GLOBAL LAND OUTLOOK

Central Asia Thematic Report

Region of Ancient Traditions and Modern Perspectives

United Nations
Convention to Combat Desertification

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United Nations Convention to Combat Desertification

The UNCCD Interregional Group Central Asia - Russia

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Foreword

Yasmine Fouad
UNCCD Executive Secretary

Central Asia is not merely a geographic region. It is a unique space where natural wealth, history, and culture have been deeply intertwined for millennia. Among its majestic mountains, vast steppes, deserts, and river valleys, generations of communities have developed traditions of careful and sustainable natural resource management, enabling these landscapes to retain their vitality even under harsh climatic conditions. Today, however, the region stands at a defining moment. It faces one of the most pressing challenges of our time: halting land degradation, strengthening the resilience of natural and socio-economic systems to climate change, and securing a prosperous future for present and future generations.

The Global Land Outlook Central Asia Thematic Report presents a comprehensive perspective on the region as a unified ecological system in which natural processes and human activities are inextricably linked. It reminds us that the future of the region depends on recognizing the inseparable relationship between land, water and people, and on managing these resources as one interconnected system.

The report demonstrates that maintaining healthy land resources is fundamental to ensuring reliable water availability, sustainable agriculture, economic development, and human well-being. Healthy land is the foundation of healthy food systems, resilient communities, and sustainable economies. Drawing on contemporary scientific research and extensive regional experience, the authors trace the evolution of approaches to sustainable land management, examine the causes and consequences of desertification, land degradation, and drought, and propose practical solutions for ecosystem restoration and the sustainable use of natural resources in support of sustainable development.

The countries of Central Asia have consistently demonstrated their commitment to addressing these shared challenges through the framework of the United Nations Convention to Combat Desertification (UNCCD). The continued advancement of regional cooperation reflects a shared understanding that effective land management, enhanced drought resilience, and the restoration of degraded ecosystems can only be achieved through coordinated action by governments, the scientific community, local authorities, and communities. The report also reflects an important shift in thinking, from responding to land degradation after it occurs to investing in prevention, restoration, resilience, and the sustainable management of natural capital.

The development of cooperation between the countries of Central Asia and the Russian Federation within the framework of the UNCCD further confirms that the interconnectedness of natural processes gives rise to shared environmental challenges. Therefore, interregional cooperation plays a vital role in strengthening scientific collaboration, exchanging best practices, and scaling up effective solutions that contribute to environmental conservation and improved quality of life. As this report clearly demonstrates, ecosystems connect countries far more than borders divide them.

The UNCCD welcomes and supports the strengthening of such partnerships. By bringing together scientific advances, effective public policies, innovative technologies, and the traditional knowledge of local communities, we can accelerate progress towards achieving Land Degradation Neutrality, while simultaneously enhancing climate resilience, conserving biodiversity, strengthening food security, and creating conditions for sustainable socio-economic development. At the same time, investing in healthy land is an investment in people, creating jobs, strengthening livelihoods, reducing migration pressures, enhancing water availability, and building more resilient communities across the region.

This report is not only an analytical assessment but also a call for collective action. It demonstrates that the solutions already exist, and that the challenge before us is to scale them through stronger partnerships, sustained investment, sound science, and long-term political commitment. The decisions made today will determine the future state of land resources and the quality of life for generations to come. Building on the region's rich historical heritage, advancing scientific knowledge, and strengthening cooperation both within Central Asia and beyond, the region can demonstrate that the conservation and restoration of land resources are essential foundations for environmental sustainability, economic prosperity, and the long-term well-being of society. By acting together, Central Asia has an opportunity not only to restore its landscapes, but also to demonstrate to the world that healthy land is the foundation of resilience, prosperity, and lasting solidarity.

Acronyms and Abbreviations

AIFC	Astana International Financial Centre
AIS	Agroindustrial Solutions
BCarbon	American non-profit organization specializing in the standardization of carbon units and the development of science-based protocols for nature-based climate solutions
CACILM II	Central Asian Countries Initiative for Land Management Phase II
CAREC	Regional Environmental Centre for Central Asia
CBD	Convention on Biological Diversity
CIS	Commonwealth of Independent States
CMS	Convention on the Conservation of Migratory Species of Wild Animals.
COP16 (UNCCD context)	16th session of the Conference of the Parties to the United Nations Convention to Combat Desertification, Saudi Arabia, Riyadh, December 2024
COP16 (CBD context)	16th meeting of the Conference of the Parties to the United Nations Convention on Biological Diversity, Colombia, Cali, October 2024
COP17	17th session of the Conference of the Parties to the United Nations Convention to Combat Desertification, Mongolia, Ulaanbaatar, August 2026
COP28	28th Conference of the Parties to the United Nations Framework Convention on Climate Change, the UAE, Dubai, November 2023
COVID-19	Coronavirus Disease 2019
DEWS	Drought Early Warning Systems
DLDD	Desertification, Land Degradation and Drought
ELD	Economics of Land Degradation Initiative
FAO	Food and Agriculture Organization of the United Nations
FFS	Farmer Field School
FSC	Federal Scientific Centre of Agroecology of RAS
GDP	Gross domestic product
GEF	Global Environment Facility
GIS	Geographic Information System
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
ICSD	Interstate Commission for Sustainable Development
ICWC	Interstate Water Coordination Commission
IFAS	International Fund for Saving the Aral Sea
IPCC	Intergovernmental Panel on Climate Change
IRG	UNCCD Interregional Group “Central Asia – Russia”
IYRP	International Year of Rangelands and Pastoralists
LDN	Land Degradation Neutrality
MRV	Monitoring, Reporting, Verification
NAP	National Action Programme to Combat Desertification
NDVI	Normalized Difference Vegetation Index
NVT	National Voluntary LDN Targets
PFI	Peace Forest Initiative
PRAIS	Performance Review and Assessment of Implementation System
RAS	Russian Academy of Sciences

RCP 8.5	Representative Concentration Pathway 8.5
REP4SD CA	Regional Environmental Programme for Sustainable Development of Central Asia
RESILAND	Resilient Landscapes in Central Asia Programme
RI	Research Institute
SDGs	Sustainable Development Goals
SLM	Sustainable Land Management
TNSFP	Three-North Shelter Forest Program, the Chinese Great Green Wall Programme
UN	United Nations
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States Dollar
USAID	United States Agency for International Development
USSR	Union of Soviet Socialist Republics
WMO	World Meteorological Organization
WOCAT	World Overview of Conservation Approaches and Technologies
WUA	Water Users Association

Key Messages: Central Asia at the Turning Point

Developed within the IRG


Pexels, Tomáš Malík

1. A Silent Crisis at the Heart of Eurasia

In the vast heart of Eurasia, a silent crisis is unfolding. Central Asia, a region once celebrated for its sweeping steppes and fertile oases, is now one of the world's epicenters of land degradation. Over 80 million hectares – more than a quarter of the region – are already degraded. To put that in perspective, this area is approximately four times the size of Kyrgyzstan. Nearly 30% of the population – 24 million people – live on land that is dying beneath their feet (*UNCCD Regional Factsheet, 2023*).

This is not just environmental statistic; it is a human tragedy. Every year, Central Asia loses between USD 2 and 6 billion to the ravages of degraded land. These losses are not abstract, they are harvests that never reach the table, villages emptied of life, the health of communities eroded, and the dreams of young generations quietly fading away.

Climate change is not a distant threat; it is already here. Central Asia is heating at twice the global average. The glaciers – once the "water towers" of the region – have shrunk by 30% in just fifty years. The rivers and oases that have nourished civilizations for millennia are running dry.

Yet this is not simply a crisis of nature. It is a crisis of governance, of foresight, and of cooperation. Central Asia stands at a crossroads: one path leads to ecological collapse, mass migration, and irreversible loss; the other to a bold transformation, turning the region into a global model of sustainable dryland management. The choice is urgent, and the time to act is now.

2. The Paradigm Shift: From Fighting Desertification to Managing Assets

Land Degradation Neutrality (LDN) is not a bureaucratic exercise in reporting – it is a new philosophy of development. Its principle is deceptively simple, yet profoundly transformative: Avoid – Reduce – Reverse. Preventing land degradation is always faster, cheaper, and more effective than trying to fix it later. It is far wiser to care for a hectare of land today than to spend enormous effort restoring it tomorrow.

All five Central Asian states have embraced National Voluntary LDN Targets (LDN) under Sustainable Development Goal (SDG) 15.3, and half of these targets are already met. This is not a moment of triumph – it is the end of denial. LDN has moved from theory into practice, now embedded in national green economy strategies, agricultural development plans, and climate adaptation policies.

The adoption of SDG Indicator 15.3.1 – the proportion of land that is degraded over total land area – has given the region a shared language for measuring what was once invisible. Yet numbers alone cannot tell the full story. A desert with naturally low vegetation is not degraded; it is the land's inherent character. Central Asia is now developing its own locally relevant indicators: spectral

salinity indices for irrigated lands, species composition for pastures, and carbon stocks in saxaul forests. These tools reveal the real pulse of the land.

The emerging economics of land demands a shift in perspective. Soil is more than a productive resource – it is a vital form of natural capital. Soil organic carbon, in this light, is an investment in the long-term health and productivity of the land. Assessing these investments requires robust approaches that consider ecosystem functionality, resilience, and natural capital, not just immediate returns.

The traditional framing of "combating desertification" also warrants refinement. Human activity should not be framed as inherently detrimental to land systems. Rather, people and land are interdependent components of natural capital. Sustainable land management (SLM) therefore requires strengthening this relationship by promoting integrated approaches in which socio-economic activities and ecosystem processes are mutually reinforcing and collectively support long-term resilience. LDN is more than a framework; it represents a guiding paradigm. It calls for recognizing land as the foundation of life, a form of natural capital, and a shared responsibility to be safeguarded for present and future generations.

3. Five Paths, One Goal: National Peculiarities Become Mutual Strengths

Central Asia's strength lies in its diversity. Each country has developed distinct capacities, and there is a growing commitment to sharing knowledge and experience across the region.

Kazakhstan – *'the pragmatist'*.

- 2 billion trees by 2025. 900,000 hectares of eroded cropland to be restored by 2030.
- Law on Soil Protection (2026): establishment of a comprehensive soil protection and monitoring system and stricter land-use requirements.
- Pasture deficit cut from 3.5 to 2.1 million hectares in one year. 2.1 million hectares of unused land returned to the state.
- Carbon farming pioneer. Potential: USD 35 billion/year from soil carbon.

Message: "Long-term thinking is the only rational choice."

Uzbekistan – *'the innovator'*.

- 2 million hectares of the drained Aral Sea bed planted with saxaul. Actual dust retention: 35–40% (forecast was 15–18%).
- "Yashil Makon" Initiative: 200 million seedlings/year. Urban greening from 8% to 30% by 2030. Permanent moratorium on tree cutting – a cultural revolution.
- 1 million hectares under drip irrigation. Projects linking law, forests, communities development and transboundary trust.

Message: "Even a dead sea can be resurrected – with patience and science."

Turkmenistan – *'the guardian of ancient knowledge'*.

- 80% desert. Mastery of sand dune fixation, moisture-harvesting trenches, living green walls.
- Initiative to establish an Interregional Centre on Climate Technology in cooperation with the UN and a Reigonal Centre to Combat Desertification.

Message: "The desert is not an enemy. It is a teacher."

Kyrgyzstan – *'the community pioneer'*.

- Pasture Law: Pasture Committees – local communities – now set grazing norms, collect fees, reinvest in infrastructure. A model for the entire Eurasian steppe.
- "Jashyl Muras" Campaign: restore 23,000 hectares of forests, 300,000 hectares of degraded land by 2030.

Message: "The people who live on the land must govern the land."

Tajikistan – *'the mountain engineer'*.

- 93% mountains. Turning "wasteland" into productive orchards, stopping mudflows, holding water drop by drop.
- 124 documented technologies in WOCAT – the highest in Central Asia. A living encyclopedia of survival.
- Dushanbe Water Process: global advocacy for glaciers as global public goods.

Message: "Every centimeter of soil saved is a victory."


Pixabay | WaSZI

4. The Aral Sea: From Symbol of Tragedy to One of Hope

The Aral Sea, once a symbol of environmental collapse, is increasingly being reframed as a defining ecological lesson for Central Asia. Today, it is no longer merely a symbol of past degradation. Large-scale national and transboundary saxaul planting initiatives on the dried seabed are helping to stabilize soils, reduce wind erosion, and mitigate sand and dust storms. The Northern Aral Sea's water volume has increased from 18.4 to 23 billion m^3 since 2023, with a goal to reach 34 billion m^3.

The Aral experience underscores that while ecosystems respond sharply to unsustainable use, they also demonstrate a capacity for recovery when supported by sustained efforts, cooperation, and adaptive management.

5. Building the Institutional Architecture: From Silos to Synergy

The most significant achievement of the past five years has been the growing recognition that current economic, social and environmental challenges cannot be addressed by any country in isolation. The International Fund for Saving the Aral Sea (IFAS) is active and effective. Two binding regional strategies are now in force: Drought Risk Management and Mitigation and Sand and Dust Storms Management (2021–2030). Drought is no longer an unexpected shock; it is a predictable and recurrent risk. This shift transforms the response from reactive to proactive, demonstrating that drought is a manageable challenge.

The UNCCD Interregional Group "Central Asia – Russia" (IRG) represents a distinctive instrument of science-based cooperation. It has contributed to depoliticizing elements of the environmental agenda, advancing the harmonization of monitoring approaches, and developing a Roadmap for joint action – encompassing data exchange, technology transfer, transboundary restoration, and capacity-building.

A growing number of successful international initiatives demonstrate that land restoration can also serve as a platform building trust across borders. The message is clear: ecosystems function beyond boundaries of political geography. Borders do not divide ecological realities; they delineate areas of joint stewardship and shared responsibility for sustainable management of natural capital.

6. The Human Dimension: Youth, Women, and the Fight Against Social Desertification

Central Asia is home to over 80 million people – half under the age of 30. The median age is just 26.7 years (*UNCCD Regional Factsheet, 2023*). This is the largest, youngest, and most dynamic workforce in the region's history. It can be either a demographic dividend or a demographic time bomb.

Land degradation is not just an ecological problem – it is a socio-economic one. Left unaddressed, it can lead to "social desertification," marked by declining livelihoods, fewer opportunities, and increased migration. Preventing land degradation requires integrated approaches that enhance resilience, generate socio-economic opportunities, and advance sustainable development.

Conversely, land restoration generates locally grounded employment opportunities in pasture management, forestry, irrigation, and climate-resilient agriculture. With returns of up to five dollars for every dollar invested over 30 years, it is both an economic opportunity and an investment in future generations.

Women in local communities are not passive actors – they are central drivers of change. In Tajikistan's mountains, women built subsurface greenhouses with stone heat accumulators. In Karakalpakstan, they lead community forestry groups. In Kyrgyzstan, women serve on Pasture Committees. Where women manage land, sustainability rises.

