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# ENVIRONMENTAL THREATS AS A FACTOR OF POPULATION MIGRATION IN REGIONS WITH LOW RESILIENCE

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## ABSTRACT

### Environmental Threats as a Factor of Population Migration in Regions With Low Resilience

This study examined the impact of environmental transformations on migration behavior under conditions of environmental degradation, water scarcity, and soil exhaustion. A comparative analysis was conducted in vulnerable regions of Uzbekistan, Iran, China, and Kazakhstan using spatio-temporal demographic and environmental data. Findings revealed demographic shifts such as increased migration, youth out-migration, and declining fertility, alongside high mortality and morbidity in Kazakhstan. Legal frameworks evolved from declarative to adaptive policies. Results confirm the interrelation of environment, society, and migration, underscoring the need for integrated regional policies to address environmentally induced migration.

**KEYWORDS:** environmental degradation, internal displacement, water scarcity, adaptive mechanisms, demographic vulnerability, environmental policy

## IZVLEČEK

**Okoljske grožnje kot vzrok za migracije prebivalstva v regijah z nizko odpornostjo**  
Avtorji so v študiji preučevali vpliv okoljskih sprememb na migracije v okoliščinah degradacije okolja, pomanjkanja vode in izčrpanosti tal. V ranljivih regijah Uzbekistana, Irana, Kitajske in Kazahstana so izvedli primerjalno analizo z uporabo

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prostorsko-časovnih demografskih in okoljskih podatkov. Ugotovitve so pokazale na demografske spremembe, kot so povečan obseg migracij, odseljevanje mladih in upad rodnosti, skupaj z visokima stopnjama umrljivosti in obolevnosti v Kazahstanu. Pravni okviri so se razvili od deklarativnih do prilagodljivih politik. Rezultati študije potrjujejo medsebojno povezanost migracij ter okoljskih in družbenih dejavnikov in tako izpostavljajo potrebo po integriranih regionalnih politikah za obravnavanje migracij zaradi okoljskih dejavnikov.

**KLJUČNE BESEDE:** degradacija okolja, notranje razseljevanje, pomanjkanje vode, prilagoditveni mehanizmi, demografska ranljivost, okoljska politika

## INTRODUCTION

In the twenty-first century, global environmental transformations caused by climate change, land degradation, water scarcity, and the increasing frequency of natural disasters have increasingly acted as catalysts of forced population displacement. According to the Internal Displacement Monitoring Centre (2025), in 2022 alone, more than 32 million people were displaced due to climatic and environmental factors. Regions characterized by a combination of ecosystem instability, economic specialization, and social inequality are particularly vulnerable to such processes. At the same time, environmental migration as a socio-environmental phenomenon remains conceptually ambiguous and legally undefined: most states, including those of Central Asia, still do not recognize a distinct legal status for environmental migrants.

In the study by Rakhmatulina et al. (2024), attention was devoted to examining the correlation between environmental degradation and demographic dynamics in the Kyzylorda region. Drawing on statistical data from local authorities and sociological surveys, the authors documented a significant increase in internal migration driven by desertification, the loss of irrigated fertile land, environmental decline, and difficulties in agricultural production. The study also highlights the fragmented and inconsistent nature of state policy in addressing environmental crises, the limited scope of social protection for internally displaced persons, and the insufficient integration of environmental issues into national migration planning.

In the works of Cipollina et al. (2024) and Issova and Rakhmatulina (2023), the environmental vulnerability of the Atyrau region in the context of oil extraction was analyzed. The authors found that over 68% of respondents associate environmental deterioration with health disorders; however, population support mechanisms remain ineffective, while migration responses are uneven. Despite valuable empirical data, the study does not provide a systematic analysis of the long-term consequences of degradation.

Smagulov et al. (2024) examine the relationship between levels of social vulnerability and migration propensity in environmentally unstable regions of Kazakhstan. Using multifactorial analysis, the authors found that limited access to water, soil

degradation, and heavy reliance on agriculture are key predictors of forced displacement. However, the study does not elaborate on regional differences and intergroup mobility patterns.

In a comparative study of Iran and Kazakhstan, Altin and Altin (2022) emphasize water scarcity as a driver of migration. They found that in areas with the poorest water supply, the share of potential migrants increases by 27%. Nonetheless, the study is territorially limited and does not cover less developed regions, where the consequences of degradation are most acute. As demonstrated by an interdisciplinary study conducted by Anchita et al. (2021), the rural population of the Kyzylorda region has declined by approximately 17% over the past decade. This trend is attributed to environmental deterioration caused by the desiccation of the Aral Sea, soil degradation, and reduced agricultural productivity, which have intensified environmental pressure on households and contributed to sustained migration.

Hermans (2024) proposes the concept of “adaptive mobility,” interpreting environmental migration as a strategic household response to changing living conditions. The author substantiates the need for new legal categories for environmental migrants; however, the examples from Central Asia remain largely contextual. Miholjic-Ivkovic (2024) analyzes the decline of agricultural potential in Iran’s Sistan region and its impact on internal migration growth. While the analysis draws upon a broad range of socioeconomic indicators, it predominantly focuses on the Iranian context and pays little attention to the specificities of post-Soviet institutional structures, limiting the relevance of its findings for Kazakhstan. In Miholjic-Ivkovic (2024), the risks of cross-border migration triggered by water conflicts in Central Asia are examined. The author stresses that such movements often remain invisible in official statistics; however, the study lacks household-level data that would allow for a more precise assessment of the real drivers of mobility.

Despite the growing number of studies on environmental migration, significant gaps remain in understanding the complex impact of environmental degradation on the spatial dynamics of migration processes in Kazakhstan. In particular, there is a lack of empirical research on household mobility models in highly environmentally vulnerable areas, as well as on the mechanisms of interaction between social, economic, legal, and demographic factors. There is also a shortage of integrated interdisciplinary approaches to studying the long-term consequences of environmental migration and substantiating adaptive policy at both macro- and micro-levels.

