Post-Soviet Environmental Governance: Institutional Gaps and Policy Failures in Central Asia

Abstract

The dissolution of the Soviet Union marked a critical turning point in environmental governance across Central Asia. This paper examines how post-Soviet institutional fragmentation, weak regulatory frameworks, and uneven policy transitions have contributed to persistent environmental degradation in Central Asia. The region - situated between the Amu Darya and Syr Darya river basins and bordered by the Caspian Sea and the shrinking Aral Sea - possesses abundant yet unevenly distributed natural resources, including hydrocarbons, minerals, and glacial freshwater reserves. However, water has emerged as the most conflict-prone and strategically significant resource. Soviet-era ecological exploitation, particularly unsustainable irrigation and monoculture practices, laid the foundation for contemporary crises. In the post-independence period, institutional gaps, limited regional coordination, and governance deficits have hindered effective environmental protection and climate adaptation.

Climate change intensifies these vulnerabilities through glacier retreat, desertification, declining agricultural productivity, and worsening public health outcomes. The pollution of the Caspian Sea and the near-collapse of the Aral Sea exemplify policy failures and weak enforcement mechanisms. This study argues that environmental degradation in Central Asia is not merely an ecological issue but a multidimensional security challenge shaped by governance weaknesses and fragmented regional cooperation. By analysing institutional structures, policy implementation gaps, and regional dynamics, the paper situates Central Asia within broader debates on environmental security and post-socialist governance transitions, offering pathways toward integrated and resilient environmental governance.

Keywords: Central Asia; Environmental Governance; Post-Soviet Transition; Water Security; Climate Change; Institutional Gaps

Introduction

Central Asia occupies a distinctive geopolitical and ecological space, marked by abundant yet unevenly distributed natural resources(Kumar D. H., 2015). Stretching between the Amu Darya and Syr Darya river systems and bordered by the Caspian Sea and the Aral Sea, the region is predominantly arid and semi-arid, where water constitutes the most critical and contested resource. Despite vast reserves of hydrocarbons - particularly in Kazakhstan, Turkmenistan, and Uzbekistan - freshwater scarcity defines the environmental reality of the region. In countries such as Kazakhstan, water withdrawal rates have surpassed 40 percent of available supplies, indicating acute water stress. Meanwhile, Kyrgyzstan and Tajikistan depend heavily on glacier-fed water sources, which are increasingly vulnerable to climate change.

The ecological fragility of Central Asia is inseparable from its historical political economy. During the Soviet era, centralized agricultural planning converted the region into a major cotton-producing zone through extensive irrigation projects. This model, especially dominant in Uzbekistan and Turkmenistan, prioritized output over sustainability and dramatically altered natural hydrological systems. The diversion of the Amu Darya and Syr Darya rivers for irrigation stands as the most consequential example of this transformation. Prior to the 1960s, approximately 55 billion cubic meters of water flowed annually into the Aral Sea; by 2000, this figure had fallen to roughly 1.5 billion cubic meters. The result was one of the gravest ecological disasters of the twentieth century: the Aral Sea shrank to nearly a quarter of its original size, devastating surrounding ecosystems and livelihoods(Kumar, 2021, p. 91). Regions such as Karakalpakstan in Uzbekistan witnessed rising mortality rates, declining life expectancy, and widespread public health crises linked to environmental degradation.

The environmental consequences inherited at independence in 1991 were profound. The newly sovereign republics - Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan - emerged from the Soviet collapse with degraded ecosystems, aging infrastructure, and fragmented governance mechanisms ill-suited for cooperative water management. Although political authority largely remained in the hands of former Soviet-era elites, the institutional framework that had previously coordinated resource allocation across republics disintegrated(Kumar, H., 2024, p. 2). This created significant governance gaps, particularly in transboundary water management, where upstream and downstream interests often diverged.