Green jobs are not merely a slogan – they are an essential component of sustainable development. Land restoration can create millions of jobs that are inherently local and cannot be outsourced or automated, including herders, foresters, irrigation engineers, agroecologists. This represents a pathway from social desertification towards a genuine demographic dividend. The lesson is clear: restoring land requires, in parallel, strengthening the social fabric that sustains it.

7. The Road Ahead: Priorities for Action

1. **Secure long-term land tenure.** Farmers with 20–50-year leases are more likely to invest in soil health and sustainable practices. Short-term arrangements often limit stewardship and long-term planning.
2. **Legislate anti-degradation frameworks.** High-risk zones should have clear legal status, including mandatory conservation practices, grazing limits, and green belts. These measures should be enforceable, not optional.
3. **Harmonize and digitize monitoring.** Establish a Regional minimum set of LDN indicators tailored to Central Asia's arid landscapes, supported by an open "Digital Earth Central Asia" platform. Triple verification should combine satellite imagery, ground surveys and community observations for accuracy and transparency.
4. **Build carbon-ready institutions.** Develop national soil carbon registries, define legal frameworks for carbon credits, and invest in capacity building in MRV, Big Data, and AI to support sustainable land management.
5. **Empower local communities.** Scale successful initiatives such as Kyrgyzstan's Pasture Committees, Uzbekistan's community forestry, and Tajikistan's farmer-to-farmer extension programs. Women and youth should not be seen as beneficiaries alone – they are essential decision-makers and drivers of sustainable land use.
6. **Speak with one voice as a region and collaborate internationally.** UNCCD COP17 in Ulaanbaatar (August 2026) offers a historic opportunity. A unified Central Asian position on drought management, rangelands, pastoralism, and glacier protection will strengthen the region's voice in global climate finance and policy discussions.

There is no concern if neighbouring countries adopt similar approaches – this is actively encouraged. The objective is to ensure that individual success translates into shared regional success. Land Degradation Neutrality in Central Asia can only be achieved through collective action. Progress in one country is intrinsically linked to progress across the region. We invite the international community to join us on this journey.

UNCCD Interregional Working Group
"Central Asia – Russia"

Ashgabat – Astana – Bishkek –
Dushanbe –Moscow – Tashkent
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Executive Summary


Unsplash | Oziel Gómez

Central Asia at a Crossroads: Land, Water, and the Future of the Region

Central Asia is not merely a geographical name. It is a unique civilizational, environmental, and economic organism that has taken shape at the very heart of the Eurasian continent. For thousands of years, life here has been defined by one fundamental condition: people's ability to work with nature under conditions of severe water scarcity. From the oases of Mesopotamia to the high-mountain pastures of the Pamirs and Tian Shan, from the Kyzylkum and the Karakum deserts to the endless steppes of Saryarka, land has always been the region's greatest wealth. Yet it is fragile resource, requiring constant care, respect, and sound management. This understanding has been passed down from generation to generation, shaping not only economic, life but also a distinctive worldview in which people did not place themselves above nature, but sought to become its wise allies.

This Thematic Report is dedicated to the state of land resources in Central Asia. It would, however, be a profound mistake to view it as a purely technical or sector-specific document. Behind the figures on soil degradation, the outlines of saline irrigated areas, the statistics on dust storms, and the losses in pasture productivity lie the lives of millions of people, the food security of sovereign states, the environmental stability of a vast region, and, ultimately, the quality of life of future generations. We are dealing not simply with a set of environmental issues, but with the question of what Central Asia will become in twenty, thirty, or a hundred years: a flourishing region that has preserved its unique nature and provides a decent life for its citizens, or an area of environmental disaster from which people are forced to flee in search of water, food, and security.

Global context: a planetary warning. Central Asia is not alone in facing this challenge. According to UNCCD, between 2015 and 2019 the world lost about 100 million hectares of productive land every year. Total losses over those five years reached 420 million hectares – an area larger than the entire territory of our region [1, 2, 3]. This is not merely a set of statistics. It is a signal that the land-use crisis has become global. And the answer Central Asia is seeking today is one the whole world is waiting for.

Expanding the View: A Region without Artificial Borders

Although this Thematic Report focuses primarily on the five countries of the region – Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan [4] – we consider Central Asia as an integrated arid macroregion. In this document, we deliberately emphasize the abstract and limited nature of a purely political and administrative view of Central Asia as five post-Soviet republics. The region's environmental, climatic, historical, and economic processes extend beyond any formal borders, however legitimate those borders may be under international law.

The problems examined in this review are transboundary in nature and do not respect state borders. The basins of the Amu Darya and the Syr Darya rivers supply water not only to the five countries of the region but also to adjacent territories, home to millions of people whose lives and economic activities also depend on water resources formed in the Pamir glaciers. Dust and salt storms arising on the dried seabed of the Aral Sea and in the Karakum and Kyzylkum deserts reach the southern regions of Russia and the foothills of the Caucasus, reminding us that the atmosphere does not recognize customs posts or border checkpoints [5, 6]. The grassland ecosystems of Mongolia and Kazakhstan form part of a single Eurasian steppe belt, facing the same challenges of overgrazing and climate change; nomads on both sides of the border are grappling with the same questions: how to preserve mobility in an age of sedentary settlement, and how to feed growing herds on shrinking pastures.

This broader, ecosystem-based approach allows us to look beyond isolated national hotspots and see a systemic land-use crisis affecting the entire macroregion – one that requires an equally systemic, coordinated, and evidence-based response. Today, all countries share this understanding, and it underpins joint solutions to DLDD challenges common to the Central Asian region [7].

International recognition. In 2026, the attention of the international community is focused on a significant extent on Central Asia. The Regional Ecological Summit in April in Astana [8], the Water Action Decade Conference in Dushanbe [9], the GEF Assembly in Samarkand [10], and COP17 in Ulaanbaatar in August 2026 [11] are not merely events. They are recognition that the region's experience in pasture management, combating desertification, and adapting to climate change is of global relevance.

The "Land – Human – Water" Triad

Central Asia is considered as a single socio-ecological system. The triad "Land – Human – Water" is not a set of separate resources to be managed in isolation, but a single, indivisible whole that requires an integrated, interdisciplinary approach to planning and management.

Within this triad, land is not only, and not even primarily, an object of economic activity, a factor of production, or a source of profit. Land is the foundation of the cultural identity of the peoples of Central Asia. It carries the memory of ancestors who, for centuries, passed on the knowledge needed to cultivate arid soils. It is the basis of a traditional way of life, a lifestyle, and a value system. Without a connection to the land, people in this region lose their roots, their sense of home, and belonging. The food security that land provides is not simply a matter of calories and nutrients. Land stands for independence, sovereignty, and the capacity of states to care for their citizens.

Water is not merely a technical resource for irrigation, nor only a number of cubic metres distributed according to limits and schedules. Water is the circulatory system that unites the entire region. The glaciers of the Pamirs and Tian Shan feed the rivers; the rivers bring life to deserts and steppes; and the water returns to the atmosphere to fall again as snow in the highlands. This cycle knows no state borders. It obeys only the laws of nature. Any human intervention in this cycle therefore requires the

utmost caution, wisdom, and solidarity. No country can say: "the water belongs to me." Water is a common gift, a common responsibility, and a common destiny.

The human element in this triad is neither an outside observer, nor a mere consumer or exploiter. Rather, it is the central actor whose decisions and actions determine the stability of the entire system. People built irrigation canals and terraced fields, domesticated wild plants, and bred livestock adapted to the harsh climate. And it is people who, today, equipped with powerful machinery and fertilizers but lacking environmental culture, can destroy in a few decades what was created over millennia.

Demographic Factor: Human Capital and Social Risks

The demographic factor adds even greater urgency and responsibility. Central Asia is one of the few regions in the world that continues to experience steady and sustained population growth. The population of Central Asia is currently estimated at 84.9 million. According to the World Bank, an average of 53% of the region's population lives in rural areas, although the degree of urbanization varies considerably across countries. The share of the population living in rural areas is approximately 38% in Kazakhstan, 62% in Kyrgyzstan, 71.5% in Tajikistan, 45% in Turkmenistan, and 49% in Uzbekistan. More than half of its residents are under 30 years of age. The average age in the region is only 26.7 years [12, 13, 14].

With the right investments in education, health care, and decent jobs, this tremendous human capital and enormous development potential can become the main driver of sustainable economic growth and modernization.

Yet this same potential can become a source of serious social risk if young people see no prospects for fulfilment on their own land, cannot find decent work, start a family, or provide for their children's future. In Central Asia, land degradation, climate change, and migration are linked through people's living conditions. Land degradation can act as a powerful push factor, especially in remote rural areas where there are virtually no alternatives to employment in the agricultural sector [14]. Young people leave for cities or move abroad – to Russia, Europe, and other regions. The outflow of the most active, educated, and dynamic part of the population weakens local communities, entrenches underdevelopment, and creates demographic imbalances.

The reverse process – from degradation to restoration – can not only return productivity to degraded, ecosystems but also create millions of new jobs in rural areas. Pasture restoration needs herders, not only grants and projects. Afforestation on the dried bed of the Aral Sea requires thousands of working hands. Modernizing irrigation systems requires engineers and construction workers [15]. Producing organic products requires qualified agronomists. All these jobs are rooted in place: they cannot be moved to another country or automated to the point where people´s participation is excluded entirely. They offer young people the chance to link their future to

their native land and to see it not as a source of issues but as a source of opportunity.

Review as an Invitation to Dialogue: Earth in the Spotlight

We, the IRG members, see this Thematic Report as an open invitation to broad, honest, and constructive dialogue. It is addressed not only to the relevant ministries and agencies responsible for agriculture, water resources, and environmental protection. We also address international donors and investors, whom we regard not merely as sources of financing but as strategic partners able to share risks and responsibilities with us. We appeal to the scientific community, both within the region and beyond it, to join forces in studying complex, interdisciplinary problems. We reach out to civil society, farmers' associations, water users, environmental activists, and everyone who faces the consequences of land degradation every day and is searching for solutions.

Our goal is not simply to state that issues exist – many of them have been known for decades. Our goal is to demonstrate the region's readiness for systemic, deep, and irreversible change. We seek to show its investment appeal not only as a source of raw materials or a sales market, but also as a space for introducing green technologies, piloting innovative approaches to natural resource management, and implementing large climate projects. We seek to prove Central Asia's capacity to be not only a recipient of international assistance but also an actor in global policy, with its own vision, significant resources, and, most importantly, the political will to act.

The work on this document has confirmed that, despite differences in economic development, political systems, and national priorities, the countries of Central Asia share common values and face challenges that can be overcome only through joint efforts.

We are united by the understanding that land is not merely a commodity, an asset, or an object of sale. Land is a national treasure, the foundation of life for present and future generations, and a source of sovereignty and identity.

We are united by the understanding that the water flowing from the Pamir and Tian Shan mountains belongs neither exclusively to the country of origin nor exclusively to the downstream country. It is a common gift of nature, a common heritage, and a common responsibility that requires fair, careful, and science-based allocation.

We are united by the memory of our ancestors, who for centuries passed on knowledge about cultivating this difficult arid land, and by our responsibility to our descendants, to whom we must leave a blooming garden, not a scorched desert.

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Section 1.
Historical Background: The Legacy of the Past and the Evolution of Approaches to Land Resource Management

1.1. Central Asia: A Crossroads of Civilizations and Eras

The rich shared history of the Central Asian countries includes major events associated with the region's development in different periods: ancient history, the Russian Empire, the Soviet Union, and the present day. Along the caravan routes of the Great Silk Road, goods, ideas, and inventions moved across Central Asia between ancient cultural centres [1]. The history of Central Asia is the history of the many peoples who have inhabited it [2]. The way of life of the region's population was shaped first and foremost by geography and climate.

Central Asia is associated not only with sands and deserts, but also with picturesque oases, mountain regions where glaciers feed major waterways, and cultural and historical monuments that bear witness to ancient routes linking Eastern and Western civilizations. The region has significant natural resources, social stability, and experience in maintaining productive agriculture under difficult desert and mountain conditions, in high heat and with limited irrigation and drinking water. These assets are now complemented by modern capacities: digital land mapping for monitoring land condition at the national and regional levels; transboundary agricultural production clusters based on the latest information and agricultural technologies; and the education and training of specialists in planning and managing land and transboundary water resources at both national and regional levels, taking into account the vital interests of all countries.

The arid climate required the construction of irrigation systems to support farming on fertile but dry lands. In every historical period, successful agriculture in the region depended on the combined efforts of communities and authorities [3]. The countries of Central Asia have accumulated rich experience within a shared development paradigm, including the ability to farm in an arid climate and under water scarcity. The region functions as a single geopolitical and spiritual space with significant natural resources, strong human capital, and a rich cultural and historical heritage.

Today, after gaining political independence, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan are developing individually, in line with their own economic interests and resource capacities. Export and import indicators for goods and services among the Central Asian countries within the CIS reflect historically established economic links.

All Central Asian countries have common regional interests in politics, economy, and culture, linked to their natural resource endowments, favourable transit position, and aspiration for stable development. The countries of the region are committed to strengthening both mutual and international cooperation, while preserving their cultural identity and rich historical heritage.

MAP 1

Central Asia

Source: UNCCD Interregional Group "Central Asia – Russia" website https://www.land-irg.org/

TABLE 1

Key Macroeconomic Indicators of the Countries of the Region:

Country name	Total export (2023)	Import including by countries of the region:					Total import (2023)	Trade balance
		Kazakhstan	Kyrgyzstan	Tajikistan	Turkmenistan	Uzbekistan		
Kazakhstan	**$96 B**	**GDP $263 B GDP per capita $12.9 K**	Subtotal $1.09 B Top $214 M Gold	Subtotal $859 M Top $261 M Wheat	Subtotal $397 M Top $177 M Wheat	Subtotal $3.04 B $735 M Wheat	**$63.4 B**	**$32.5 B**
Kyrgyzstan	**$3.99 B**	Subtotal $559 M Top $159 M Precious Metal Ore	**GDP $14 B GDP per capita $1.97 K**	Subtotal $1.2 M Top $1 M Special purpose motor vehicles	Subtotal $4.62 M Top $1.59 M Electric Filament	Subtotal $284 M Top $35.1 M Coal Briquettes	**$17.8 B**	**-$13.9 B**
Tajikistan	**$1.49 B**	Subtotal $271 M Top $99.7 M Lead Ore	Subtotal $1.18 M Top $977 K Aluminium Bars	**GDP $12.1 B GDP per capita $1.16 K**	Subtotal n/a Top $727 K Aluminium Bars (2022)	Subtotal $142 M Top $33.3 M Zinc Ore	**$6.48 B**	**-$4.99 B**
Turkmenistan	**$15.3 B**	Subtotal $166 M Top $95.6 M Petroleum Gas	Subtotal $17.5 M Top $8.51 M Tomatoes	Subtotal n/a Top $42 M Refined Petroleum (2022)	**GDP $60.6 B GDP per capita $8.23 K**	Subtotal $950 M Top $645 M Petroleum Gas	**$4.72 B**	**$10.6 B**
Uzbekistan	**$24.3 B**	Subtotal $1.37 B Top $310 M Vehicle Bodies (including cabs) for the motor vehicles (8701 to 8705)	Subtotal $769 M Top $77.7 M Light Rubberized Knitted Fabric	Subtotal $489 M Top $37.6 M Refined Petroleum	Subtotal $170 M Top $49.6 M Nitrogenous Fertilizers	**GDP $102 B GDP per capita $2.85 K**	**$38.1 B**	**-$13.7 B**

Source: The Observatory of Economic Complexity (OEC). https://oec.world/en

1.2. A Double-Edged Legacy: Ambition, Achievements, and Systemic Mistakes

Any discussion of contemporary strategies to address desertification in Central Asia would be incomplete without looking back. The region entered independence with a complex environmental legacy. During the Soviet period, large-scale irrigation infrastructure – canals, reservoirs, and pumping stations – was built, making it possible to turn deserts and steppes into flourishing oases and to make the region one of the leading cotton producers [4]. At the same time, an extensive network of scientific institutes, experimental stations, and land reclamation services was created. Yet the practice of "developing nature" that took shape in those years often meant using land and water resources without fully accounting for their restoration and replenishment.