The purpose of the present study was to determine how multidimensional environmental degradation affects migration processes in the Kyzylorda region of Kazakhstan, taking into account the interplay of socioeconomic, demographic, and institutional factors shaping population adaptive strategies under conditions of growing environmental vulnerability. Special attention was devoted to identifying key environmental, socioeconomic, and institutional determinants that create conditions for the emergence of persistent environmental mobility. Based on

previous literature and empirical data, the analytical hypothesis was advanced that structural socioeconomic vulnerability of local communities—specifically limited access to water and land resources, inequality in employment opportunities, lack of economic diversification, and insufficient infrastructure quality—constitutes the decisive factor shaping the scale, intensity, and spatial configuration of environmentally induced migration processes in the region.

## MATERIALS AND METHODS

The research was conducted between March 2023 and June 2025 within the framework of a large-scale interdisciplinary project aimed at an in-depth examination of environmental migration as a complex socio-environmental process shaped by several interdependent factors: climate change, environmental degradation, state policy, and the socioeconomic vulnerability of populations. The study's methodological design was based on the application of three major empirical approaches, each playing a crucial role in building a multilayered analytical framework: content analysis of regulatory and legal acts, analysis of official statistical data, and qualitative analysis of sociological sources and case studies concerning migration behavior in environmentally vulnerable regions of Central Asia.

The content analysis of regulatory and legal documentation was intended to identify the dynamics of state policy transformation regarding climate change, population adaptation to environmental challenges, and the prevention of adverse consequences triggered by migration processes. The analysis encompassed both current documents and archival acts, thereby enabling a retrospective assessment of the regulatory environment. In particular, the sources analyzed included: Environmental Code of the Republic of Kazakhstan (Ministry of Justice of the Republic of Kazakhstan, 2007), Ecological Code of the Republic of Kazakhstan (Ministry of Justice of the Republic of Kazakhstan, 2021), Resolution of the Government of the Republic of Kazakhstan No. 910 "On Approval of the Concept for the Development of Ecological Culture "Taza Kazakhstan" for 2024–2029" (Ministry of Justice of the Republic of Kazakhstan, 2024), Decree of the President of the Republic of Kazakhstan No. 1241 "On the Concept of Environmental Safety of the Republic of Kazakhstan for 2004–2015" (Ministry of Justice of the Republic of Kazakhstan, 2003), the Law of the Republic of Uzbekistan No754-XII "On Nature Protection" (President of the Republic of Uzbekistan, 1992), the Strategy for the Transition to a Green Economy for the 2019–2030 Period (IEA, 2025), *Iran's National Adaptation Plan (NAP) for priority sectors readiness proposal* (FAO, 2025), the Environmental Protection Law of Iran (ILO, 1974), the Environmental Protection Law of the People's Republic of China (Standing Committee of the National People's Congress, 2014), and the Climate Change Adaptation Strategy of the PRC (Panella et al., 2022). Selection was conducted according to the criteria of official validity, relevance to the research subject, and the degree

of regulatory detail. NVivo 14 software was used for text processing, providing thematic coding, frequency analysis of key categories, detection of latent semantic fields, and identification of typical frames within discourse. Particular attention was given to mechanisms of state response to high ecological risk conditions and to the integration of principles of climate justice into legal strategies.

The statistical analysis was conducted to quantitatively assess the interrelation between environmental degradation and demographic change in vulnerable regions. A large-scale body of official statistical data covering the period 2010–2024 was collected, systematized, and analyzed. Key sources included the *Human Development Report 2023–24: Breaking the Gridlock: Reimagining Cooperation in a Polarized World* (UNDP, 2024a); *The Climate Change Impact on Water Resources in Kazakhstan* (UNDP, 2021); the International Organization for Migration (IOM)'s *World Migration Report 2022* (McAuliffe and Triandafyllidou, 2021); National Bureau of Statistics of China, 2014; *UNDP Iran HPMP Factsheet* (UNDP, 2025). The primary focus was on the Kyzylorda and Atyrau regions—territories officially recognized as zones of high ecological risk. Indicators considered included the intensity of internal and external migration, unemployment rates, household dynamics, population density, and access to basic services.

The third analytical dimension of the study entailed examining social attitudes and migration intentions of populations residing in environmentally vulnerable regions. Instead of primary data collection through field sociological surveys, secondary analysis was performed using open-source data containing relevant information on behavioral responses and adaptive strategies of households under ecological stress. In particular, data from IOM (Scissa & Martin, 2024), UNDP (2021), as well as findings published in the *Climate and Environment Program in Central Asia* (World Bank, 2025) and the article “Asia has ‘enormous’ shortfall of funds to adapt to climate change, warns ADB” (White, 2024) were utilized. Additional legal and policy sources included: Law of the Republic of Uzbekistan No. LRU-1036 “On Environmental Expertise, Environmental Impact Assessment, and Strategic Environmental Assessment” (President of the Republic of Uzbekistan, 2025), the Environmental Protection Law of Iran (ILO, 1974), Standing Committee of the National People’s Congress (2014), and Resolution of the President of the Republic of Uzbekistan No. RP-149 “On Additional Measures to Support Citizens of the Republic of Uzbekistan Engaged in Temporary Labor Activities Abroad and Their Family Members” (President of the Republic of Uzbekistan, 2022). These sources provide quantitative assessments of the impact of environmental degradation on migration processes in Kazakhstan, Uzbekistan, Iran, and China. The data collected addressed such aspects as public perceptions of ecological threats, assessments of access to resources and assistance, and socioeconomic risk factors underlying residential relocation. Data processing was conducted using content analysis and comparative analytics, enabling the identification of typical profiles of ecological migrants and the reconstruction of decision-making logics within various social groups.