Environmental degradation in Central Asia extends beyond ecological loss; it intersects directly with human security, economic stability, and regional politics. Water disputes, energy dependence, migration flows, and food insecurity illustrate the multidimensional nature of environmental challenges. In desert and semi-desert contexts, where water is indispensable for agricultural survival, scarcity carries immediate socio-economic implications. The Aral Sea crisis further exemplifies how environmental mismanagement can generate long-term health emergencies, including respiratory illnesses, contaminated water supplies, and declining agricultural productivity.Moreover, climate change has intensified existing vulnerabilities. Melting glaciers in the mountainous upstream states threaten long-term water availability, while rising temperatures accelerate desertification and soil salinization. The heavily polluted Caspian Sea adds another layer of environmental concern, particularly given the expansion of hydrocarbon extraction.

Following the dissolution of the Soviet Union, the region also attracted renewed international attention due to its strategic location and substantial oil and gas reserves(Kumar D. H., 2023, p. 115). However, resource wealth has not translated into effective environmental governance. Instead, institutional fragmentation, limited regional cooperation, and competing national priorities have constrained sustainable policy responses.

In this context, post-Soviet environmental governance in Central Asia must be understood as a complex interplay of historical legacies, institutional weaknesses, and emerging climate pressures. The environmental crisis confronting the region is not merely a matter of ecological decline; it represents a structural challenge rooted in governance deficits and policy failures that continue to shape the trajectory of sustainable development in Central Asia.

Review of Literature

The concept of environmental security brings together two deeply contested and analytically complex notions - security and environment. Because both terms carry diverse meanings across disciplines, their convergence has generated extensive debate and multiple interpretations(Matthew, A. Richard et al, 2010, p. 5). The interaction between ecological change and questions of safety, survival, and stability has therefore emerged as a significant area of scholarly inquiry. Historically, concerns regarding the relationship among population growth, environmental degradation, and conflict can be traced back to early political economy. In his essay on the *Principle of Population*, Thomas Malthus argued that “the

power of population is indefinitely greater than the power of the earth to produce subsistence for man." He maintained that the imbalance between food supply and demographic expansion would inevitably result in famine, disease, and war.More than a century later, Fairfield Osborn revived similar anxieties by questioning when it would be acknowledged that aggressive national policies and international discord could be linked to diminishing productive land and rising population pressures. Such reflections laid the intellectual foundation for later debates connecting environmental stress to instability. By the 1960s, environmental degradation had become a visible global concern, and scholars increasingly examined its political and social consequences. Rachel Carson's *Silent Spring* (1962) marked a turning point by drawing attention to the destructive effects of pollution and catalysing environmental movements worldwide. Although environmental awareness gained momentum during this period, the systematic linkage between environmental change and violent conflict entered mainstream security studies only toward the end of the Cold War. In 1989, nearly ten academic articles addressing this connection were published, signalling a significant shift in the discipline (O' Tuathail, 1996). These developments collectively elevated environmental change from a scientific concern to a matter of political and societal security.

Conceptually, the term "environment" commonly refers to the "natural environment," encompassing all components, conditions, and factors that influence the growth and development of living organisms(Yadav, Alok, 2013). The relationship between ecological protection and human security involves both normative and practical dimensions, as environmental deterioration directly affects livelihoods, health, and social stability. This interdependence is particularly visible in Central Asia, where environmental challenges are multidimensional and deeply intertwined with socio-economic and political dynamics. Among the most pressing concerns in the region are water scarcity, radiation hazards, and waste management, each posing serious threats to human security.

The most widely cited example of environmental mismanagement in Central Asia is the Aral Sea crisis. Over the past half-century, the Aral Sea has shrunk dramatically, leading to severe ecological, social, economic, and public health consequences (Oral, 2003, p. 5).The desiccation resulted primarily from the diversion of rivers to support the Soviet Union's cotton cultivation strategy. Covering approximately 68,000 square kilometers in 1960, the sea had reduced to a fraction of its original size by the mid-1990s and was nearing ecological collapse by 2000. The degradation of this once-vast water body exemplifies how state-driven

development policies, when detached from ecological considerations, can generate long-term regional instability.