Cotton monoculture: from "white gold" to Ecological Crisis. In the past, the main priority was the large-scale expansion of irrigated land for cotton – "white gold" [5]. Thousands of kilometres of canals, major reservoirs, and the conversion of deserts into fields enabled the region to become a leading cotton producer. However, water from the main rivers – the Amu Darya and the Syr Darya – almost ceased to reach natural water bodies. Over time, the consequences of this approach became clear: the Aral Sea, once the fourth-largest lake in the world, became a dry seabed [6]. The drying up of the Aral Sea is not simply an environmental tragedy; it is the result of an intensive model of water and land use. Cotton, which required more water than the rivers could provide, depleted the soil and needed large quantities of fertilizers and pesticides, which returned to the rivers and the sea with drainage water.

Virgin land development: black storms over the steppe. In northern Kazakhstan, the large-scale ploughing of virgin lands in the 1950s, intended to address food security needs, led to unexpected environmental

consequences[7]. Black dust storms, the blowing away of the fertile humus horizon, and erosion affected millions of hectares. Wind erosion, previously known mainly in desert areas, became a serious problem in the steppe zone. Soil stripped of its natural turf turned to dust and was carried hundreds of kilometres by the wind[8]. What nature had created over millennia proved vulnerable to intensive economic intervention within only a few years.

Neglect of drainage: salt as a sentence. The inherited paradox was this: the more water was supplied for irrigation, the faster groundwater rose to the surface, evaporated, and left salts in the soil. And the faster salts accumulated, the more water was needed to leach them out. This was a vicious circle that had to be broken. Yet large-scale irrigation systems were built without proper consideration of drainage: water reached the fields, but had no way to leave. Worn-out collector and drainage networks and intense evaporation turned this process into one of the region's key environmental problems[9, 10]. This is how the mechanism of secondary salinization emerged, affecting millions of hectares today.

Loss of tradition: a generational gap. Traditional land- and water-use practices that had sustained people in an arid climate for centuries – seasonal grazing on winter and summer pastures, community-based irrigation management, complex crop rotations, and respect for water sources – have largely lost their significance or been marginalized. Nomads forced to settle lost not only their customary way of life, but also their unique skills in the rational use of pastures. Traditional and local knowledge, passed down by word of mouth for millennia, became undervalued. Where traditions were disrupted, a vacuum emerged; it was not filled by alternative management systems, often oriented towards centralized planning and standardized approaches.

The bright side of the legacy: science waiting for its moment. It would be unfair, however, to forget another legacy: a strong scientific school of desert studies[11]. This legacy includes the scientific institutes in Ashgabat, Tashkent, Almaty, and Moscow, where knowledge was accumulated over decades on how to survive and provide food in conditions where annual rainfall can sometimes be no more than a single rainy day in a European summer. It includes collections of drought-resistant plants, methods of phytomelioration, and soil maps prepared with a precision that even modern GIS centres might envy.

This knowledge did not disappear; it was waiting for its moment. Today, as the region faces a climate crisis, these archives, scientific schools, and people are becoming a bridge between the past and the future.

1.3. The Institutional Gap of the 1990s: System Collapse and a Governance Vacuum

With independence in the 1990s, large collective and state farms collapsed, which used to not only to produce goods, but also protected the environment through maintaining soil-protective crop rotations, creating shelterbelts, and carrying out land reclamation works. At the same time, the unified water management system for the Aral Sea basin, built over decades, was dismantled.

Land reform and its consequences. Land passed to millions of small farmers and dehkan farms, who often lacked the sufficient experience in agriculture. However, the knowledge accumulated over decades often remained on the pages of textbooks. The previous system had trained specialists for large farms, while the new land users had to learn to manage small plots amid economic uncertainty, shortages of machinery and fertilizers, and limited access to markets. This created a knowledge vacuum whose consequences are still felt today [12, 13]. In the early 2000s, dehkans often explained why they continued irrigating fields according to the old farm routines: "The water is there – use it while it lasts." This revealed a specific generational issue: people did not always see the direct link between today's actions and tomorrow's possible consequences. Soil salinization was seen not as the result of inadequate drainage or inefficient water use, but as "bad land" or "God's punishment".

Short-term leases: the tragedy of the commons compounded. In most countries of the region, land remained state-owned and was leased on short three- to five-year terms. This created what economists call the "tragedy of the commons", but in an especially acute form: without security for the future, farmers were forced to focus on short-term results, often with little incentive to restore land over the long term. Under such conditions, intensive and sometimes wasteful resource use often became a forced survival strategy. Why apply organic fertilizers if the plot might pass to someone else tomorrow? Why maintain a drainage network if no responsibility for it is assigned? Why plant perennial grasses if the lease expires in two years?

Over time, land relations in the Central Asian countries began to change [14, 15, 16, 17, 18]. In Kazakhstan and Uzbekistan, land may be privately owned under certain conditions. In Tajikistan, land is the exclusive property of the state, and it guarantees its effective use in the interests of the people. In Kyrgyzstan, land may be privately owned, with the exception of pastures and forests. Turkmenistan recognizes the right to private ownership of land. Today, land-lease conditions in Central Asian countries vary depending on the circumstances, land category, purpose of use, and other factors. For example, agricultural land in Kazakhstan and Uzbekistan is now provided on long-term leases of up to 49 years; in Tajikistan, land plots may be leased for up to 20 years; while in Kyrgyzstan, land from the State Agricultural Land Fund is leased for up to five years.

Water deadlock: energy versus irrigation. Reservoirs in the upper reaches of rivers in Kyrgyzstan and Tajikistan were originally designed for irrigation. Today, however, they increasingly operate primarily in an energy regime: water is stored and released in winter to generate electricity, while summer is when irrigation water is most needed. Downstream countries – Kazakhstan, Uzbekistan, and Turkmenistan – face irrigation-water shortages at the height of the agricultural season. This is not the result of anyone's deliberate choice, but an objective expression of regional interdependence: upstream states in river basins must use water resources simultaneously for energy and agriculture [19, 20]. The price of this compromise is chronic water shortages downstream and flooding of land in winter. Without an agreed regional "water compromise", any efforts towards sustainable land use in irrigated areas will have only limited effect.

MAP 2

Water resources of the Aral Sea basin

Source: CAWater-Info – Portal of Knowledge for Water and Environmental Issues in Central Asia, https://cawater-info.net/index.htm
Map produced by Zoï Environment Network, 2011

1.4. Evolution of Approaches: From Reactive Measures to Proactive Management

The first generation of strategies: diagnosis without a prescription. In the mid-1990s, following the voluntary commitments under the UNCCD, which all countries of the region had ratified, the first NAPs to Combat Desertification were developed. These documents played an important role [21]. For the first time, land degradation was recognized not as a local agricultural failure, but as a systemic issue requiring state intervention. An inventory of "hotspots" was carried out, along with an initial diagnosis of soils and pastures.

However, the first generation of strategies also had inherent limitations. Most often, they remained programme documents rather than legally binding instruments. Responsibility was dispersed among agencies responsible for agriculture, environment protection, water, and forestry, while inter-agency coordination was somewhat sporadic. Financing, with rare exceptions, was provided with whatever funds remained. Ambitious goals were not supported

by sustainable budgetary mechanisms, and by the mid-2000s it had become clear that a new approach was needed.

Integration into strategic development. A key shift over the past fifteen years has been the inclusion of land degradation issues in core strategic development documents. Environmental concerns are no longer an "afterthought" to the economy. Today, no AIS strategy or green-economy concept is complete without provisions for achieving LDN.

Kazakhstan has integrated goals for restoring pastures and eroded land into its Green Economy Transition Concept and the State Programme for AIS [22]. Uzbekistan has included water-saving and afforestation objectives in its Agricultural Development Strategy until 2030 [23]. Turkmenistan has made drought adaptation one of the key areas of its National Climate Change Strategy. Tajikistan and Kyrgyzstan, given their mountainous terrain and high vulnerability to erosion, have focused on integrated water and land resources management and included it in their national adaptation strategies.

1.5. The Concept of Land Degradation Neutrality: A Paradigm Shift

A qualitative shift occurred when the countries of the region made voluntary commitments to achieve LDN under the 2030 Agenda for Sustainable Development (target 15.3) [24]. The LDN concept does not imply an end to land use; its aim is to prevent the net loss of healthy and productive land, in other words to achieve a balance between degradation and restoration. Every hectare lost to degradation should be offset by restoring an equivalent area within the same land category. Behind this neat calculation, however, lies a profound paradigm shift. For the first time in decades, people are ceasing to see land as a fail-safe mechanism obliged to produce harvests regardless of how much has been taken from it. Soil is being viewed not as a "means of production", but as a living system that, as it turns out, has limits of resilience.

The "Avoid – Reduce – Restore" principle establishes a clear logic for action: prevention is always cheaper and more effective than restoration. If degradation cannot be stopped completely, its impacts must be minimized. Only then, as a last resort, should restoration of lost land begin [25]. This idea may appear almost self-evident, but when consistently applied in policy and practice, it requires a radical restructuring of the existing land-use system.

According to expert estimates, many LDN targets in the region have already been achieved, and countries are seeking to implement their previously established plans for 2030 in full [26]. This does not mean that the problem has been solved: land degradation continues, secondary salinization is expanding, and glacier melt is outpacing adaptation capacities. At the same time, it indicates a shift towards a more systematic and transparent approach – one based on accounting, objective assessment of progress, and recognition of both achievements and continuing challenges [27].

TABLE 2

State of land in Central Asian countries, 2001-2018 (by SDG indicator 15.3.1)

Country	State of Land in Central Asian Countries under Indicator 15.3.1 SDG 2001–2018								LDN Index
	Improved		Stable		Deteriorated		No Data		
	%	km²	%	km²	%	km²	%	km²	%
Kazakhstan	20.0	532614	55.2	1468965	24.1	641761	0.7	19971	-4.1
Kyrgyzstan	15.6	30027	49.9	96130	25.2	48555	9.4	18021	-9.6
Tajikistan	18.2	25454	33.5	46958	29.5	41385	18.8	26280	-11.4
Turkmenistan	5.0	24313	70.5	341003	24.2	117117	0.2	949	-19.2
Uzbekistan	10.2	44858	66.7	293840	19.8	87048	3.3	14589	-9.6
Central Asia, total	**16.8**	**657266**	**57.3**	**2246896**	**23.9**	**935866**	**2.0**	**79810**	**-7.1**

Source: calculated data from the Trends.Earth module in the Quantum GIS platform (authors' materials)

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Section 2.
Analysis of Land Degradation Processes: Diagnosis, Scale, and Trends

2.1. A Silent Crisis in the Heart of Eurasia: The Scale and Geography of the Problem

Central Asia is a region of striking contrasts: the snow-white peaks of the Tian Shan and the Pamirs, the emerald green of the Fergana Valley, and the boundless, heat-breathing expanses of the Kyzylkum and Karakum deserts. Yet a closer look reveals another picture: lands covered with networks of cracks, pastures where only dust remains instead of grass, and dry riverbeds that are unlikely ever to fill with water again.

For a person living in New York, London, or Moscow, the words "land degradation" and "desertification" may seem remote and abstract. For a farmer in the foothills of Khatlon or a herder in the Kyzylorda desert, however, they are a matter of survival. When the wind carries away the topsoil and the sun turns pasture into dust, a family loses its main asset – the land.

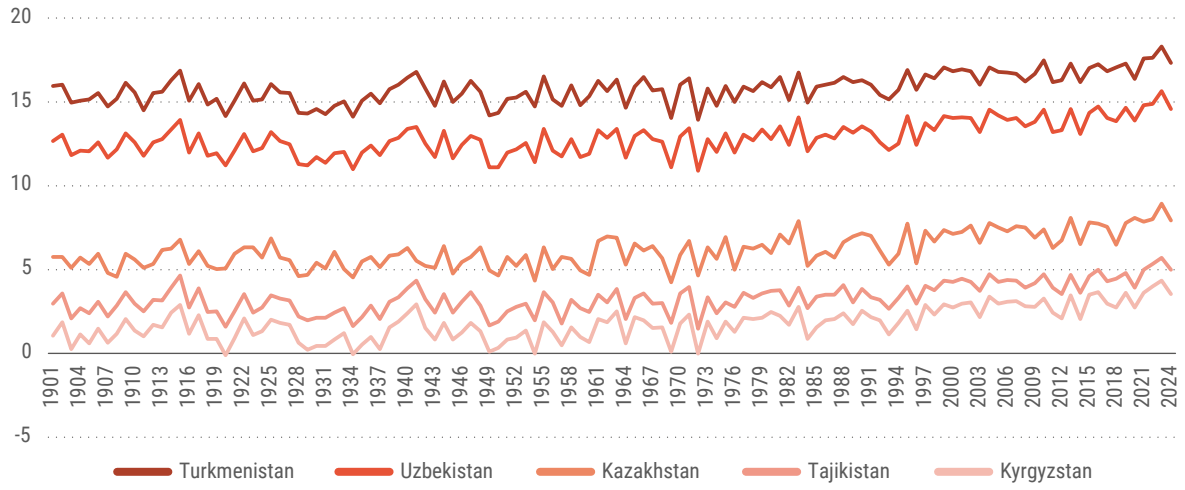
According to UNCCD estimates, more than 20 per cent of Central Asia's territory – about 80 million hectares – is already degraded *(UNCCD, CRIC 21, 2021)*. This is almost four times the area of Kyrgyzstan. The situation directly affects around 30 per cent of the region's population. In Kazakhstan, according to UN expert estimates, about 78 per cent of the territory is classified as at high risk of desertification, and the country remains one of the region's major sources of dust storms [1]. In Uzbekistan, the land that has lost productivity, despite the measures being taken, is still estimated at about one quarter of the country's territory.

Natural Vulnerability of the Region. Central Asian ecosystems are highly fragile. The region lies deep within the Eurasian continent and is isolated by mountains from Atlantic and Pacific circulation. The climate is sharply continental and arid. Average annual precipitation ranges from 400 mm in the north to less than 100 mm in the south. For comparison, Moscow receives about 700 mm and Berlin about 600 mm. Here, rain is more an exception than a rule, and evaporation exceeds precipitation many times over. Without water, land quickly becomes lifeless.