The application of this triadic methodology enabled a comprehensive analysis of the phenomenon of ecological migration, encompassing legal, statistical, and socio-behavioral levels. Such an approach ensured a multidimensional understanding of the causal linkages among environmental degradation, political strategies, and changes in population migration patterns. The findings open up opportunities to develop institutionally adaptive policies that take into account local contexts, the specificity of environmental risks, and the sociodemographic characteristics of vulnerable territories.

## RESULTS

For a holistic understanding of the legislative foundations regulating environmental governance and migration issues, it is expedient to examine the regulatory frameworks of four countries: Kazakhstan, Uzbekistan, Iran, and China. The analysis focuses on two major aspects: environmental regulation as a systemic approach to environmental protection, and the presence or absence of legal frameworks for regulating environmentally induced migration. In Kazakhstan, environmental policy regulations have undergone substantial updates in recent decades. The principal document in this field is the Environmental Code of the Republic of Kazakhstan (Ministry of Justice of the Republic of Kazakhstan, 2007). This code provides detailed regulation across all major areas of environmental policy—including the protection of atmospheric air, water resources, soils, and biodiversity—and prescribes strict controls on pollution. In 2021, the updated version of the Ecological Code of the Republic of Kazakhstan (Ministry of Justice of the Republic of Kazakhstan, 2021) entered into force, strengthening environmental requirements and addressing new challenges of climate change and environmental degradation. However, these acts do not contain any direct provisions regulating migration processes, including those arising under the pressure of ecological disasters or environmental degradation.

Migration issues are regulated by a separate document, the Law of the Republic of Kazakhstan No. 477-IV “On Migration” (Ministry of Justice of the Republic of Kazakhstan, 2011). It establishes the legal mechanisms for both internal and external migration, including procedures for document processing, the rights and obligations of migrants, and the legal status of foreigners. However, no mention is made of environmentally driven migration.

Uzbekistan has recently introduced a new legal framework for environmental assessment: the Law of the Republic of Uzbekistan No. LRU-1036 (President of the Republic of Uzbekistan, 2025) stipulates mandatory environmental impact assessment (EIA) procedures for projects and state programmes. It also provides mechanisms for strategic environmental assessment and for public participation in decision-making. However, the migration component is absent from this law, even though such procedures may indirectly contribute to shaping a safe living

environment for the population. In the migration domain, Uzbekistan primarily focuses on labor migration. The normative basis consists of presidential decrees, such as Resolution of the President of the Republic of Uzbekistan No. RP-149 (President of the Republic of Uzbekistan, 2022), defining policy directions for the overseas employment of citizens. No specialized law on migration, and particularly on environmental migration, has been identified.

In Iran, the regulatory framework in the environmental sphere has a long-standing history. The central act is the Environmental Protection Law of Iran (ILO, 1974), adopted in 1974. Although amended periodically, it retains the character of a framework law. It prescribes measures for natural resource management, control of industrial emissions, biodiversity conservation, and development of protected areas. Nevertheless, the law does not contain explicit provisions regarding the influence of environmental degradation on migration processes.

Migration regulation in Iran is predominantly implemented through bylaws that govern immigration procedures, personal registration, and border control. A systemic legal framework addressing ecological or climate migration is absent. In China, one of the key documents in the environmental domain is the Environmental Protection Law (Standing Committee of the National People's Congress, 2014), the current version of which was adopted in 2014. This law covers all major areas of environmental protection—emission standards, protection of water and land resources, waste management, and safeguarding of the biological and technogenic environment. Despite its comprehensive character, it does not contain provisions on the consequences of environmental degradation for population mobility.

Internal migration in China is primarily regulated through the *hukou* (household registration) system, introduced as early as 1958. It has a significant impact on citizens' access to social services in cities and regions. Nevertheless, the ecological dimension of migration processes remains outside the scope of this legislation. Table 1 below presents the key regulatory acts governing environmental policy and migration in China, Kazakhstan, Uzbekistan, and Iran.

Country	Document	Year adopted (Updated)	Scope/Area of application	Covered aspects (Environment/ Migration)
Kazakhstan	Environmental Code of the Republic of Kazakhstan (2007) (replaced by new code— Ecological Code of the Republic of Kazakhstan (2021))	2007 (updated 2021)	Comprehensive regulation of environmental relations (protection of atmospheric air, water, soil, environment, emissions control, etc.)	Environmental issues— detailed (soil, water, air, biodiversity, etc.); does not directly regulate migration (focuses on environmental protection)
	Law of the Republic of Kazakhstan No. 477-IV "On Migration"	2011	Regulates matters of citizen migration (internal and external), the status of foreigners, etc.	Migration aspects— documentation procedures, rights/ obligations of migrants; environmental aspects are not addressed.
Uzbekistan	Law of the Republic of Uzbekistan No. LRU-1036	2025	Establishes procedures for environmental expertise of projects, strategic assessment of state programmes, and public engagement.	Environmental issues—introduces environmental expert review of projects, strategic programme assessments; migration is not mentioned.
	Migration Legislation (no specific laws identified)	-	Development of overseas employment policies (Presidential Decrees, e.g., Resolution of the President of the Republic of Uzbekistan No. RP-149)	Primary focus on labor migration; no legislation on climate- or environmentally-induced migration.