In response to escalating environmental vulnerabilities, Central Asian states have begun formulating adaptation and mitigation strategies, particularly in relation to climate change. National policies increasingly emphasize water resource management, renewable energy development, and energy efficiency. Kazakhstan, for instance, has set targets to expand its renewable energy capacity(UNDP Kazakh, 2023), while Uzbekistan is undertaking reforms to modernize its energy sector and reduce carbon emissions(Dimovska, 2023). These initiatives reflect growing recognition of climate-related risks and the need for sustainable development pathways.

Regional cooperation has also become central to addressing shared environmental challenges, especially in managing transboundary water resources critical to regional stability. International organizations such as UNDP and ADB are actively supporting adaptation and mitigation projects aimed at strengthening institutional capacity and fostering resilience. Moreover, Central Asian countries have demonstrated commitment to global climate governance frameworks. Kazakhstan signed and ratified the Paris Agreement on August 2, 2016, and December 6, 2016, respectively(OECD, 2016), underscoring the region's engagement with international climate commitments.In addition to state and multilateral initiatives, several NGOs and INGOs - including the Aga Khan Foundation, Asian Development Bank, CARE International, Central Asian Climate Information Platform, ECO Forum of NGOs of Kazakhstan, International Union for Conservation of Nature, the German Corporation for International Cooperation, Oxfam, and the Regional Environmental Centre for Central Asia - play an instrumental role in advancing environmental awareness, capacity-building, and policy implementation across the region. Collectively, the literature underscores that environmental governance in Central Asia remains closely linked to broader questions of institutional capacity, regional cooperation, and human security.

Although substantial scholarship exists on post-Soviet environmental governance, important analytical gaps remain. In particular, limited attention has been paid to examining institutional deficiencies and policy failures in the specific context of Central Asian states. While individual country-based studies are available, there is a noticeable shortage of comparative research exploring how these states interact and address shared environmental

challenges collectively. The absence of a region-wide, comparative framework highlights the need for focused research to bridge these gaps and strengthen understanding of governance dynamics in Central Asia.

Research Questions

1. How did the Soviet environmental legacy shape post-independence governance structures?
2. What institutional gaps hinder effective environmental policy implementation?
3. How does environmental degradation intersect with regional security and conflict risks?

Hypothesis

Weak institutional coordination and fragmented policy frameworks in post-Soviet Central Asia have exacerbated environmental degradation and heightened environmental security risks.

Research Methodology

This study adopts a mixed-methods research design combining quantitative and qualitative approaches to examine institutional gaps and policy failures in post-Soviet environmental governance in Central Asia. The quantitative component draws on official environmental statistics, national legislation, and policy documents from the Central Asian states to identify trends in water stress, climate vulnerability, pollution levels, and resource management. Descriptive statistics and comparative analysis are employed to assess cross-country variations and institutional performance since independence. The qualitative component involves systematic document and policy analysis of environmental laws, interstate water agreements, government strategies, and regional cooperation frameworks. These materials are interpreted through the lens of environmental governance and environmental security to evaluate regulatory capacity, enforcement mechanisms, and coordination gaps. Primary sources include national legal frameworks and governmental reports, while secondary sources consist of peer-reviewed academic literature, international organization assessments, and policy analyses. This integrated approach enables a comprehensive evaluation of structural weaknesses and governance constraints shaping environmental outcomes in post-Soviet Central Asia.

Result and Analysis

Central Asia's contemporary environmental governance structure cannot be understood without reference to the Soviet legacy that shaped patterns of resource extraction, centralized decision-making, and ecological neglect. The Soviet model prioritized large-scale agricultural expansion, hydroelectric production, and industrial output, often without regard for ecological sustainability. Water, in particular, was treated as a strategic production input rather than a shared ecological resource. In this context, the diversion of the Amu Darya and Syr Darya rivers for cotton monoculture fundamentally altered the hydrological balance of the Aral Sea basin, initiating one of the gravest environmental crises of the twentieth century (Oral, 2003, p. 5).