Since 1965, the region has shown a consistent trend: average annual temperature is steadily rising, while precipitation is declining. Central Asia is warming twice as fast as the global average [2]. Climate models under the SSP5.85 scenario – depicts an extreme highwarming pathway characterized by rapid economic growth driven largely by fossil fuels and minimal climate policy action – project that by 2050 the number of rainy days in the plains will decrease by a further 10-15 per cent [3]. At the same time, surface runoff is declining, and soil moisture – the farmer's "invisible capital" – is being depleted.

FIGURE 1

Average Annual Air Temperature in Central Asian Countries (C⁰)



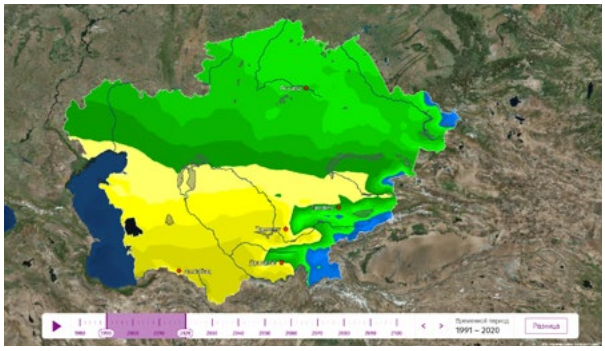
Source: STATBASE open database. https://statbase.ru/datasets/

Aridification is compounded by unsustainable land-use practices. Central Asia's problems are not purely natural. This is a combined anthropogenic and natural crisis, in which management failures and institutional gaps play a role no less important than climate change.[1]

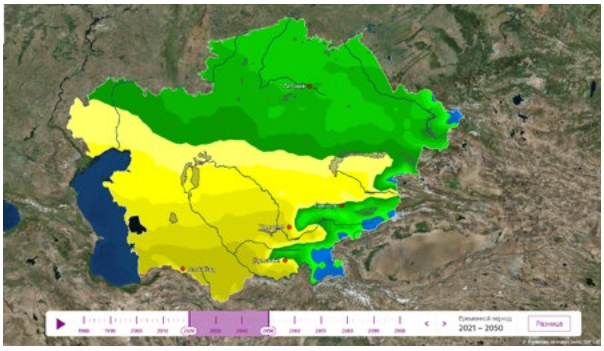
[1] The United Nations Convention to Combat Desertification Report on rising aridity trends globally and associated biological and agricultural implications https://www.preventionweb.net/publication/united-nations-convention-combat-desertification-report-rising-aridity-trends-globally

MAP 3

Average air temperature in Central Asia (historical data and forecast for 2021-2050)

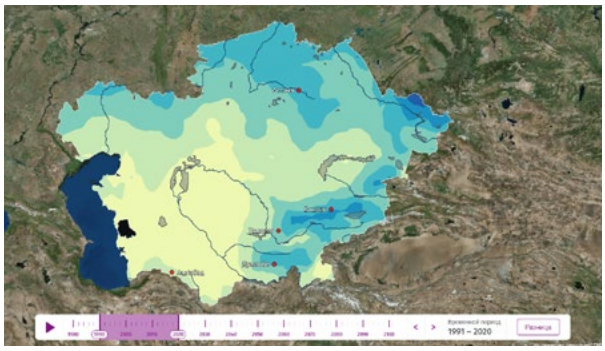


Average air temperature, historical data, 1991-2020

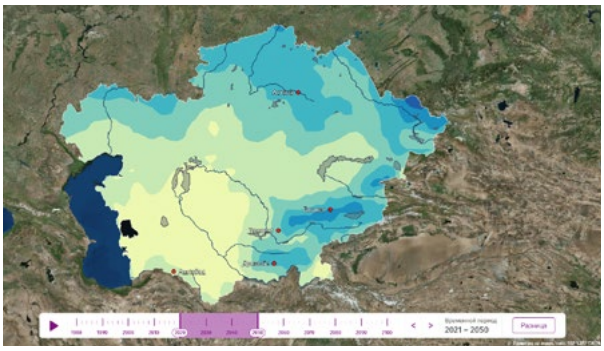


Average air temperature, projected data, 2021-2050, under the SSP5-8.5 climate scenario

Rainy days in Central Asia (historical data and forecast for 2021-2050)

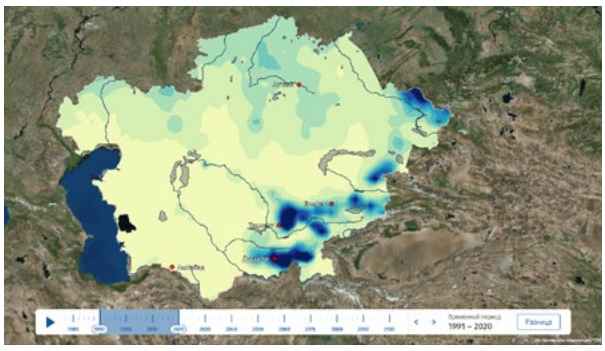


Rainy days, historical data, 1991-2020

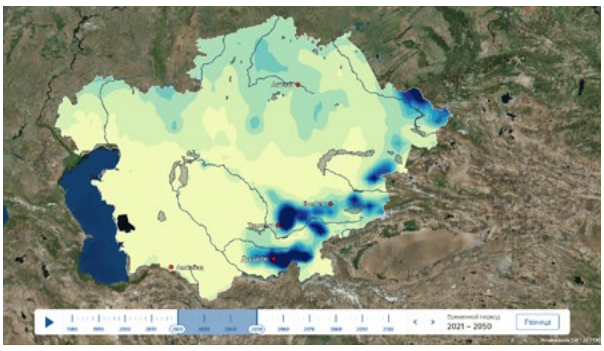


Rainy days, projected data, 2021-2050, under the SSP5-8.5 climate scenario

Total surface water runoff in Central Asia (historical data and forecast for 2021-2050)

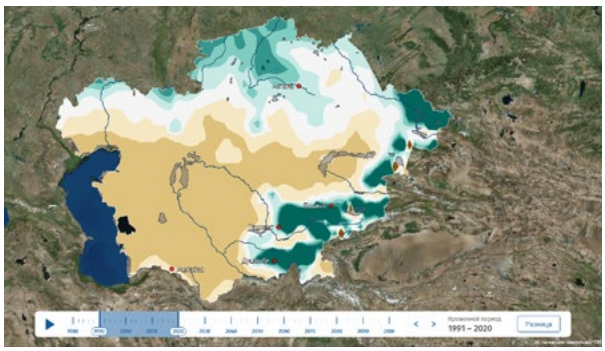


Map of total surface-water runoff in Central Asia, historical data, 1991-2020

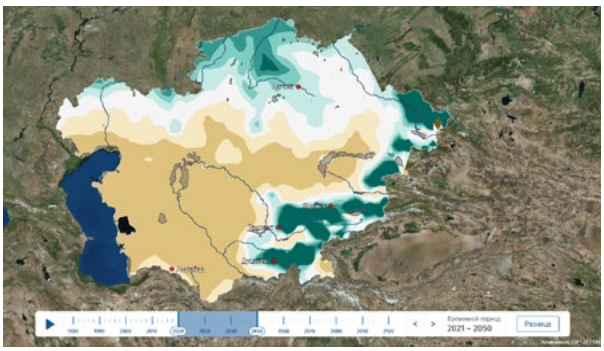


Map of total surface-water runoff in Central Asia, projected data, 2021-2050, under the SSP1-2.6 climate scenario

Aridity index in Central Asia (historical data and forecast for 2021-2050)



Aridity index in Central Asia, historical data, 1991-2020



Aridity index in Central Asia, projected data, 2021-2050, under the SSP1-2.6 climate scenario

Source: Climate Impacts Online https://kfo.pik-potsdam.de/index_en.html?language_id=en

2.2. LDN Assessment: What the Decade Has Shown

Before planning for the future, it is necessary to assess the present reliably. An analysis using the Trends.Earth calculation module for 2001-2018 shows a mixed [4], complex, but by no means hopeless picture.

Key figures. Stable land accounts for almost 57 per cent of Central Asia's territory – a vast area that is, for now, withstanding growing pressure. Another 16.8 per cent shows signs of improvement. One might think there is room to breathe. Yet the remaining 23.9 per cent is land where degradation is already changing the very face of the landscape: fertility is declining, ecosystems are being depleted, and environmental stress is increasing.

The LDN index – the difference between the improved and degraded land within the same land category, capturing the net dynamic – is negative in all five countries. The most concerning situations are in Turkmenistan and Tajikistan, where the decline in the index approaches twenty percentage points (-19.2 per cent and -11.4 per cent respectively). As part of data updating in 2025, surveys were conducted over 53.5 million hectares and identified 2.7 million hectares of land as actually degraded. This is a vast territory, comparable with the area of an entire European state. The countries of Central Asia approach national target indicators for assessing progress towards LDN in different ways, reflecting factors ranging from voluntary commitments to challenges in implementation and monitoring. In Kyrgyzstan, NVT have been developed and approved in line with specific national circumstances and development priorities [5]. In Turkmenistan, defining national LDN targets and creating indicator systems for monitoring are regarded as important strategic tasks linked to implementation of SDG target 15.3 by 2030. In Uzbekistan, LDN targets were approved by government resolution in 2023, including commitments to restore a defined area of degraded land, introduce water-saving technologies, and increase forest cover. These indicators are subject to regular monitoring and review. According to the document, an inter-agency monitoring system has been established in the country to calculate SDG indicator 15.3.1.

The paradox of improvement. Contrary to gloomy forecasts, forested areas increased by 6.4 per cent over the period under review. Uzbekistan [6] and Tajikistan led this growth, with increases of 39 per cent and 23 per cent respectively. People are planting trees in deserts, foothills, and saline lands, often under extremely difficult natural and climatic conditions. This is no longer merely a statistic; it is evidence that the environmental agenda has ceased to be the exclusive domain of international organizations and is becoming increasingly embedded in national strategies and land resources management practice. At the same time, however, the region faces a growing water deficit. The area of water bodies has declined by 18.5 per cent, and in Uzbekistan this figure is approaching 50 per cent. The Aral Sea is not the only loss, but it is certainly the most symbolic. Water resources that only recently seemed an integral part of the landscape are shrinking rapidly.

Reforestation, as a compensatory measure, also requires irrigation, at least for the first two or three years. Without sufficient moisture, the resilience of woody vegetation in arid desert areas remains fragile. The region is increasingly finding itself in an environmental limbo: gains in restoration go hand in hand with continued losses. The question of which of these trends will prevail by 2030 remains open.

2.3. Water Availability as Destiny: The Crisis of Irrigated Agriculture

The water paradox. Central Asia lives with a permanent water paradox. On the one hand, it contains the great "water towers" – the glaciers of the Tian Shan and the Pamir-Alay. Billions of cubic metres of freshwater accumulated over millennia feed the Amu Darya and the Syr Darya every summer. On the other hand, much of this water flows hundreds of kilometres downstream – from northern Afghanistan to the plains of Uzbekistan, Turkmenistan, and southern Kazakhstan, where the largest irrigated areas are located and where most of the region's population lives. Here, water is not merely a means of irrigation; it is the basis of life. This spatial divide is not simply a geographical feature, but a fundamental characteristic of the regional water system. The upstream countries – Kyrgyzstan and Tajikistan – have the river headwaters but limited land resources. The downstream countries – Uzbekistan, Turkmenistan, and Kazakhstan – have extensive fertile lands but are critically dependent on the flow regime from upstream.

Water and salt: a closed circle. Irrigated agriculture made the development of civilization in Central Asia possible. Without it, the flourishing oases of Fergana and Khorezm, Merv and Tejen, would have remained part of the desert landscape. Yet what for centuries was a necessary condition for life and farming is now increasingly turning into a disadvantage: secondary salinization. This process is a direct consequence of

the traditional model of irrigated land use, in which, as noted above, large-scale irrigation systems were built without proper outflow. Water was supplied to fields in abundance, but there were almost no mechanisms to remove it. Groundwater rose to the surface, evaporated, and left salt on the soil surface and plant roots.

Secondary salinization remains one of the main issues of irrigated agriculture. Addressing it requires not only the repair of existing irrigation and collector and drainage networks, but also a new systemic approach based on cooperation among all states of the region. The problem is especially acute in the lower reaches of the Amu Darya – in Uzbekistan and Turkmenistan (Karakalpakstan, Khorezm, and Dashoguz) – as well as in some areas of Kazakhstan and Tajikistan. Here, up to 40-60 per cent of irrigated land is affected by secondary salinization. The long-standing cotton monoculture, which depleted soils and required excessive irrigation, left a painful legacy. Soils lose fertility, yields fall, and yesterday's fields gradually turn into barren fallow land and solonchaks. At the same time, soil potential is improving in mountain and foothill zones because low-productivity land has been abandoned. People have left, and nature has begun a slow recovery. But can it be considered a success when land recovers only because farming there has become impossible? [7]

Glaciers are melting: the clock is ticking. Climate change is advancing here at an accelerated pace. According to the IPCC and regional hydrometeorological services, the glacial coverage in the Aral Sea basin has declined by 30 per cent over the past 50 years [8]. In the coming decades, the region may face the counterintuitive effect of "false abundance": river runoff may temporarily increase because of accelerated glacier melt. This will be followed, however, by an inevitable decline once the glaciers have exhausted their freshwater reserves accumulated over millennia. Central Asia must brace for that moment today, because the water that will be gone tomorrow cannot be replaced.

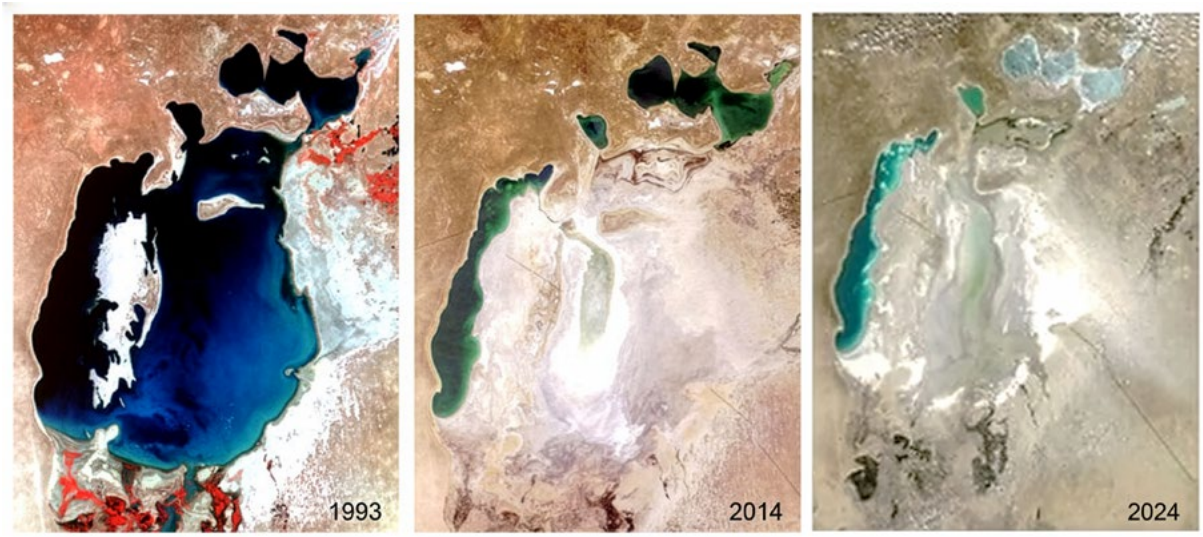
2.4. The Aral Sea Bed: A Human-Made Desert

Nowhere has the link between unsustainable water use and land degradation been more dramatic than in the fate of the Aral Sea. Once one of the world's largest lakes, providing life and work for millions of people, it has become a symbol of ecological catastrophe caused by human hubris and miscalculations in natural resource management. After it began shrinking in the 1960s, following large-scale withdrawal of river flow for irrigation, the sea had lost about 90 per cent of its volume by the early 2000s.