<b>Iran</b>	Iran (Islamic Republic of)—Environmental Protection Law (analogous to the 1974 law) and others	1974+ (periodically updated)	General coverage of environmental issues (resource management, industrial emissions, protected areas) (expected to include)	Environmental aspects—present (environmental protection, long-term planning); no explicit provisions on environmental migration.
	Migration Legislation (no specific laws identified)	-	Migration regulation primarily through immigration rules and domestic policy	Migration aspects—general immigration/passport regulations; no environmental provisions in migration legislation.
<b>China</b>	Environmental Protection Law (Standing Committee of the National People’s Congress, 2014) (latest edition)	2014	Full regulation of environmental standards (emissions control, resource conservation, etc.)	Environmental issues—comprehensive (air, water, waste, biodiversity); no direct linkage to migration.
	Regulations on Household Registration of the People’s Republic of China (Congressional-Executive Commission on China, n.d.) ( <i>hukou</i> ) and related urban reforms	1958+ (updated)	Regulates internal registration and population resettlement (housing reforms)	Migration—restricted access to services for migrants under the <i>hukou</i> system; environmental aspects are not considered.

Table 1: Regulatory framework for environmental and migration issues in Central Asian countries and China. Source: compiled by the authors based on McLeman, 2011; UNFPA, 2012; Wang, 2020; McAuliffe and Triandafyllidou, 2021; UNDP, 2021; Kun.uz Admin, 2023; UNDP, 2024b; UK Green Building Council, 2024; 2025; Bureau of National Statistics, n.d.; Congressional-Executive Commission on China, n.d.

The conducted analysis demonstrates that in all four countries there exists a robust regulatory and legal framework in the field of ecology, encompassing a wide range of issues—from the protection of the atmosphere and water resources to the conservation of ecosystems and the introduction of environmental assessment instruments. At the same time, although migration-related legislation exists as a separate domain, it primarily regulates administrative procedures related to internal or external migration (documentation, registration, migrant rights), without linking migration to environmental challenges.

None of the analyzed normative acts explicitly recognizes environmental or climate-induced migration as a distinct legal phenomenon, which indicates a significant regulatory gap. This gap is especially critical as natural disasters become more frequent and land and water resources degrade—conditions that already compel thousands of people to relocate. Establishing legislative conditions for recognizing environmental migration as a national priority constitutes an urgent step for regions under pressure from climate change.

For a comprehensive understanding of the interrelationship between environmental conditions and migration processes, current official statistical data from open sources were employed—national statistical agencies, reports of international organizations (in particular the National Bureau of Statistics of China (2021)), as well as informational platforms aggregating indicators in specific domains (ecology, migration, health, agriculture).

Kazakhstan, as of the end of 2023, had a population of approximately 20.03 million, up by 1.4 million from 2019. However, the birth rate is declining: from 445,000 births in 2021 to 388,000 in 2023. Simultaneously, internal migration is increasing, particularly toward urbanized regions, where a positive migration balance (+9,293 persons in 2023) has been recorded. The agricultural sector is under pressure: more than 90 million hectares of land have degraded, of which 29 million exhibit signs of erosion, compelling populations to leave rural areas. The deterioration of the environmental situation also affects health outcomes: over 16% of all oncological mortality cases are linked to lung and bronchial cancer, especially in industrially polluted areas.

Uzbekistan demonstrates stable demographic growth (35.65 million in 2023) with an annual increase of 2.04%. The country is undergoing urbanization: more than half of the population resides in cities, while rural areas, particularly in the Aral Sea zone, face soil degradation, droughts, and water scarcity, which have already led to the loss of approximately 100,000 jobs. Consequently, labor migration and environmental migration are taking place. In Karakalpakstan, rising respiratory illnesses from dust storms carrying toxic particles also influence population mobility.

Iran, with a population of 90.6 million, is entering a demographic plateau, accompanied by population ageing and declining birth rates. Nearly 2.6 million hectares of arable land have been lost in recent years. In some southern provinces, precipitation has decreased by 45%, leading to droughts and desertification (over 1 million hectares of land become unsuitable for cultivation each year). Natural disasters trigger forced internal migration: in early 2024, more than 800,000 people were compelled to leave their homes. Deteriorating access to healthcare is vulnerable to an outflow of medical professionals and an increase in psychosomatic and infectious diseases.

China, with a population of 1.42 billion, is already experiencing demographic decline caused by ageing and the consequences of the “one-child policy.” More than 200 million people migrate internally each year, predominantly for economic reasons. At the same time, only 12% of the territory remains arable, and due to

water shortages, farmers are forced to use intensive technologies. The environmental situation remains acute: in 2017, more than 1.24 million premature deaths were recorded due to air pollution. Chronic respiratory diseases are widespread despite large-scale public health programmes. Aggregate quantitative indicators of demographic dynamics, agricultural transformation, and population health status in the four countries of Central and East Asia are summarized in Table 2.

Indicator	Kazakhstan	Uzbekistan	Iran	China
<b>Population (2023)</b>	~20.03 million (increase of +1.4 million between 2019–2023, reaching 20,033,842 by the end of 2023)	~35.65 million (growth rate ~2.04% in 2023)	~90.6 million (2023 estimate)	~1.42 billion
<b>Population dynamics</b>	Moderate growth: in 2023, the growth rate declined to ~12.95‰ (declining birth rates from 445k in 2021 to 388k in 2023)	Steady growth (~1.9–2.0% annually); preserved youthful population structure	Significant slowdown (declining birth rates); population size nearly unchanged from the previous year	Beginning to decline (first decrease in 2022); ageing process underway
<b>Internal migration</b>	Present: in 2023, net migration balance of +9,293 individuals (primarily urban relocation); significant development of “green” cities	Present: rapid urbanization (over 50% urban population); many workers migrate to northern Uzbekistan and major cities	Substantial: hundreds of thousands displaced annually due to natural disasters; e.g., ~800k displaced by climatic shocks (droughts, floods) in early 2024.	Very high: several hundred million internal labor migrants (mainly rural-to-urban); significant urbanization effects (1.24 million premature pollution-related deaths in 2017 indicate lifestyle changes)

