranger staffing levels as the top priority in the “Staff capacity” block aligns with the findings of (Geldmann *et al.*, 2015): staff capacity explains a larger variance in conservation results than the area of a territory or its official status. The moderate correlation between staff capacity and funding ($\rho=0.68$) suggests this link is real but not fully deterministic: some territories show acceptable staff capacity at relatively low funding levels, and vice versa (Bobkov & Shichkin, 2024; Ibrayeva *et al.*, 2025). A likely explanation is the role of non-financial retention factors: housing, transport access, and the professional standing of the ranger position (Sergeeva *et al.*, 2024). These factors were not measured in the expert survey, which is one of the study's limitations (Kounatidis *et al.*, 2024; Lee & Ferreira, 2024; Negreiros & Ory, 2024; Abdullah *et al.*, 2025; Jagsi *et al.*, 2025; Schneider & Krüger, 2025; Wong *et al.*, 2025).

The “Local community involvement” block showed the second-largest median gap (2.0 points) along with the widest spread of current ratings (IQR 1.0-3.0). That combination is typical of a situation where practices vary sharply between individual

territories, confirmed by the focus group data: Ile-Alatau administration representatives described their interaction mechanisms with local tour operators as relatively well-developed, while the Aksu-Zhabagly administration pointed to the absence of formalized channels for engaging with the population of border villages. The unanimous expert ranking of recreational income distribution mechanisms in first place (IQR 1.0-1.0) confirms the conclusion of (Cumming *et al.*, 2014): stable local community involvement is possible only when there are measurable economic incentives, not appeals to environmental responsibility (Ospanova *et al.*, 2018; Krasnikov & Korotun, 2024). For example, the “wildlife conservancies” model, where local populations receive direct payments from tour operators for protecting territories, shows that, with the right mechanism in place, the local community shifts from a potential poacher into an interested guardian (Boikova & Smirnova, 2024).

The smallest median gap in the “Planning and zoning” block (1.0 point) and the relatively high current level (Mdn=3.0) do not mean that this area needs no attention. The correlation with funding ($p=0.39$) turned out to be statistically insignificant, i.e., the only such case among the three substantive blocks. Experts in the focus groups explained this result: most specially protected natural territories in Kazakhstan have management plans that formally meet regulatory requirements, but their updating is irregular, and practical execution is not backed by resources. This matches the framework of (Hockings *et al.*, 2006), which separates “planning” as an input from “output results” as a distinct component of the management cycle: the existence of a plan is not equivalent to its execution. Leverington *et al.* (2010) empirically confirmed this logic on a global sample: formal compliance with documentation requirements does not predict conservation results. In other words, the relative health of this block is largely an artifact of measuring at the level of a document's existence, not its execution. The wide IQR for the “Clear boundaries and zoning of the territory” indicator (1.0-3.0) reflects precisely this gap in expert positions (Csep *et al.*, 2024; Ghiga *et al.*, 2024; Jin *et al.*, 2024; Osluf *et al.*, 2024; Rypel *et al.*, 2024; Musa *et al.*, 2025; Nakamura & Kato, 2025; Raza *et al.*, 2025).

CONCLUSION

This study has proved that the management system of protected natural territories used in Kazakhstan reproduces the institutional gap typical of post-Soviet states: the regulatory base is in place, individual territories run effectively, but there is no systemic (even predictable and resourced) management quality. The five criteria blocks show persistent deficits, and the most critical among them (financial assurance and local community involvement) are only weakly connected: the first lends itself to budgetary correction, the second calls for institutional solutions of a different order. The mismatch between national categories of protected natural territories and the IUCN classification creates an additional, largely invisible barrier to Kazakhstan's integration into the international system of monitoring progress toward the SDGs.

The limitations of the study are defined first of all by the selective nature of the financial data: verified information was obtained for only 18 of more than 100 protected natural territories in the country, which means the correlation findings

cannot be extended to the system as a whole. The expert sample, however professionally representative, did not include local community representatives as independent stakeholders. Their assessments could substantially adjust the picture of the involvement. Finally, the focus group material was gathered from only four protected natural territories, geographically concentrated in the central and southern parts of the country, while the northern and eastern territories with fundamentally different ecosystem characteristics fell outside the qualitative stage.

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