Today, the area of the exposed seabed exceeds 5.5 million hectares, of which 3.2 million hectares are in Uzbekistan and the rest in Kazakhstan. This is comparable with the area of a country such as Croatia. A new desert – the Aralkum – has formed on the former seabed. Wind lifts salt, pesticides, and dust that accumulated on the dry bottom over decades and carries them thousands of kilometres far beyond the region.

MAP 4

Contours of the Aral Sea in 1993, 2014, and 2024



Source: Open sources

Every year, between 15 million and 75 million tonnes of salt and fine dust rise from the dried bed of the Aral Sea into the atmosphere. These figures vary depending on wind strength and temperature. Climate change further intensifies the problem: rising temperatures and declining humidity make the surface of the Aralkum even more vulnerable to wind erosion. As a result, storms are becoming not only more frequent, but also more intense.

Salt dust from the Aral does not recognize borders. It falls across Uzbekistan, Kazakhstan, Turkmenistan, Kyrgyzstan, Tajikistan, Afghanistan, and Iran, and reaches southern Russia and the Caucasus. Satellite images show plumes moving west towards the Caspian region and the Caucasus, north into Russia, and east towards China. Aral dust settles can be seen on the glaciers of the Pamir and Tian Shan, darkening them and accelerating melt by reducing albedo, the reflective capacity of the Earth's surface. It covers fields and pastures, reducing their productivity. It enters people's lungs, aggravating respiratory and oncological diseases. The economic damage from dust storms in the Aral Sea region is estimated at tens of millions of dollars annually, including crop losses, infrastructure repairs, and increased morbidity. Scientific studies of atmospheric dust transport conducted by the Institute of Geography of the RAS together with the A. M. Obukhov Institute of Atmospheric Physics of the RAS provide grounds to believe that particles from sand and dust storms in Central Asia can be transported by air flows and may even reach Arctic territories.

A ray of hope: saxaul is working better than expected. Yet even this tragedy contains an important lesson. Uzbekistan has not merely accepted the challenge; it has made combating desertification a public policy priority. Saxaul has been planted on two million hectares of the dried Aral seabed within Uzbekistan. The project, launched in 2018, is already showing impressive results. Initially, it was expected that saxaul would retain 15-18 per cent of the salt and dust lifted from the land surface. The outcome has exceeded preliminary calculations: according to expert estimates, saxaul and other soil-stabilizing plantings now retain about 35-40 per cent of dust and salt, preventing their spread in the atmosphere.

In January 2026, a new joint project between Kazakhstan and Uzbekistan was announced to green the dried Aral seabed in the border area. Astana and Tashkent are joining forces, exchanging experience, and jointly improving methods for planting saxaul [9]. The Aral has ceased to be only a story about past mistakes. Gradually, it is becoming a symbol of present-day courage, cooperation, and responsibility towards future generations.

The Northern Aral: water returns. There is another encouraging story. Thanks to effective water diplomacy and an agreement signed with Uzbekistan, Kazakhstan has been able to ensure a stable inflow of water even in low-water periods. As a result, the volume of the Northern Aral Sea increased from 18.4 billion cubic metres at the beginning of 2023 to 23 billion cubic metres by the beginning of 2026 [10].

The second phase of the sea conservation project, which includes reconstruction of the Kokaral Dam and raising the water level to 44 metres, is nearing completion. It is planned that within four to five years the volume of the Northern Aral will increase to 34 cubic kilometres [11].

Kazakhstan emphasizes: *"The conservation and restoration of the Northern Aral Sea remain not only an environmental task, but also a social and strategic one. Redirecting part of the saved water resources to support ecosystems is an investment in the region's resilience, public health, and the future of coming generations."*

These words reflect the shared view of the countries of the region: caring for water and land resources is a joint responsibility requiring coordinated action and long-term planning.

2.5. Pastures: From Boundless Steppes to Points of No Return

Pastoral livestock production is not merely an economic sector. It is a way of life, a cultural code, and the heritage of nomadic civilizations formed over millennia across the lands from Mongolia to the Caspian Sea. Today, pastures occupy up to 70-80 per cent of the territory of the five countries of the region, and their condition is critical. Land degradation, climate change, and growing pressure on natural resources make pasture conservation an especially urgent issue.

The key problem: overgrazing and pasture abandonment. Satellite data and ground surveys record large-scale land degradation across almost the entire region. The mechanism is largely similar and relentless: zones of "pasture overload" form near settlements and water sources. After the collapse of the USSR, traditional systems of seasonal movement and grazing were disrupted. Infrastructure on remote pastures – wells, roads, and winter camps – gradually fell into disrepair. At the same time, livestock numbers, especially in private households, grew unbridled and without sufficient regulation, increasing pressure on the land.

Livestock concentrate on limited areas, leading to excessive grazing of valuable forage plants and trampling of the turf. Soil deprived of protection is exposed to erosion – wind erosion on plains and water erosion in mountain areas. The species composition of vegetation gradually changes: grasses and legumes give way to wormwood, ephemerals, and inedible thorny plants, followed by bare patches of sand or solonchaks. At the same time, remote pastures that are hard to reach are also being abandoned. The disruption of traditional migration routes and the deterioration of infrastructure have essentially resulted in abandonment of significant pasture areas.

The data for **Kyrgyzstan** are telling: between 2001 and 2020, the area of meadows and pastures decreased by 12,650 km², or almost 11 per cent. This is in a country where pastures account for 85 per cent of agricultural land [12].

In **Kazakhstan**, where pastures account for almost 70 per cent of agricultural land, the area of degraded land has exceeded 3,000 km². According to estimates, 60-80 per cent of all pastures in the region are now affected by degradation to varying degrees. At the beginning of 2026, Kazakhstan's pasture deficit stood at 3.5 million hectares; however, the Government has set an ambitious goal to eliminate it completely by the end of 2026. Significant progress was achieved through measures implemented in 2025: update of livestock numbers, expansion of settlement boundaries, and withdrawal of unused land. A total of 2.1 million hectares have already been returned to state ownership because of identified violations or non-use, and a further one million hectares are planned for withdrawal during the current year. The total area of redistributed land is 8.5 million hectares, of which 2.8 million hectares have been transferred for public use by the population and 5.7 million hectares have been allocated through tenders to agricultural producers [13].

An important step has been Kazakhstan's shift from quantitative indicators to qualitative results. The emphasis is now not only on returning land to state ownership, but also on whether it is genuinely suitable for sustainable grazing. Tenant selection criteria have been tightened: investment commitments, ownership of machinery and livestock, and professional qualifications are now taken into account. A system for assessing the good faith of land users has also been introduced. Nevertheless, problems remain: pasture management plans have been

approved in only 157 of the country's 198 districts. The absence of such documents in 41 districts hinders the effective allocation of resources at the local level.

Erosion: wind and water. Erosion processes in the region are very distinct in terms of their geography. On the plains of Kazakhstan, Uzbekistan, and Turkmenistan, wind erosion, or deflation, dominates: open landscapes, light soils, strong winds, and destroyed vegetation cover create ideal conditions for the fertile layer to be blown away. In the mountain areas of Kyrgyzstan and Tajikistan, water erosion prevails. Steep slopes, deforestation, unregulated grazing, and intense precipitation lead to soil wash-off, increased mudflow risk, and landslides. Both processes have a common cause: the loss of natural soil protection. Without a dense turf cover or forest litter, only the bare soil remains, particularly vulnerable to destruction and degradation.

2.6. Sand and Dust Storms: The Breath of the Desert

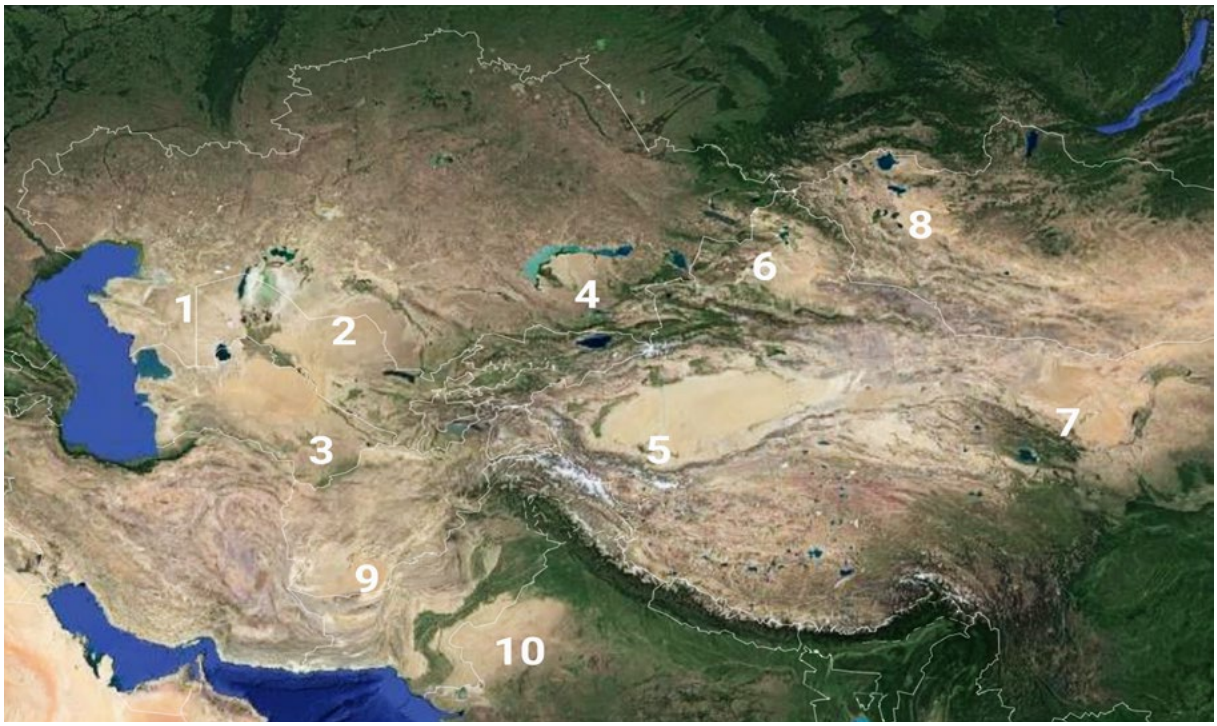
Land degradation has a visible and alarming face: sand and dust storms. High temperatures and droughts dry out soil stripped of vegetation. Toxic salt from the exposed bed of the Aral Sea, fine particles from degraded pastures, and dust from abandoned arable land rise into the air.

These storms are not simply an inconvenience or a meteorological anomaly. They blow away the most fertile humus layer, exposing barren substrate. Salt dust spreads over hundreds and thousands of kilometres, contaminating soils and water bodies and accelerating glacier melt. Storms paralyse transport, destroy crops, and kill people by causing life-threatening respiratory and cardiovascular diseases [14].

Kazakhstan, according to UN expert estimates, remains one of the largest sources of dust storms in the region: almost 78 per cent of its territory is classified as at high risk of desertification. The growing frequency and intensity of these storms is a direct indicator that the desert is advancing. Maps of dust-particle transport show dozens of persistent source areas: Ustyurt, Kyzylkum, the south-eastern Karakum, Saryesik-Atyrau, Taklamakan, and the Gobi. Air flows do not ask border guards for permission. Combating dust storms alone is meaningless.

MAP 5

Air Transport from Central Asian Deserts



Direct trajectories of air particles (elementary air masses) starting at an altitude of 100 m above the deserts of Central Asia: 1 – Ustyurt; 2 – Kyzylkum; 3 – south-eastern Karakum; 4 – Saryesik-Atyrau; 5 – Taklamakan; 6 – Dzungarian Desert; 7 – Alashan; 8 – Mongolian Gobi; 9 – Registan; 10 – Tar.

Source: based on scientific studies of the N. F. Glazovsky Scientific Coordination Centre for Combating Desertification and Drought, Institute of Geography, RAS

2.7. The Impact of Desertification, Land Degradation, and Drought on the Socio-economic Conditions of the Population

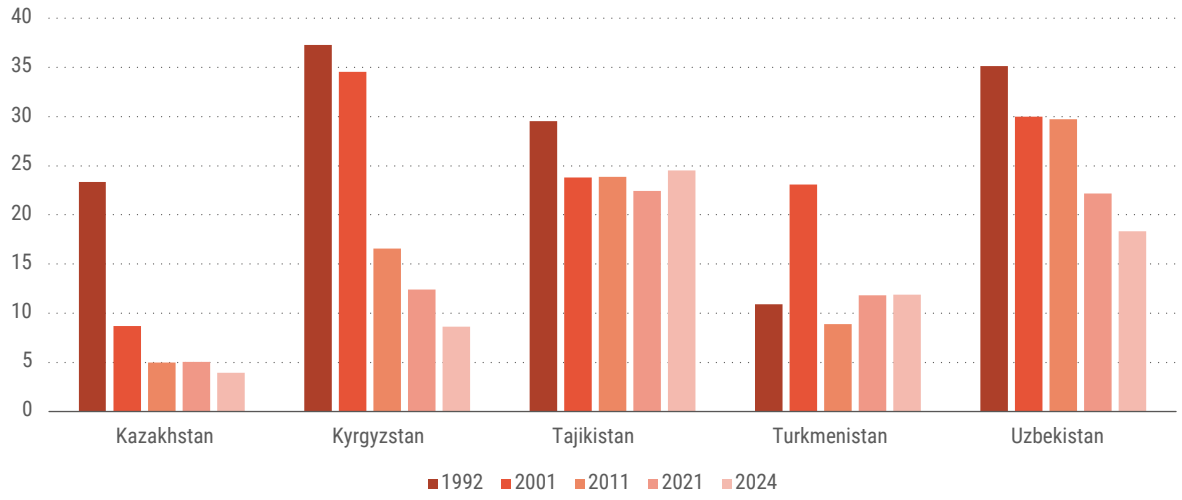
2.7.1. The Economics of Degradation: The Cost of Inaction

Many people see land degradation as a purely "environmental" problem on the margins of the economy. This is a dangerous misconception. According to well-supported estimates by the Economics of Land Degradation (ELD) Initiative, annual damage from land degradation in Central Asia amounts to around USD 2 billion [15]. Other studies, which consider a broader range of losses – unrealized harvests, reduced pasture productivity, loss of forest resources, and rising morbidity – put annual losses at USD 5.85-6 billion [16].