After independence, the dissolution of the centralized *Ministry of Land Reclamation and Water Resources* (Minvodkhoz) in Moscow transferred water management responsibilities to newly sovereign but institutionally fragile states. Although regional mechanisms were created to negotiate annual water allocations at the presidential level, micro-level reforms remained limited. In many cases, Soviet-era practices such as the "use it or lose it" allocation principle continued in the absence of effective sanctions or conservation incentives. This institutional fragmentation directly validates the hypothesis that weak coordination and disjointed policy frameworks have intensified environmental degradation and increased environmental security risks.

The Aral Sea's shrinkage - from 68,000 square kilometres (approximately the size of Odisha, an India State) in 1960 to nearly one-tenth of its size by the mid-1990s - illustrates how inherited production priorities combined with post-Soviet economic nationalism undermined ecological sustainability. The resulting Aralkum desert now emits approximately 755 million tonnes of toxic dust annually, spreading pollutants across the Pamir and Tien Shan mountains and beyond. Soil salinity, biodiversity loss, declining agricultural productivity, and public health crises demonstrate how environmental degradation intersects with socio-economic instability. The environmental crisis is therefore not merely ecological but structural, linking poverty, governance deficits, and regional tension.

Climate change has further intensified vulnerabilities. Glacial retreat in Kazakhstan and neighbouring Central Asian countries reduced ice reserves by more than one-third between 1956 and 1990 and continues at an annual rate of 0.6-0.8 percent. Since glacial meltwater contributes roughly 25 percent of annual river runoff, continued decline threatens long-term

water security. In a region marked by demographic growth and irrigation dependence, such hydrological uncertainty increases the risk of inter-state friction. The evidence thus confirms that environmental degradation, resource scarcity, and governance gaps collectively heighten environmental security concerns.Regional and international efforts, including the Environment and Security Initiative (ENVSEC-2002) and subsequent coordination meetings in Bishkek(OSCE, 2017, p. 16), indicate growing recognition of shared vulnerability. However, while institutional architecture has expanded, implementation gaps persist across national contexts.

Kazakhstan represents both the most institutionally developed and environmentally burdened state in Central Asia. Soviet policies, including the *Virgin Land Program* initiated in 1953, converted nearly 60 percent of pastures into cropland, much of it ecologically unsuitable. By 1992, although 36.5 million hectares were cultivated, only 2.3 million hectares were irrigated, exposing structural inefficiencies(AllRefer, 2016). These historical interventions contributed to soil erosion, desertification, and water stress.The Aral Sea catastrophe particularly affected Kazakhstan's northern regions. By 2007, the water surface had declined by nearly 90 percent(Nugumanova, 2017, p. 4). The construction of the Kokaral Dam in 2005 partially restored the North Aral Sea, reviving limited fishing activities and providing modest livelihood recovery. Nonetheless, broader basin-level degradation remains unresolved.Kazakhstan also inherited extensive radioactive contamination from the Semipalatinsk Nuclear Testing Polygon, established in 1947. Between 1949 and 1989, 470 nuclear tests were conducted, releasing contamination across 19 million acres(UNDPKAZ, 2004, p. 54). Cancer rates in the region tripled between 1980 and 1990, with lung and esophageal cancer mortality increasing significantly(Karimova, 2018, p. 1422). These figures demonstrate how Soviet-era militarization generated enduring health and ecological consequences.

Institutionally, Kazakhstan has developed an extensive legal framework. Article 31 of the 1995 Constitution obliges the state to protect an environment favourable to life and health(UNDPKAZ, 2004, p. 20). Th Law on Environmental Protection (1997), the Environmental Code, 2007 (amended 62 times between 2007-2017), and the Emissions Trading Scheme administered by the Department of Climate Change reflect advanced legislative capacity(UNECE, 2019, p. 15), (Nugumanova L. &., 2017). Kazakhstan was also among the first post-Soviet states to ratify the UNFCCC and introduce carbon market mechanisms.Yet frequent institutional restructuring - including the abolition of the *Ministry*

of Environmental Protection in 2014 and the transfer of responsibilities to the *Ministry of Energy* - illustrates governance volatility. Despite legal sophistication, enforcement deficits and bureaucratic overlap constrain effective implementation. Thus, Kazakhstan confirms the hypothesis: institutional complexity without coherent coordination perpetuates environmental risk.