<p><b>Agriculture</b></p>	<p>Over 90 million ha of land (33% of territory) affected by degradation, including ~29 million ha of soil erosion; 27.1 million ha of degraded pastureland. This constrains productivity and leads to abandoned farmland.</p>	<p>Severe degradation in the Aral Sea region (soil salinisation, reduced crop yields); ~100k people lost livelihoods due to salinisation of floodplains. Reports indicate partial aridification of arable land (climate threats)</p>	<p>Agricultural land decreased from ~18 million to ~15.43 million ha (~14% reduction); 45% decline in annual rainfall in central/southern provinces (2024), drought days, aridification; +1 million ha decertified annually.</p>	<p>Only ~12% of the territory is arable; significant land losses in the 20th century, though the government now maintains a minimum of 120 million ha. High irrigation levels, but drought remains an issue (partial aridification). (Organic erosion losses up to 0.0052 mm/year in some regions; active restoration of degraded land underway)</p>
<p><b>Yield/ Production</b></p>	<p>Stable growth of cereals in high-potential regions; meanwhile, productivity declines on degraded soils (due to depletion and salinization). Over 29 million ha eroded—lower yields.</p>	<p>Reduced yields in the Aral zones due to salinisation. FAO data indicate declining field fertility (official figures pending).</p>	<p>Modern hybrids and technologies mitigate climatechange pressure, but yield stability issues persist (dry-wheat yields decline). Irrigation was introduced, but &gt;14% of agricultural land was lost (dried wetlands, erosion).</p>	<p>Yield of key cereals (rice, wheat) generally increasing due to intensive technologies, but water deficit limits expansion; farmers shifting to intensive practices (greenhouses, high-yield varieties).</p>

<p><b>Population health</b></p>	<p>High rates of cancer and respiratory diseases: e.g., lung/bronchial cancer accounts for ~16% of all cancer deaths (significant smoking rates, industrial pollution). Elevated cancer incidence observed in regions with industrial pollution or radiological events (e.g., Pri-Balkhash).</p>	<p>Dust storms and salt winds in Karakalpakstan drive a sharp rise in respiratory diseases (asbestosis, asthma, etc.); salt dispersion causes respiratory illnesses, prompting migration. Cancer statistics: late-stage diagnoses due to weak prevention.</p>	<p>Climate disasters (droughts, floods) impact health: post-flood outbreaks of infection, rising rates of psychosomatic disorders. Desert dust storms increase respiratory diseases. Official reports note higher trauma/deaths from disasters and medical staff emigration. Moderate overall cancer mortality, but hazardous regional emissions were detected.</p>	<p>A significant portion of the population suffers from air pollution (1.24 million premature deaths in 2017). Chronic respiratory diseases are prevalent in major cities. Lung cancer is among the leading causes of mortality. National healthy lifestyle programmes have slightly reduced smoking and improved disease diagnostics.</p>
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Table 2: Statistics on demographics, agriculture, and health. Source: compiled by the authors based on Steed, 2011; Aghmashhadi et al., 2018; Schulz, 2020; Ministry of National Economy of the Republic of Kazakhstan & UNFPA Kazakhstan, 2020; WHO, 2021; Farzanegan et al., 2022; Jeenbaeva and Banerjee, 2022; Coordination Office of Domestic Policy, 2022; WHO & UNFCCC, 2022; FAO, 2023; Sánchez, 2023; Abuova, 2025; UK Green Building Council, 2024; 2025; “World Population”, 2025; Bureau of National Statistics, 2025a; 2025b.

The statistical review confirms that across all countries, there is a strong interconnection among environmental degradation, public health, and migration dynamics. Environmental challenges, notably pollution, loss of fertile land, and the spread of respiratory diseases, not only diminish the quality of life but also constitute major

drivers of environmentally induced population displacement. This is corroborated by cases of mass relocation in Iran and environmentally vulnerable regions of Uzbekistan. At the same time, the absence of systemic mechanisms in health and migration policies exacerbates the consequences of environmental impacts on human mobility.

No comprehensive, representative sociological studies dedicated exclusively to environmental migration in countries such as Kazakhstan, Uzbekistan, Iran, and China were found in open access. Instead, fragmented empirical evidence appears within broader research on labor, internal, or rural migration. In certain instances, environmental factors are mentioned as secondary or accompanying motives, but they are rarely considered as the primary cause of displacement.

Based on a comparative analysis of available open-source materials, including regional reports, reviews, articles, and a limited number of surveys, it was possible to reconstruct a generalized profile of migrants whose choice of residence was at least partly determined by environmental deterioration.

In Kazakhstan, migrants are predominantly individuals aged 25–45, who mostly move within the country, concentrated in urbanized clusters. The main motives remain employment opportunities and infrastructural accessibility; however, in regions with a high concentration of harmful emissions (notably Western Kazakhstan and Mangystau Region), environmental discomfort becomes an additional factor driving relocation. These motives, although not always explicitly articulated, show a tendency to strengthen, particularly among young families with children.

In Uzbekistan, internal and external mobility is especially characteristic of individuals aged 18–40. In zones of the greatest environmental stress, such as Karakalpakstan, where dust storms, drought, and soil salinisation have become permanent features, instances of population displacement bear features of environmental migration. Although such relocations are not officially classified as environmental migration, they demonstrate local sensitivity to environmental change while simultaneously reflecting dependence on the general economic situation. It is precisely following reforms and the easing of external labor migration in the past decade that mobility volumes from environmentally problematic regions have increased.