At the same time, the cost of land restoration measures is significantly lower than the cost of inaction. According to the UNCCD, investments in restoring degraded land generate high economic returns: each dollar invested today can generate up to five dollars in net present value over 30 years. This is not charity, but one of the most effective forms of long-term investment. Agriculture continues to play an important role in the economies of the countries of the region: its share of GDP ranges from 24.5 per cent in Tajikistan and 18.3 per cent in Uzbekistan to 8.6 per cent in Kyrgyzstan and 3.9 per cent in Kazakhstan. For millions of families, these are not abstract macroeconomic indicators, but a matter of survival. Lower yields directly lead to falling incomes, increasing poverty, unemployment, and migration.

FIGURE 2

Agriculture in GDP in Central Asian Countries (%)



2.7.2. Food Security

Food security in Central Asia depends directly on land productivity [17]. Salinization and soil depletion lead to a sustained decline in the yields of wheat, cotton, and vegetables. Maintaining previous production volumes requires increasing amounts of water and fertilizer, which raises costs and at the same time increases environmental pressure.

In livestock production, pasture degradation means a shrinking feed base, lower weight gain, and increased livestock mortality. For the nomadic and semi-nomadic communities of Kazakhstan, Kyrgyzstan, and Turkmenistan, this is not only an economic blow, but also a threat to a traditional way of life shaped over centuries.

Small farmers and dehkan farms remain particularly vulnerable. Most rural residents in the region are small land users. The loss of even a small plot of fertile land can push a family towards poverty and hunger. Droughts, which have become more frequent and severe, often lead to complete crop failure on rainfed land.

At the same time, Central Asia is a significant player in the global food market. Kazakhstan is among the world's leading wheat exporters, which means that water scarcity and reduced harvests in the region affect not only local economies, but also global food security, especially in the Middle East and South Asia, where countries depend on grain imports.

FIGURE 3

Area of Agricultural Land (mln hectares)

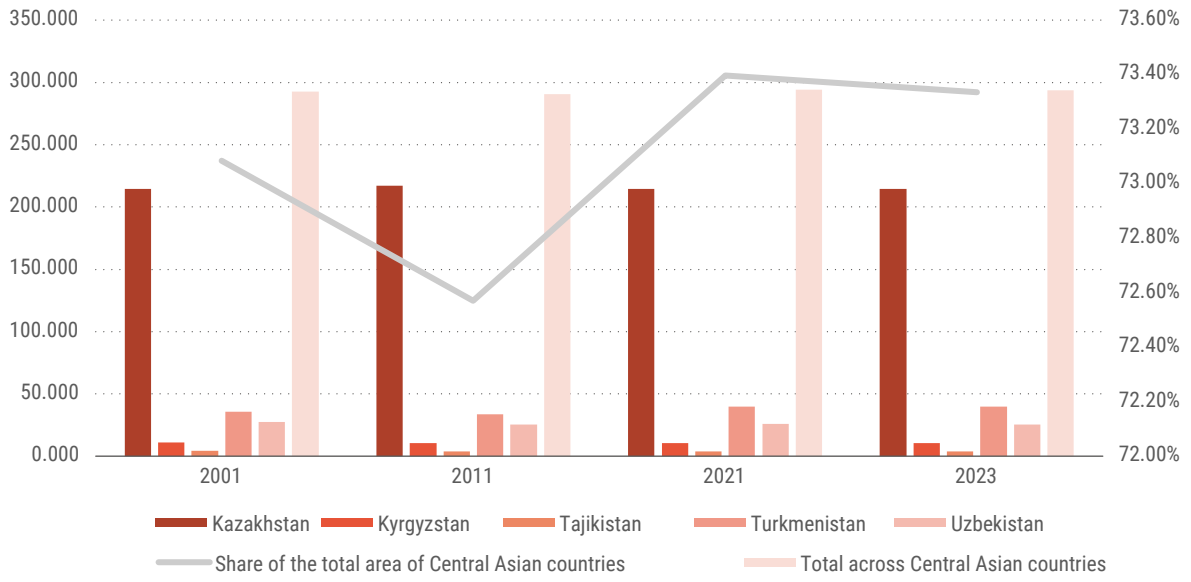
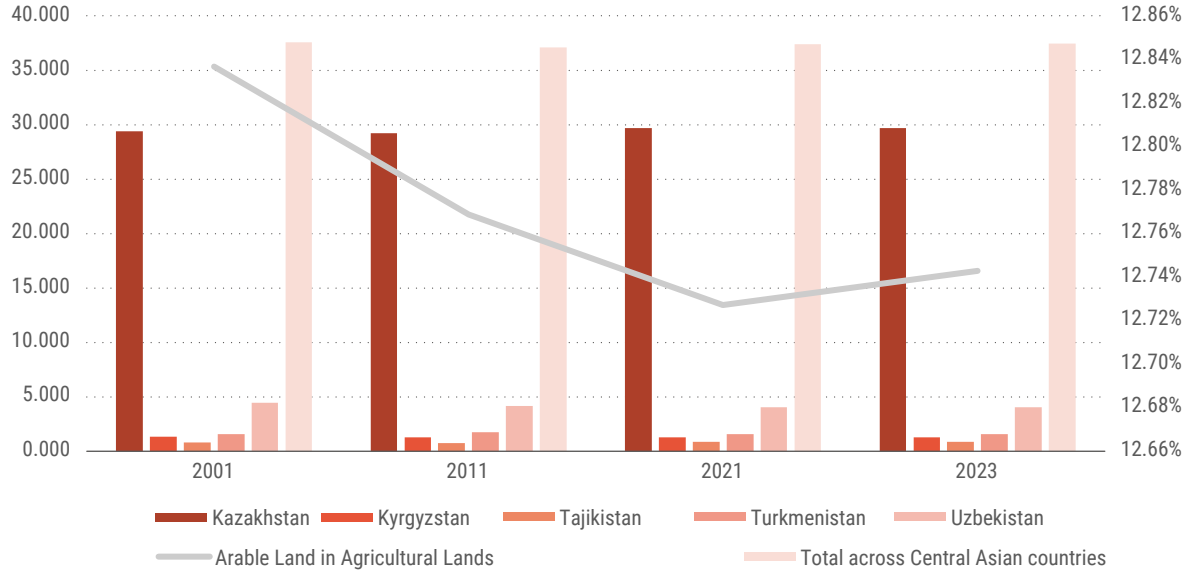


FIGURE 4

Arable Land Area in Agriculture in Central Asian Countries (mln hectares)



2.7.3. Migration and "Social Desertification"

The link between the condition of land and social well-being is not always obvious, but it is deep and inseparable. Land degradation is rarely the direct cause of migration, but it gradually undermines the foundations of rural life, acting as a powerful "push" factor [18]. The study within the framework of the IRG on the relationship between land degradation, climate change and migration in Central Asia examined the causes of labor migration related to land use and climate change, presented key observations and made appropriate recommendations.

When land can no longer feed people, they have little choice. Rural unemployment increases, and labour migration, primarily to Russia, Kazakhstan, and Türkiye, becomes the only option for many. Migrants support their families through remittances, which account for a substantial share of GDP in their countries. This contributes to processes described as "social desertification", reflecting

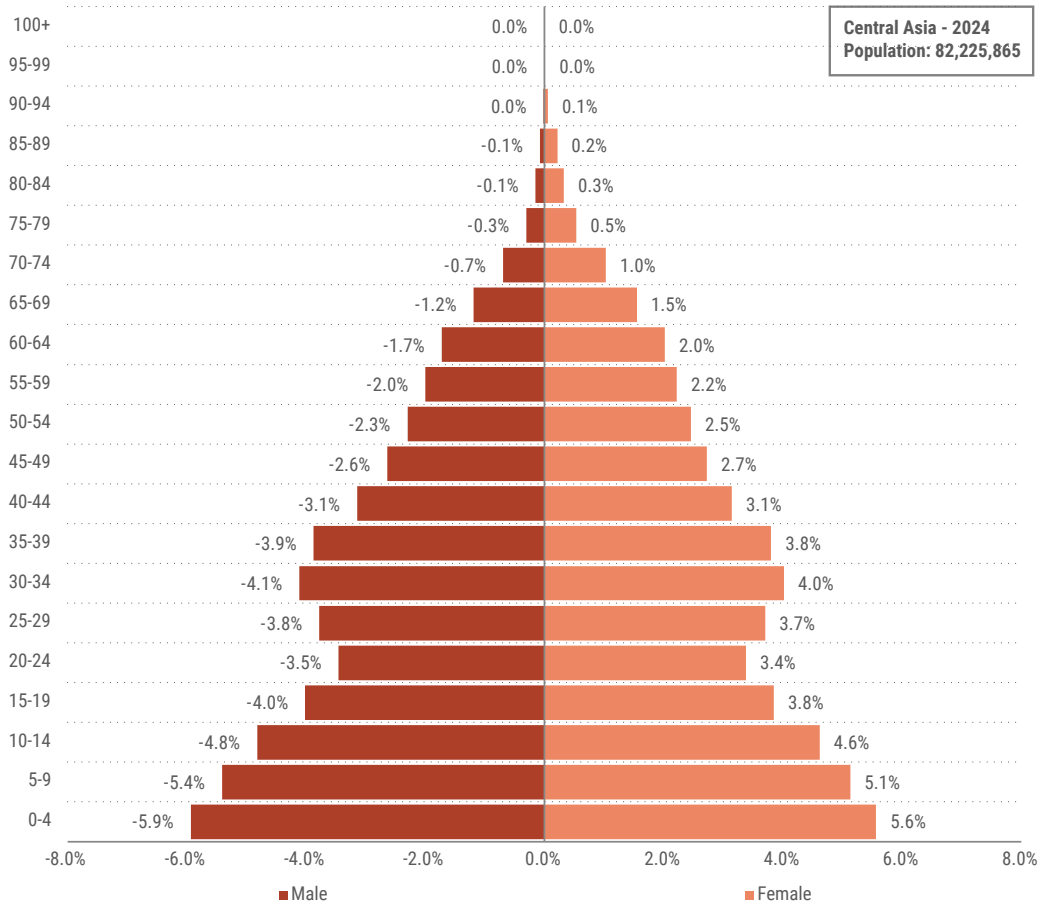
the declining viability of local communities and the loss of socio-economic opportunities, with women and children bearing the greatest burden.

The demographic dynamics of Central Asia make this situation especially acute [19]. The average age of the region's population is only 26.7 years, which is significantly lower than the world average. The population increases by more than one million people each year, and over the next two decades the largest cohort of young people in the region's history will enter the labour market.

Whether this becomes a "demographic dividend" or a "demographic burden" depends on the ability of the economy, and above all agriculture, to provide young people with decent work and stable incomes. If land productivity continues to decline, migration may become one of the few available adaptation strategies. In that case, the issue will no longer be only soil degradation, but also "social desertification": the depopulation of rural areas, the loss of traditional knowledge, and the erosion of cultural heritage.

FIGURE 5

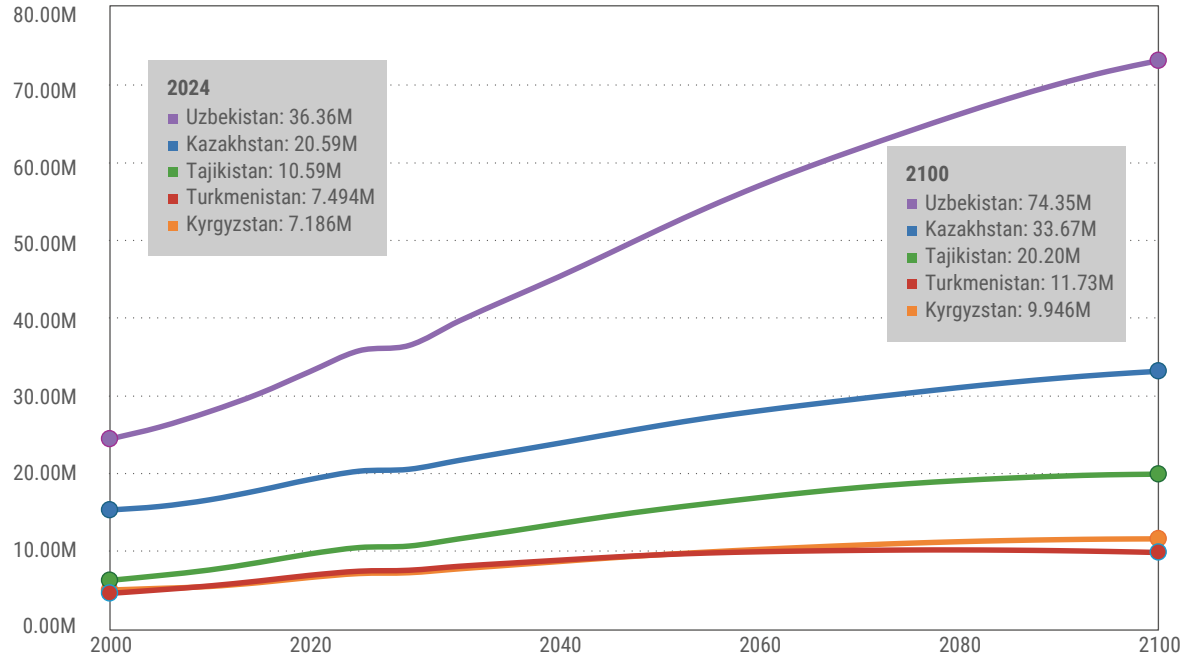
Population Pyramid of Central Asia



Source: United Nations, Department of Economic and Social Affairs, Population Division. World Population Prospects: The 2024 Revision (medium variant). www.PopulationPyramid.net

FIGURE 6

Population of Central Asian Countries in 2024 and Projection to 2100



Source: United Nations, Department of Economic and Social Affairs, Population Division. World Population Prospects: The 2024 Revision (medium variant). PopulationPyramid.net

2.7.4. Health, the Gender Dimension, and Vulnerable Groups

The impact of land degradation on public health often remains outside public attention. Yet dust storms contribute to increases in respiratory diseases, including asthma, bronchitis, and silicosis, as well as allergies and cancer. A lack of clean water increases the risk of infection, while declining incomes limit access to quality health care and adequate nutrition [20].