Kyrgyzstan's environmental governance reflects both vulnerability and adaptive experimentation. As an upstream state dependent on glacial meltwater, it faces acute climate sensitivity. The degradation of mountain glaciation threatens hydroelectric production and irrigation stability.Unlike some regional counterparts, Kyrgyzstan pursued decentralization through the Law on Pasture (2009), transferring rangeland management to community-based pasture committees(Wang, 2020, p. 2501),(Hughes, 2012, p. 11). This reform sought to correct Soviet-era overgrazing patterns and enhance local stewardship. Complementary frameworks such as the *National Climate Change Adaptation Strategy* (2015; updated 2020) and the *Green Economy Development Strategy* (2019) institutionalized climate planning(Bychkova, 2023, p. 152).

The establishment of the *Climate Change Coordination Commission* in 2012 improved inter-sectoral oversight(PAGE, 2019, p. 20). Civil society organizations, including the UNISON foundation, have strengthened community participation. However, fiscal constraints, limited administrative capacity, and dependence on external funding restrict policy continuity.Kyrgyzstan's experience suggests that decentralization can enhance responsiveness but requires robust coordination and sustained financial support. The persistence of glacier retreat and water-sharing tensions underscores the structural link between environmental vulnerability and regional security.

Tajikistan, another upstream country, relies heavily on glacial runoff for hydropower and agriculture. National communications to the UNFCCC (2003, 2008, 2014) and the *National Strategy for Climate Resilience* (2019) reflect formal commitment to adaptation(Khakimov, 2020, p. 7)(Scissa, 2024, p. 52).Institutionally, climate governance is shared among the *Executive Office of the President*, the *Committee for Environmental Protection, and the Agency on Hydrometeorology*(OSCE, 2017, p. 53). While this multi-actor approach broadens participation, it also risks fragmentation.

Frequent floods, landslides, and glacial lake outburst events expose communities to compounded environmental threats. Poverty amplifies vulnerability, and adaptation measures

often depend on donor-supported initiatives. Tajikistan therefore exemplifies how limited institutional capacity constrains the operationalization of environmental strategies, reinforcing the central hypothesis.

Uzbekistan, as a downstream state heavily dependent on irrigation for cotton, bears substantial responsibility for Aral Sea depletion. Water diversion policies during the Soviet period entrenched monoculture dependence. The resulting desertification and salinization have severely degraded agricultural productivity.Recent reforms signal a shift. Ratification of the *Paris Agreement* (2018), the *Environmental Protection Concept* (2019), and *the Green Economy Development Strategy* (2019) outline sustainability commitments. *Presidential Decree No. PP-436 of December, 2022*, operationalizes measurable green growth targets(World Bank Group, 2023, p. 18). Initiatives such as Yashil Makon and large-scale renewable energy investments demonstrate policy ambition (Bychkova, 2023, p. 112),(Nematov, 2025).

However, implementation remains challenged by irrigation inefficiency, institutional centralization, and rural vulnerability. Media narratives and international finance mobilization have increased public engagement, yet structural water dependence persists. Uzbekistan's trajectory illustrates incremental institutional reform within an inherited resource-intensive model.

Turkmenistan's governance model remains highly centralized. The *National Climate Change Strategy* and afforestation drive under the *National Forestry Programme* (since 2013) reflect symbolic commitment.Its participation in Rio+20 and international forums indicate diplomatic engagement(OSCE, 2017, p. 57).Nevertheless, expanded gas production has elevated emissions, and irrigation inefficiencies continue to strain water resources. Limited transparency and civil society engagement restrict policy accountability. While political stability is relatively high, environmental governance remains state-centric, reinforcing regional fragmentation.