A different situation is observed in Iran, where environmental factors are more explicit. Since 2019, numerous cases of mass displacement have been recorded, caused by catastrophic floods, prolonged droughts, and sandstorms that have affected hundreds of thousands of people. A significant share of these migrants are working-age individuals with professional qualifications, who were forced to leave regions that were becoming uninhabitable. Such relocations are increasingly recognized not only in public discourse but also in the political agenda as a problem requiring appropriate policy responses.

In China, where internal migration involves hundreds of millions of people, clearly distinguishing environmentally motivated migration is difficult because the

specificity of the *hukou* registration system frames migration within a socio-economic context. At the same time, numerous accounts indicate that air pollution, water resource depletion, and land degradation are among the factors prompting rural populations to relocate to other regions. Although these causes are rarely recorded separately in official reports, they frequently appear in studies on health, labor conditions, and migrant welfare, summarized in Table 3.

Country	Average age of migrants	Reasons for relocation	Peak mobility	Sociological conclusion
Kazakhstan	Predominantly 25–45 years (majority migrate for work)	Economic (employment in cities, higher wages) as well as environmental “stressors” (pollution, waste, industrial accidents—e.g., oil or mining spills)	Steady growth in internal migration during the 2010s; peaks coincided with the end of the “Polish labor migrant programme” (2019)	Migration is primarily labor-driven; approximately 40% associate relocation with acquaintances (reported data). Environmental motives are rarely cited, yet awareness of issues (pollution, resources) exists.
Uzbekistan	Predominantly 18–40 years (youth and middle-aged adults)	Labour/social migration (work abroad and domestically); environmental migration in Karakalpakstan due to land reclamation (44% of Karakalpakstan’s rural population resides near the Aral Sea)	Significant growth over the last 5–10 years due to open-door policies (removal of artificial barriers)	Primary motives are economic. Regarding the environment, notable out-migration from Karakalpakstan (an arid region) has been observed, though detailed studies are lacking.

Iran	Mature 20–50 years (high proportion of professionals and labor migrants)	Displacement due to natural disasters (droughts, floods, climate intensification), economic reasons (work in cities, less polluted regions)	Sharp surge in 2022–2024 due to rural drought; annual displacement reaches tens of thousands (up to 520,000 during the 2019 floods)	Large-scale internal displacement from rural provinces to major cities has been documented in recent years. Many migrants are young professionals. Environmental factors (deadly floods, water scarcity) are increasingly significant drivers of relocation.
China	Broadly dispersed (23–45 years) (mostly rural youth)	Economic (urban job-seeking) and environmental/social factors (air pollution, water quality, <i>hukou</i> policy)	Highest in absolute numbers: hundreds of millions of internal migrants; peak occurred in 2000–2010, but continues to rise steadily	Primary motives are employment; partial environmental migration is evident in relocations from polluted or arid zones. State programmes promote “reverse urbanism” to mitigate social issues.

Table 3: Sociological analysis of migration processes and environmental factors in Central Asian countries and China. Source: compiled by the authors based on UNFPA, 2012; Misra, 2021; United Nations Uzbekistan, 2021; Zhou, 2022; Bureau of National Statistics, 2024; 2025a; 2025b; Jeenbaeva and Banerjee, 2022; Blondin, 2023; Rudenshiod, 2024; Tian et al., 2024; UK Green Building Council, 2024; 2025; Omirgazy, 2025; Nakispekova, 2025.

It can be noted that the age structure of potential environmental migrants across all four countries is rather similar—predominantly individuals aged 25–40, socially active and mobile. Economic incentives remain the dominant drivers; however, under conditions of environmental deterioration, particularly in ecologically vulnerable regions, it is precisely the state of the environment that becomes the catalyst for the final decision to relocate. Available indirect evidence also indicates that spikes in migration coincide with specific environmental crises, such as natural disasters or industrial accidents. At the same time, the absence of an official classification of environmental migration as a distinct category complicates its quantitative assessment and reduces its visibility in state policy. All existing conclusions remain provisional and are based primarily on qualitative analysis and indirect evidence, rather than specialized sociological surveys.

## DISCUSSION

The findings of the conducted analysis demonstrate that environmental migration constitutes a multifactorial, complexly structured socio-ecological phenomenon shaped by several critical determinants. The main among these are progressive environmental degradation, the socioeconomic vulnerability of populations, the institutional incapacity of state structures, and limited access to quality basic services and resources. Key ecological triggers driving population displacement include deteriorating water quality, desertification, soil degradation, declining agricultural yields, and the increasing frequency of extreme climatic events. In rural communities, where agriculture remains the dominant form of employment, environmental changes directly impact household economic resilience. The gradual depletion of the natural environment deprives residents of opportunities for stable livelihoods, prompting them to seek more favorable conditions in socioeconomically more developed regions of the country.

The collected empirical data indicate that environmental migration in the studied region is not confined to responses to single catastrophic events or natural disasters. On the contrary, its dynamics are shaped by the long-term accumulation of profound structural imbalances affecting both ecological and socioeconomic systems. Migration processes in this context are largely forced, accompanied by a loss of social capital, the disintegration of traditional social networks, rising unemployment, and economic instability. Similar trends are highlighted in the interdisciplinary studies by Blondin (2019) and Abel and Muttarak (2015), which characterize Central Asia as a key region of global ecological vulnerability. It is noted that environmentally induced mobility in the countries of this macro-region is gradually acquiring the characteristics of permanent displacement, rather than seasonal or temporary migration, thereby complicating mechanisms of return and population reintegration. This aligns with findings that reveal a tendency toward long-term rather than short-term migration from ecologically degraded regions of Kazakhstan and Uzbekistan.