Loss of wetlands: a blow to health and biodiversity. Land degradation is closely linked to the condition of aquatic ecosystems [21]. Unique natural sites are gradually turning into solonchaks or disappearing completely. Intensive water withdrawal from the Amu Darya and the Syr Darya restricts inflow to delta and floodplain lakes. Over the past 50-60 years, the area of active wetlands in these zones has declined many times over, and in the past decade dozens of lake systems have dried up completely because of insufficient river flow. This has led to the fragmentation of natural habitats, the reduction of tugai forests, and the loss of fishery potential in these territories. As water bodies dry, they expose lakebeds that become sources of salt dust, directly linked to rising respiratory disease among the population. Even large cities are feeling the consequences of these processes. The disappearance of lake systems such as Maly Taldykol in Astana reduces natural flood protection and diminishes "cool islands", leading to overheating and deterioration of the urban microclimate.

Gender dimension. The gender dimension is an important part of this issue. In rural areas, especially in mountain and remote locations, women have traditionally been responsible for water supply, care of domestic livestock, and household plots. As water

resources decline and pastures are depleted, the burden on women increases, while opportunities for education and self-realization often narrow.

The countries of the region consistently declare their commitment to gender equality and seek to take into account the roles of women, men, and youth in all socio-economic and environmental processes, supporting the sustainable and harmonious development of society [22]. At the same time, under environmental stress, traditional social structures can create additional challenges for women. This highlights the need for an integrated approach to the development and adaptation of rural communities, one that takes account of both environmental and social dimensions of sustainability.

Young farmers and herders. The situation of young farmers and herders (chabans) remains complicated. Although they formally have equal rights, in practice they often face limited access to long-term land leases and finance. Without sufficient collateral, experience, or a stable credit history, it is difficult for them to obtain loans or access good-quality plots. As a result, many receive either depleted land close to villages or remote pastures with underdeveloped infrastructure. Under such conditions, soil restoration and sustainable land use become almost inaccessible, while the need to survive leads to excessive resource use.

Land degradation becomes a mechanism for reproducing inequality. It affects not an abstract "economy", but people first and foremost – and the lower their level of social protection, the more strongly it affects them. Without real access for vulnerable groups to land, long-term leases, green grants, and participation in decision-making, strategies to combat desertification will remain incomplete. Institutions that are unable to support the most vulnerable groups risk losing their developmental function and becoming mechanisms of exclusion.

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Section 3.
Integrating Approaches Under the Rio Conventions to Address Desertification, Land Degradation and Drought (DLDD)

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3.1. Land Degradation and Climate Change Adaptation: Mutual Impacts

3.1.1. As Glaciers Melt, Deserts Advance

Central Asia is more than a crossroads of civilizations and ancient caravan routes. Today, it is among the regions of the world most vulnerable to climate change. Located in the heart of Eurasia, far from the oceans, the region and its people have long adapted to life in an arid and semi-arid climate. Yet the scale of current changes is beyond the region's centuries-long experience of adaptation. Temperatures are rising faster here than the global average. Over the past 70 years, the region's mean annual temperature has risen by 1.5–2°C, and by as much as 2.5°C in some areas, exceeding global averages. According to the WMO, Asia as a whole is warming at nearly twice the global average rate[1], making heatwaves and droughts more severe. Winter and spring months are warming fastest, disrupting the natural rhythms to which agriculture, planting seasons and cycles of transhumant pastoralism have been tied for millennia [1].

Across the Pamirs and Tian Shan, Central Asia's strategic "water towers" are retreating at an alarming rate [2]. By 2100, under a high–concentration scenario (RCP 8.5), Tajikistan could lose up to 80% of its glaciers. This is not merely a climate statistic. It means that the rivers that carry water to fields and cities today may tomorrow become seasonal streams dependent solely on rainfall.

3.1.2. Droughts: From Episodic Shocks to Chronic Stress

Droughts have always been part of life in Central Asia. People grew used to them and prepared for them. Today, however, they are no longer exceptional events but are becoming a chronic stress factor. Drought is commonly classified into three types (or has three dimensions): meteorological drought, driven by a lack of precipitation; agricultural drought, caused by insufficient soil moisture; and hydrological drought, reflected in declining river and groundwater levels. Climate change is intensifying all three types at once.

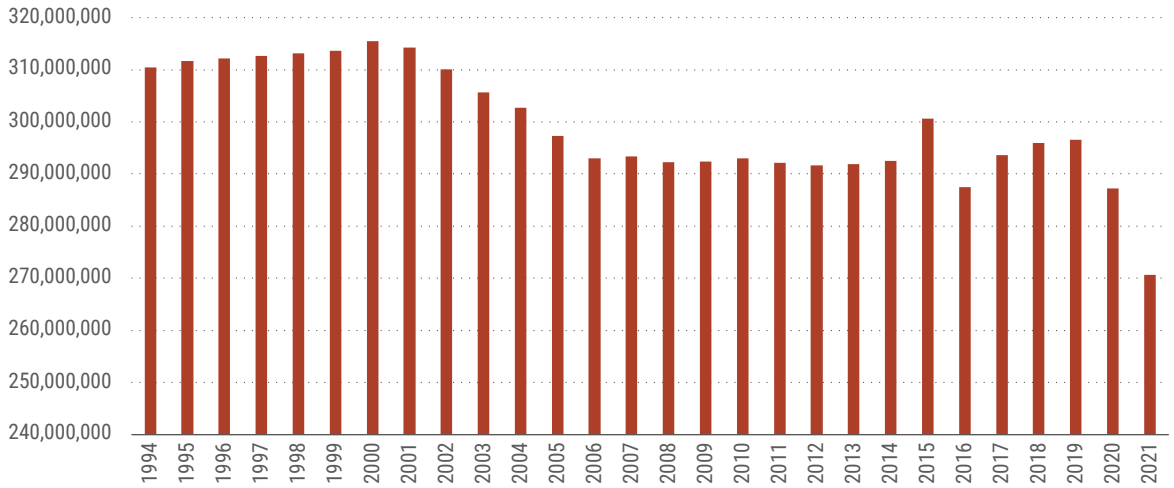
Climate models developed for the region are consistent in their projections: by 2040–2050, the water-resource deficit in the lower reaches of the Amu Darya and Syr Darya could reach 15–30% [3]. As a result, millions of hectares of irrigated land may lose productivity or require a radical rethinking of the entire agricultural system.

On arable land this can lead to catastrophic salt accumulation. Under water-scarce conditions, farmers are forced either to use mineralized water for irrigation or to irrigate less frequently. As a result, cotton yields on saline soils can decline by 30–50%, and in some cases land is withdrawn from production altogether.

For pastures, drought is not simply a matter of dry grass. It changes the composition of plant species. Valuable forage grasses give way to wormwood species, ephemeral plants and inedible thorny species. Pasture productivity can fall dramatically. According to research, in some areas of Kazakhstan and Kyrgyzstan it has fallen by 40–60% compared with the mid-twentieth century.

FIGURE 7

Total Freshwater Withdrawals in Central Asia (m³ per 1,000 km²)

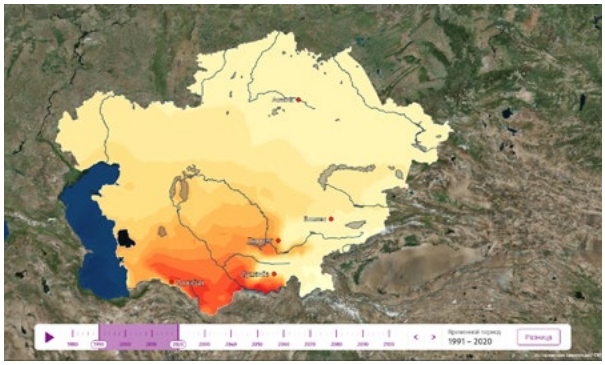


Source: Online Catalogue of Statistics and Global Data https://statbase.ru/data/

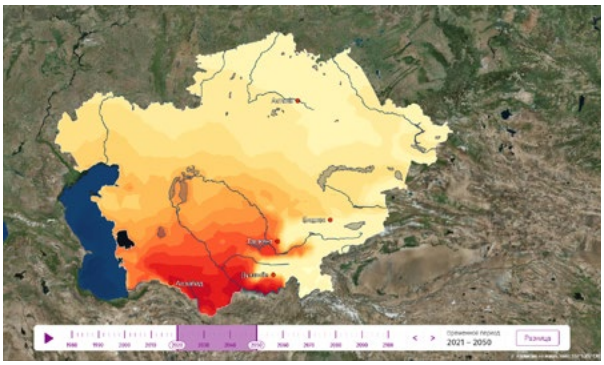
[1] Rising temperatures and extreme weather hit Asia hard. wmo.int/news/media-centre/rising-temperatures-and-extreme-weather-hit-asia-hard

MAP 6

Consecutive Hot Days in Central Asia



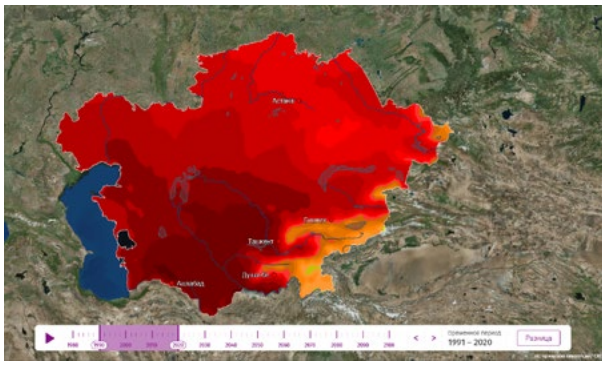
Consecutive hot days, historical data, 1991–2020



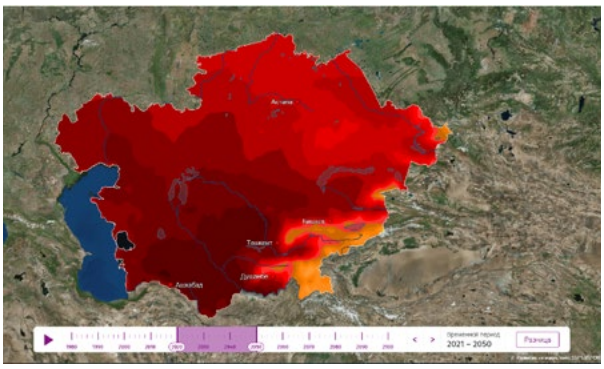
Consecutive hot days, projections for 2021–2050, under the SSP5-8.5 climate scenario

Source: Climate Impacts Online
https://kfo.pik-potsdam.de/index_en.html?language_id=en

Maximum Air Temperature in Central Asia



Maximum air temperature in Central Asia, historical data, 1991–2020



Maximum air temperature in Central Asia, projections for 2021–2050 under the SSP5-8.5 climate scenario

Source: Climate Impacts Online
https://kfo.pik-potsdam.de/index_en.html?language_id=en

3.1.3. Synergies among the Rio Conventions

For a long time, climate, biodiversity and land degradation were treated on separate institutional tracks: one set of mechanisms operated, and specialists reported, under the UNFCCC; another under the CBD; and a third under the UNCCD. Real environmental processes, however, do not follow such institutional divisions. They make no distinction between a carbon footprint and the loss of humus. The wind simply carries salt from the Aral Sea to the Pamir glaciers, accelerating their melting.

Today, this artificial divide is beginning to be bridged. In September 2025, the executive secretariats of the three Rio Conventions launched a joint platform dedicated to interaction and synergy [4] (www.rioconventions.org). Central Asia is cited as one of the key examples of successful integration, where the restoration of degraded steppes can simultaneously promote carbon sequestration, biodiversity conservation and combating desertification.

Kazakhstan's experiments with carbon farming have been among the first steps towards such integration [5]. If farmers receive income not only from the harvest but also from the carbon stored in the soil, they gain an additional economic incentive to preserve land fertility. In the longer term, the development of regional carbon markets could become the very bridge linking the climate agenda with the land agenda.

3.2. Land Degradation and Carbon Neutrality: Prospects for Carbon Market Development

3.2.1. Soil Carbon: The Invisible Dimension of Degradation

When we say that soil is degrading, we rarely specify exactly what is being lost. Visually, this is seen in surface cracks, salt deposits and sparse vegetation. Economically, it means yield losses. Yet there is also a less visible but globally significant dimension of this problem: the loss of soil carbon. Soil is the largest terrestrial carbon store: it contains more carbon than all the Earth's vegetation and atmosphere combined. Yet the ploughing of virgin lands, secondary salinization of irrigated areas and pasture degradation caused by overgrazing set in motion a process that reverses the natural accumulation of carbon in soil. What has formed over centuries can be lost and returned to the atmosphere in just a few years.

UNDP and FAO assessments show the scale of the problem. Approximately 70% of Central Asia's arable land is degraded to varying degrees. Kazakhstan, with its vast agricultural land, is facing a significant decline in soil organic carbon content in the context of global climate change [6]. In Uzbekistan and Turkmenistan, secondary salinization has affected millions of hectares, disrupting natural soil processes. On the mountain pastures of Kyrgyzstan and Tajikistan, overgrazing has compacted the soil so severely that plant roots can no longer penetrate deeply, leaving carbon stocks untapped.

3.2.2. The Paradox of Arid Soils

A reader unfamiliar with the subject might ask: why invest so much effort in building up carbon in soils that are naturally poor in organic matter (humus)? After all, Siberia's chernozems or peatlands can accumulate many times more carbon than Central Asia's chestnut and sierozem (grey desert) soils.

The answer lies in the vulnerability of arid ecosystems themselves. In humid natural systems, recovery is usually considerably faster: damage to a tropical forest can be partly offset within decades. In arid zones, restoring the soil cover takes far longer, often centuries. Every fraction of humus that is lost means the destruction of a resource that took centuries, or even millennia, to form. And every fraction restored is the result of enormous and sustained effort.

It is for this reason that the UNCCD regards soil carbon dynamics as a key indicator LDN [7]. In the world's arid regions, this metric works like a litmus test: if carbon stocks are increasing, the system is recovering. If they are declining, then despite all reports and restoration measures, degradation continues.

This inertia also has an important economic dimension. Soil carbon in arid zones is a form of so-called "long-lived" carbon: it remains stored for decades, provided that soil structure is not disturbed. Unlike carbon in the biomass of annual crops, which is released at each harvest, soil carbon remains in the ground and contributes to the climate balance for years. For carbon markets, this means long-term, predictable results. Pasture restoration projects, such as those in Mongolia that are already selling carbon credits on the voluntary market, show that investors are willing to support such sustainable and long-term solutions.

3.2.3. Carbon Markets: From Indicator to Commodity

The link between soil carbon dynamics, recorded in national reports under SDG 15.3.1, and carbon units traded on the market is not direct. The soil carbon indicator is primarily a public governance tool, whereas a carbon unit is a market asset [8]. There is a methodological, metrological and legal gap between the two. Yet it is precisely the indicator that can form the basis for trust.

When a farmer from Kazakhstan or Uzbekistan claims that their land has accumulated an additional two tonnes of carbon per hectare over five years, this claim must be supported by verifiable data. Without a national monitoring system built to UNCCD standards, without baseline values (how much carbon was present in the soil before the project began) and without long-term monitoring, such claims will remain mere declarations.