Policy Recommendations

1. Establish a binding, rules-based transboundary water framework with enforceable compliance mechanisms.
2. Clarify mandates among ministries and integrate water, energy, and agriculture policies.

3. Scale up community-based resource management models, especially in irrigation and pasture systems.
4. Prioritize glacier monitoring, water-saving irrigation technologies, and drought-resilient crops.
5. Institutionalize access to environmental information and strengthen civil society oversight.
6. Integrate environmental risk assessments into regional security cooperation frameworks.

Conclusion

The findings confirm that Soviet environmental legacies structured centralized extraction-oriented governance. Post-independence fragmentation, inconsistent decentralization, and weak enforcement mechanisms have hindered effective implementation. While legal and institutional reforms are evident across the region, coordination deficits persist.Environmental degradation - manifested in water scarcity, glacial retreat, desertification, and radioactive contamination - intersects directly with socio-economic vulnerability and regional security. The hypothesis that weak institutional coordination and fragmented policy frameworks exacerbate environmental degradation and heighten security risk is therefore substantiated.

Central Asia's environmental governance trajectory reveals a complex interplay between inherited structural legacies and contemporary institutional fragmentation. Addressing these systemic weaknesses is essential not only for ecological sustainability but also for regional peace and human security.

References (*indicate primary sources)

AllRefer (2016, March). Kazakhstan: Agriculture in Kazakhstan, Kazakhstani Information Resource. Retrieved from AllRefer.com: http://reference.allrefer.com/country-guide-study/kazakhstan/kazakhstan33.html

Bychkova, A. (2023, September). Understanding Climate Change Narratives in Central Asia: The Power Dynamics in Vulnerable States. Department of Politics and International Relations, Nottingham Trent University. Retrieved April 28, 2025, from https://irep.ntu.ac.uk/id/eprint/51624/1/Alina%20Bychkova%202023.pdf

Dimovska, M. (2023). *Meeting Uzbekistan's climate goals while lighting homes and powering industry.* United Nations Development Programme. Retrieved from https://www.undp.org/uzbekistan/blog/meeting-uzbekistans-climate-goals-while-lighting-homes-and-powering-industry

Karimova, B. Z. (2018). Ecological Problems in Mass Media in Kazakhstan. *Journal of Pharmaceutical Sciences & Research, 10*(6), 1422-1427. Retrieved from https://www.jpsr.pharmainfo.in/Documents/Volumes/vol10Issue06/jpsr10061823.pdf

Khakimov, P. A. (2020). Climate Change Effects on Agriculture and Food Security in Tajikistan. *SilkRoad: A Journal of Eurasian Development, 2*(1), 1-21. doi:https://doi.org/10.16997/srjed.33

Kumar, D. H. (2015). Geopolitics and Great Powers in Central Asia. Retrieved from https://www.researchgate.net/publication/390985314_Geopolitics_and_Great_Powers_in_Central_Asia

Kumar, D. H. (2023). Central Asia's Security: A study of Great Powers, Bilateral Treaties and Regional Organizations. *NIU International Journal of Human Rights, 10*(III), 115-128. Retrieved from https://www.researchgate.net/publication/372110443_Central_Asia's_Security_A_study_of_Great_Powers_Bilateral_Treaties_and_Regional_Organizations

Kumar, H. (2021). Traditional and Non-Traditional Threats in Central Asian Republics. *Journal of Education: Rabindra Bharati University, XXIII*(9), 86-93. Retrieved from https://www.researchgate.net/publication/390980175_TRADITIONAL_AND_NON-TRADITIONAL_THREATS_IN_CENTRAL_ASIAN_REPUBLICS

Kumar, H. (2024). Democratic Process and Political Process in Central Asian States. *Central Asia and the Caucasus, 25*(1), 1-14. Retrieved from https://www.researchgate.net/publication/391279315_DEMOCRATIC_PROCESS_AND_POLITICAL_CULTURE_IN_CENTRAL_ASIAN_STATES