In the work of Warner et al. (2010), migration is interpreted as one form of adaptation to climate change. However, the effective realization of its adaptive potential is possible only under conditions of comprehensive state policy, institutional support, and access to financial and social resources. The implementation of such mechanisms remains limited due to insufficient funding, weak inter-agency coordination, and the absence of long-term programmes. Similarly, a lack of durable adaptation strategies at the regional level has been identified, preventing systemic integration of environmental migrants into host communities. Host regions display low infrastructural readiness for integrating newcomers, leading to heightened social tensions and reduced access to healthcare, education, and housing.

The legal dimension of environmental migration is also characterized by significant regulatory gaps. As noted by Kappassova et al. (2024) and Russell et al. (2018),

Kazakhstan's national legislation does not provide a specific legal status for persons displaced as a result of environmental changes. Due to the absence of such a status, displaced populations lack adequate access to social services, do not receive targeted assistance, and encounter numerous difficulties in integrating into new social environments. The study also noted the absence of a clear mechanism for registering environmental migrants and including them in the national monitoring system.

In developing a sustainable state policy response to environmental migration, it is appropriate to consider approaches to sustainable business development that create value not only for the economy but also for the social and natural environment (Mikołajewicz, 2016). The conducted research also revealed the potential of this approach for integrating environmentally induced mobility into regional spatial development models. A synthesis of migration dynamics in Asia by Hugo and Bardley (2014) shows that environmental mobility often arises from deteriorating living conditions in vulnerable agrarian areas rather than from one-off disasters. Such a trend is observed in regions of Kazakhstan, Iran, and Uzbekistan, confirmed by correlations between the intensification of out-migration from agrarian territories and indicators of soil degradation, water scarcity, and declining incomes.

The state of the environment in the region directly affects public health, especially in communities residing near degraded areas. This is confirmed by sociological surveys, which show that 68% of respondents identified worsening environmental conditions as the main reason for migration. The study by Oladejo et al. (2023) also indicates a clear correlation between water and air pollution and rising morbidity rates. The situation is particularly alarming in areas with chronic drinking water shortages, high levels of dust, industrial pollution, and weak healthcare provision. Intensive out-migration is recorded from such territories, further confirming the significance of environmental factors in shaping migration behavior and reducing the demographic resilience of peripheral regions.

In this context, the study by Khavarian-Garmsir et al. (2019) deserves attention, as it examines migration processes under conditions of ecological stress in Iran's Khuzestan province. It was established that environmental degradation—in particular, deteriorating water quality, soil salinisation, and rising temperatures—constitutes a major determinant of out-migration from small towns. The obtained data show that under conditions of inadequate adaptive mechanisms and economic instability, migration becomes the only available survival strategy, especially in regions affected by protracted crises. This is consistent with the identified causes of displacement, among which land degradation, water scarcity, and climate instability predominate.

The study by Shokhan et al. (2024) highlights the inefficiency of state governance in responding to the challenges of environmental migration. According to the analysis, current regional policy insufficiently accounts for the specificity of environmentally induced displacement, and existing instruments leave a significant share of mobile populations outside the scope of state support. The study shows that even in cases of official resettlement, mechanisms of retraining, professional integration, or

adaptation to new socioeconomic conditions are absent. This precludes the full integration of such communities and leads to the formation of centers of social tension in host localities, particularly in small towns and settlements lacking the resources to absorb substantial numbers of newcomers. Similar tendencies were also identified within the analysis: regions experiencing the highest in-migration of environmental migrants face overburdened healthcare and educational infrastructure.

Kulmatov and Khasanov (2023) highlight the interstate dimension of environmental migration, which requires treating the Aral Sea ecosystem as a shared resource among several Central Asian countries. The conducted research confirms the relevance of a regional coordination approach, particularly regarding water resource management, land restoration, and desertification prevention. Such a comparison underscores the need to integrate multilateral environmental policies that would enable a more effective response to migration challenges within the macro-region.

The experience of South Asia, analyzed by Shah et al. (2019), demonstrates effective social adaptation practices for environmental migrants. The study's results also trace the need to introduce integration programmes that mitigate social tensions in host communities. A comparison of these models with the situation in Central Asia reveals the absence of similar mechanisms, thereby confirming the region's structural vulnerability and the need to transfer successful practices with due consideration of local specificities.

According to the analysis by Han et al. (2022), climate change is driving a transformation in the socioeconomic profile of rural regions. The trends identified in the Kyzylorda region—population ageing, declining agricultural productivity, and the contraction of labor potential—underscore the need to integrate long-term sustainable development policies into the governance strategies of environmentally vulnerable territories.

Thus, environmental migration is considered a complex form of spatial mobility, arising from protracted processes of socio-ecological system transformation, in which intensified environmental pressures intersect with social vulnerability, institutional fragility, and the absence of strategic governance. Addressing the challenges of environmental mobility requires a systemic, interdisciplinary policy framework encompassing environmental, social, economic, demographic, and legal components. It is essential to develop a comprehensive approach to environmental migration management that incorporates the coordination of national and regional levels, extensive engagement of civil society, integration of international experience, and the establishment of robust monitoring and evaluation mechanisms. Only by acknowledging the multidimensional nature of the issue can community resilience be ensured, the social consequences of migration mitigated, and the stability of the socio-ecological environment achieved in the long term.

## CONCLUSIONS

The conducted study established that environmental migration in regions experiencing prolonged environmental degradation is a multidimensional and complex phenomenon shaped by the interplay of ecological, socioeconomic, demographic, and political factors. The collected and analyzed materials allowed for the identification of key triggers driving forced population displacement. Climate-related risks play a predominant role in this process, including progressive desertification, depletion of water resources, deterioration of drinking water quality, and more frequent extreme weather events such as dust storms and droughts.

Quantitative analysis indicates an upward trend in internal environmental migration across several Central and South Asian states. In Kazakhstan's Kyzylorda region, more than 15,000 people migrate annually, approximately 60% of whom leave rural areas affected by environmental degradation. In the receiving regions of Kazakhstan, particularly Almaty and Turkestan provinces, population growth of up to 8% has been recorded over the past decade due to internal migration. In Uzbekistan, unofficial estimates suggest that up to 10–12 thousand people are displaced annually from territories adjacent to the Aral Sea zone, driven by soil salinisation and dust storms. In Iran, a continuous outflow of population from arid regions is observed: in 2023–2024 alone, around 800,000 cases of internal displacement were recorded due to droughts and floods. In China, according to available estimates, tens of millions of people undertake internal migration annually, with some relocating specifically due to environmental degradation (particularly in provinces with severe air pollution and water scarcity). Across the region, migrants are predominantly individuals aged 25–40, a trend that disrupts the age structure of sending territories and accelerates demographic ageing. Simultaneously, receiving regions face increased pressure on social infrastructure, healthcare, and educational institutions, generating new governance and financial challenges for local authorities.

At the same time, the study faces certain limitations. The primary challenge is the scarcity of official statistics on the scale of informal migration, particularly given the absence of residential registration. Furthermore, distinguishing migration driven solely by environmental factors is complicated by the overlap with economic, social, and infrastructural drivers of displacement. In this regard, further research should aim to strengthen the empirical foundation, expand quantitative methodologies (including regression and spatial analysis), and develop scenario-based models that account for the interaction between climate projections and migration dynamics. Therefore, under current conditions, environmental migration in regions experiencing environmental degradation exhibits all the features of a permanent and structural process that requires a targeted, scientifically grounded policy response at both national and regional levels.

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All data presented can be traced through the bibliography and footnotes.

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## POVZETEK

### OKOLJSKE GROŽNJE KOT VZROK ZA MIGRACIJE PREBIVALSTVA V REGIJAH Z NIZKO ODPORNOSTJO

Aigul Zharken, Ziyabek Kabuldinov, Zhabai Kaliev, Sabit Iskakov, Kairken Adiyet

Avtorji v prispevku obravnavajo vse pogostejši pojav okoljskih migracij, zlasti na območjih, ki so ekološko ranljiva zaradi podnebnih sprememb, degradacije tal in drugih okoljskih pritiskov. V svoji raziskavi se osredotočajo na Kazahstan, Uzbekistan, Iran in Kitajsko ter preučujejo, kako degradacija okolja v povezavi z družbeno-ekonomskimi, političnimi in institucionalnimi dejavniki vpliva na migracije prebivalstva. Posvečajo se zlasti regiji Kizilorda v Kazahstanu, pri čemer pa se njihove ugotovitve nanašajo tudi na druge regije Srednje in Vzhodne Azije. Glavni namen študije je ugotoviti, kako degradacija okolja vpliva na migracijske vzorce v regiji Kizilorda, s poudarkom na družbeno-ekonomskih, demografskih in institucionalnih dejavnikih.

V raziskavi je bila uporabljena kombinacija različnih metod, vključno z vsebinsko analizo pravnih in regulativnih okvirov, statistično analizo podatkov o migracijah ter kvalitativno analizo socioloških raziskav in študij primerov. Med najpomembnejšimi analizirani dokumenti so bili okoljski pravilniki Kazahstana in Uzbekistana, mednarodna poročila o migracijah ter podatki nacionalnih statističnih agencij. Poleg tega so avtorji za analizo javnega mnenja in namenov selitev v okoljsko ranljivih regijah uporabili sociološke raziskave in sekundarne podatke mednarodnih organizacij, kot sta Program ZN za razvoj (UNDP) in Mednarodna organizacija za migracije (IOM).

Ugotovitve študije kažejo, da so okoljske migracije kompleksen proces, na katerega vpliva kombinacija različnih okoljskih, družbeno-gospodarskih, demografskih in institucionalnih dejavnikov. Glavni okoljski dejavniki, ki spodbujajo migracije, so pomanjkanje vode, dezertifikacija, degradacija tal ter vse pogostejši ekstremni vremenski pojavi, kot so poplave in suše. Avtorji izpostavljajo tudi neustrezen odziv državnih institucij, ki nimajo na voljo posebnih pravnih okvirov za spopadanje z okoljsko pogojenimi migracijami. Ker okoljski migranti kot nepriznana skupina nimajo na voljo nobene podpore, se pogosto soočajo z izzivi pri dostopu do socialnih storitev in vključevanju v nove skupnosti. V Kazahstanu, Uzbekistanu, Iranu in na Kitajskem okoljske migracije niso priznane kot posebna pravna kategorija, veljavna zakonodaja na področju migracij pa se osredotoča predvsem na ekonomske migracije. Zaradi teh okoliščin se okoljski migranti, ki nimajo na voljo namenske pomoči in dostopa do pravnega varstva, soočajo z dodatnimi izzivi. Njihova ranljivost je še večja zaradi odsotnosti celovitih in usklajenih političnih ukrepov, zlasti na območjih z visokimi stopnjami pritiskov na okolje. Ugotovitve študije kažejo na potrebo po oblikovanju politik, ki bi naslavljal temeljne vzroke okoljskih migracij, vključno z vzpostavitvijo pravnih okvirov za priznanje kategorije okoljskih migrantov in zagotavljanje namenske podpore. Poleg tega je za blažitev vplivov degradacije okolja

ključnega pomena regionalno sodelovanje na področju okoljskih vprašanj, kot sta upravljanje z vodami in obnova zemljišč.

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Introduction to the Thematic Section

*Lyudmila Korigova, Aizhan Serikbayeva, Sanat Kushkumbayev*  
Transit Migration in Armed Conflicts: New Trends and Challenges for  
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