Matthew, A. Richard et al. (2010). *Global Environmental Change and Human Security.* London: The MIT Press. Retrieved from http://mitp-content-server.mit.edu:18180/books/content/sectbyfn?collid=books_pres_0&id=8210&fn=9780262513081_sch_0001.pdf

Nematov, A. (2025, April 3). Euroviews. Central Asia at the forefront of the fight against climate change and Uzbekistan's regional policy. Retrieved August 10, 2025, from https://www.euronews.com/2025/04/03/central-asia-at-the-forefront-of-the-fight-against-climate-change-and-uzbekistans-regional

Nugumanova, L. a. (2017, May). Environmental governance and policy in Kazakhstan. *IOS Working Papers*. Leibniz Institute for East and Southeast European Studies. Retrieved from https://www.econstor.eu/bitstream/10419/162149/1/889792119.pdf

O' Tuathail, G. (1996). *Critical geopolitics.* London: Routledge.

*OECD. (2016). *Multi-dimensional Review of Kazakhstan: Volume 1. Initial Assessment.* OECD Development Pathways. Paris: OECD Publishing. Retrieved from

https://www.oecd.org/publications/multi-dimensional-review-of-kazakhstan-9789264246768-en.htm

Oral, A. A. (2003, March 18). Health and Ecological Consequences of the Aral Sea Crisis. *Regional Cooperation in Shared Water Resources in Central Asia*. Kyoto. Retrieved from http://www.caee.utexas.edu/prof/mckinney/ce385d/papers/atanizaova_wwf3.pdf

*OSCE. (2017). *Climate Change and Security in Central Asia - Regional Assessment Report.* Organization for Security and Co-operation in Europe. Retrieved June 30, 2025, from https://www.osce.org/secretariat/355471

*PAGE. (2019). *The Kyrgyz Republic: Green Industry and Trade Assessment (GITA).* Partnership for Action on Green Economy, United Nations Industrial Development Organization. Retrieved March 14, 2025, from https://www.un-page.org/static/65bf5ebc9e71e3e381447cdbab3b0931/2019-kyrgyz-republic-green-industry-trade-assessment-kyrgyzstan-unido-page.pdf

Scissa, C. a. (2024). *Migration in the Context of Climate and Environmental Changes within Central Asia and to the European Union and the Russian Federation.* Geneva: International Organization for Migration. Retrieved July 12, 2025, from https://environmentalmigration.iom.int/sites/g/files/tmzbdl1411/files/documents/2024-05/pub2023-041-el-migration-in-the-context-of-climate-ca-eu-rf_0.pdf

*UNDPKAZ. (2004). *Environment and Development Nexus in Kazakhstan.* A series of UNDP publication in Kazakhstan. Almaty: LEM Printhouse. Retrieved from https://www.thegef.org/sites/default/files/ncsa-documents/2147-22347.pdf

*UNECE. (2019). *Environmental Performance Reviews: Kazakhstan.* United Nations Economic Commission for Europe. New York and Geneva: United Nations. Retrieved from https://www.unece.org/fileadmin/DAM/env/epr/epr_studies/ECE_CEP_185_Eng.pdf

Wang, Y. Y. (2020). Recent responses of grassland net primary productivity to climatic and anthropogenic factors in Kyrgyzstan. *Land Degradation and Development, 31*, 2490-2506. doi:https://doi.org/10.1002/ldr.3623

*World Bank Group. (2023). *Uzbekistan: Country Climate and Development Report.* Washington: World Bank. Retrieved December 12, 2025, from http://hdl.handle.net/10986/40608

Yadav, Alok. (2013). An Empirical Study on Environmental Issues in India. *Global Journal of Management and Business Studies, 3*(9), 949-954. Retrieved from https://www.ripublication.com/gjmbs_spl/gjmbsv3n9_03.pdf