3.2.4. Breakthrough: The "Carbon Bridge" and a New Reality

Kazakhstan's Potential: USD 35 billion. Kazakhstan possesses a unique resource: more than 200 million hectares of agricultural land, including pastures and arable land. According to expert estimates, if carbon farming practices are introduced at scale, the country could earn up to USD 35 billion a year on carbon markets [9]. The sequestration potential is estimated at up to 535 million tonnes of CO_2 per year. This is not a futuristic scenario but a set of calculations based on the ability of soils and pastures to absorb and retain carbon under SLM.

Strategic Step: Partnership with BCarbon. In November 2025, an event took place that could mark a turning point for the entire region. The Astana International Financial Centre (AIFC) and the US carbon standard BCarbon signed a memorandum of understanding. The document lays the foundation for a direct "carbon bridge" between the markets of Kazakhstan and the USA. BCarbon, offers science-based protocols for measuring carbon sequestration in soils and forests. The partnership is aimed at implementing a pilot project in Kazakhstan that will enable local landowners and agricultural producers to monetize their soil and forest restoration efforts [10].

Pilot Projects and National Infrastructure. The Government of Kazakhstan has already approved the Roadmap for the Development of Carbon Farming for 2026–2028. Starting in 2027, the State Institute for Land Survey Works, a state enterprise, will begin conducting carbon monitoring. The Institute has 16 branches nationwide, 15 accredited laboratories and more than 1,200 specialists.

Starting in 2026, a three-year project entitled "Development of Carbon Farming in Kazakhstan" will be launched jointly with FAO [11]. The objective is to establish a national soil carbon monitoring system and develop a digital map. A similar project is being launched in Uzbekistan, with the support of the Russian Federation and the UNCCD.

In December 2025, Kazakhstan's first agrometeorological carbon station, KAZ AGRO CARBON, was commissioned [12]. The station is equipped with sensors for measuring the soil carbon balance and CO_2 and methane fluxes, as well as with meteorological equipment.

Private Investment. One example is Kazakhstan's agreement with the British company SEFE Marketing & Trading Limited, which plans to implement a 30-year investment project in afforestation [13]. The project will be implemented in Almaty Region on an area of 1,500 hectares, where 3.3 million trees are to be planted: poplar, elm and birch. The plantations are expected to absorb 1.2 million tonnes of CO_2 over 30 years. What Experts Say:

"*Carbon farming focuses primarily on increasing organic carbon stocks in soil and biomass. This offers unique advantages in farming methods, crop selection, integrated agroforestry and pasture management. Conventional agriculture seeks rapid yield gains, while carbon farming prioritizes soil fertility and the capacity to absorb greenhouse gases,*" notes Gulsin Aitkhozhaeva, an independent expert and Associate Professor at the Kazakh National Agrarian Research University.

"An offset can be understood as a kind of commodity. For example, if you plant a shelterbelt that absorbs carbon, you can then calculate how many tonnes of CO_2 it has absorbed; each tonne has its own market value. Investors

post these data on specialized platforms, and large corporations that need to offset emissions purchase them," explains Alya Serikzhanova, Chief Executive Officer of Chapter Zero Kazakhstan.

The Role of Big Data and AI. Experts emphasize that transparent statistical data and assessment models are needed to attract investors. At present, studies of soil composition and carbon content across regions are incomplete, and the data are fragmented [14]. There are no long-term observations of the capacity of plants and soils to absorb carbon. Kazakhstan needs to create a multi-tiered MRV system using satellite data, observation stations and artificial intelligence.

3.2.5. Obstacles: Not Climate Alone

First, Methodological isolation. International carbon accounting methodologies are designed for generalized conditions and do not always capture the specific characteristics of sierozems, solonchaks and desertified rangelands. Without national emission and removal factors adapted to the realities of Central Asia, any project will rely on default IPCC data, whose accuracy under local conditions may be limited. This creates a risk of both overestimating and underestimating the volume of carbon units, and therefore affects trust in projects and their market value.

Second, Institutional inertia. The region's land and forest codes took shape at a time when climate issues were not yet on the policy agenda. As a result, they do not include such modern concepts as "carbon unit," "soil carbon," or "climate project." The existing governance system creates additional difficulties: responsibility for forest resources, soil condition and climate reporting often lies with different government bodies. This requires closer inter-agency coordination and policy alignment to improve the effectiveness of natural resource management and climate initiatives.

Third, Risk of double accounting. Under the Paris Agreement, countries maintain national accounts of greenhouse gas emissions and removals [15]. If an emissions reduction or an increase in removals is transferred to another country for use towards its climate commitments, the country of origin cannot also count the same result towards its own contribution. Such cross-border transactions require the use of cooperative approaches under Article 6.2 of the Paris Agreement, including the relevant arrangements between participating countries and the use of so-called "*corresponding adjustments*" to avoid double counting.

Fourth, Water constraint. Carbon sequestration in soils and biomass is inevitably linked to water availability. In a region where every cubic metre of water is subject to strategic allocation, expanding tree planting solely for carbon purposes may come into conflict with food security [16]. Species selection based on strict ecological criteria is therefore critical: priority should be given to plants that do not require irrigation, can survive on residual soil moisture, stabilize sands and tolerate salinity, such as saxaul, old-world winterfat (teresken), Richter's saltwort (cherkez) and sainfoin.

Fifth Who owns the carbon? One of the most complex questions concerns the determination of rights to carbon accumulated on leased land. It is unclear whether it should be regarded as the result of the land user's investments and land-use practices or as a derivative of land ownership rights. The absence of clear legal provisions governing such rights significantly constrains carbon market development and the attraction of private investment in carbon farming. In most countries of the region, legal regulation in this area is still at an early stage of development.

3.3. Land Degradation and Biodiversity

3.3.1. Habitat Destruction and Fragmentation

Central Asia is a crossroads of natural zones where European steppes, Siberian taiga, Asian deserts, and Himalayan meadows meet. This geographical position has shaped a unique gene pool. The symbols of this natural heritage include saiga antelopes with their migrations of many thousands across the steppes, the snow leopards of the high mountains, the juniper forests on mountain slopes, and the tugai thickets in the floodplains of major rivers.

However, desertification, land degradation, and increasingly frequent droughts pose an existential threat to this unique biodiversity. The principal drivers of biodiversity loss are directly linked to land degradation.

Habitat Destruction and Fragmentation. Ploughing virgin lands, expanding pastures without regard for their carrying capacity, and building infrastructure all reduce the areas suitable for wild fauna. Over 20 years, land allocated for development expanded rapidly, increasing by 106% in Kazakhstan and by 312% in Uzbekistan. This inevitably displaces animals from their familiar ranges. The landscape fragments, leaving "islands" of viable ecosystems separated by vast expanses of degraded land. Migration routes are disrupted, and populations become isolated, losing resilience and genetic diversity.

Pasture Degradation and Loss of Forage Resources. Overgrazing and poorly managed pasture use led to the replacement of complex steppe and desert-steppe communities with impoverished, often monodominant plant communities with low species diversity. Many endemic and relict species disappear, including certain species of wormwood, feather grass, and tulips.

3.3.2. Crisis of Tugai and Wetland Ecosystems

Reduced river flow and the drainage of land for agriculture have led to the near-total destruction of unique tugai forests of poplar, oleaster, willow, and tamarisk along rivers. These forests were true ecological oases, providing habitat for a vast number of bird species (pheasants, herons), mammals (Bukhara deer, the tugai subspecies of red deer, wild boar), reptiles, and insects. Their degradation is one of the principal causes of biodiversity loss in the region.

Wetlands: A Critical Point. In recent decades, Central Asia has faced large-scale degradation of wetland systems. Unique natural sites are turning into salt flats or disappearing entirely[17]. The main drivers are urbanization (development of shoreline zones, conversion of lakes for infrastructure), intensive agriculture (high levels of water abstraction), climate change (glacier melt, abnormally high evaporation), and technogenic impacts (wastewater pollution, fragmentation of riverbeds by hydraulic structures).

The most prominent example in the region is the gradual destruction of the Maly Taldykol lake system in Astana, Kazakhstan[18]. The expansion of economic activities in these natural wetlands of these natural water bodies not only destroys unique nesting sites for migratory birds, including flamingos, but also deprives the metropolis of its natural flood protection and "cool islands," leading to urban overheating and a deteriorating microclimate for residents.

Wetlands are critically important stopover sites for millions of migratory birds. The disappearance of even small water bodies deprives rare species, including flamingos, Dalmatian pelicans, and white-headed ducks, of resting and nesting sites. Together with the water, the cultural landscape also disappears: traditional natural resource use practices that for centuries ensured harmony between people and nature. Wetlands function as free natural filters, the "kidneys" of ecosystems, and as regulators of water levels. Replacing them with artificial structures would require billions in investment in treatment facilities and drainage systems.

3.3.3. Direct Threats to the Region's Emblematic Species

Behind the dry language of reports lie the fates of specific animals, many of which have become symbols of Central Asia.

Saiga Antelope. Its populations, especially the Betpak-Dala and Ustyurt populations, suffer not only from poaching but also from the degradation of steppe and semidesert rangelands. Droughts lead to shortages of water and forage. Dust storms, which have become more frequent because of desertification, complicate migration and the survival of young animals. These antelopes were once the undisputed masters of the steppes; today, every movement they make is a struggle for survival.

Snow Leopard (Irbis). The degradation of high-mountain ecosystems caused by overgrazing reduces the prey base of its main prey, wild mountain goats and sheep. Range fragmentation leads to the genetic isolation of small groups. The snow leopard remains on the peaks, but the pyramid beneath it is collapsing.

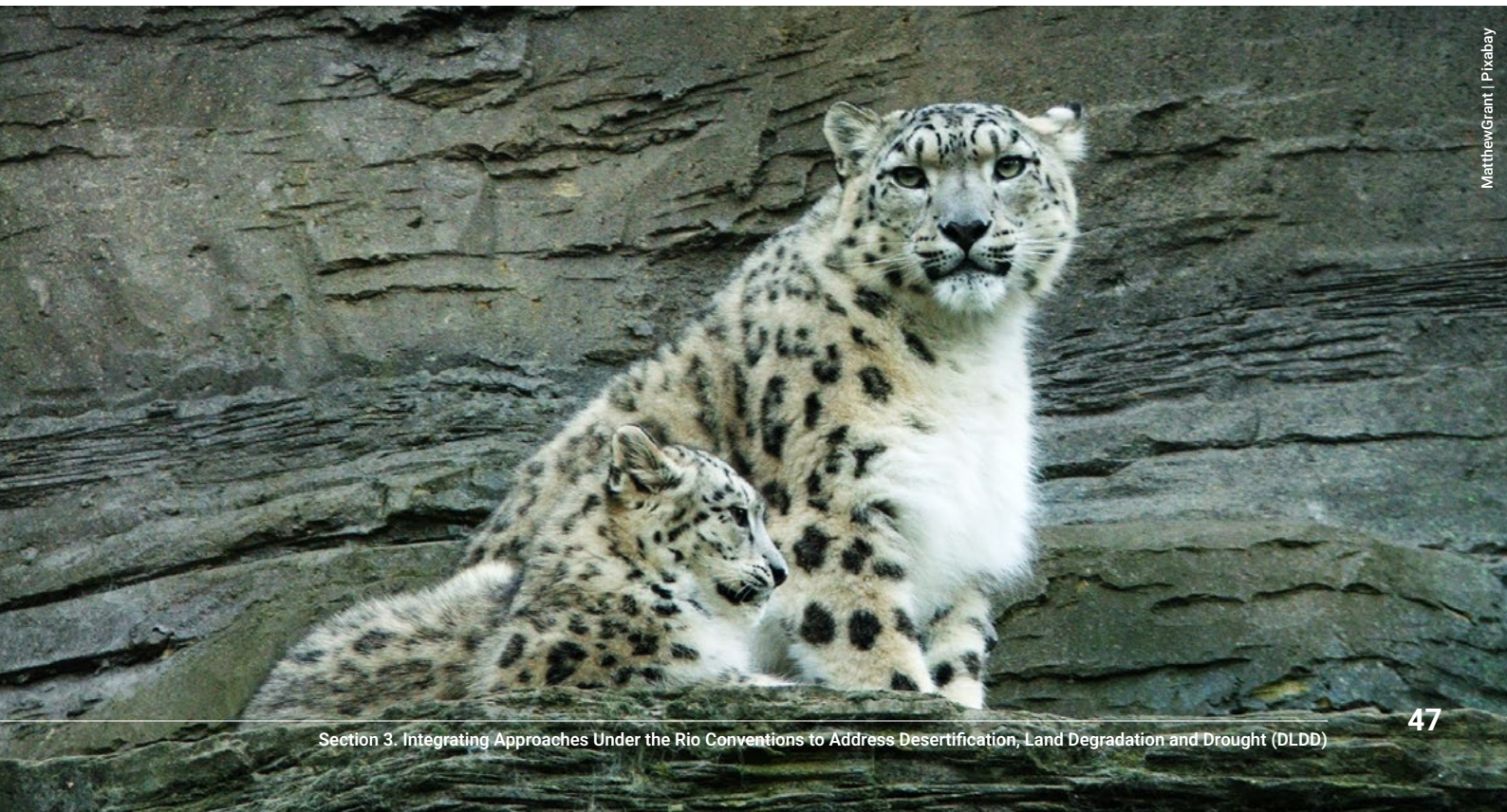
Kulan and Goitered Gazelle. These ungulates depend on vast open spaces with adequate water sources. Land development, ploughing, infrastructure construction, and pasture degradation break their habitats into small, often non-viable patches.

Endemic Fish Species. Aral trout, osmans, and other species that once inhabited the Aral Sea basin and high-mountain lakes have suffered a catastrophic decline. Changes in water flow and increasing salinity in water bodies have caused some species to disappear altogether and others to suffer critical population declines.

The plight of Central Asia's key species shows why biodiversity conservation requires a comprehensive approach. Transboundary cooperation, coordination among the region's countries, scientific and technical exchange among experts, and sustainable use of natural resources are all essential, especially in rangelands, which provide critical habitat for many migratory animals. In this context, the programmes of the Convention on the Conservation of Migratory Species of Wild Animals (CMS) have a particularly important role to play by strengthening transboundary cooperation, introducing advanced solutions, and supporting sustainable natural resource management [19]. Such initiatives bring together habitat protection, anti-poaching measures, and the involvement of local communities in a cross-sectoral approach, improving the prospects for the long-term conservation of the region's emblematic species.

3.3.4. The One Health Approach and the Hidden Cost of Biodiversity Loss

In recent years, the **One Health** approach, actively promoted by FAO [20], has been invoked with increasing frequency. Its meaning is both simple and profound: human health is inseparable from animal health and the health of the environment.



MatthewGrant | Pixabay

Soil is not just a substrate for roots but a living system in which billions of organisms interact. When soil loses humus, when its surface becomes encrusted with salt and when the wind carries away the upper fertile layer, the foundation of the entire pyramid of life is destroyed. Biodiversity loss in Central Asia is not just a matter of conserving rare and endangered species. It also means losing pollinators for agricultural crops, soil organisms that build soil structure and natural regulators of pest populations, which in turn increases agricultural producers' dependence on pesticides.

Ecosystem Services: The Hidden Cost. The decline in biodiversity directly weakens ecosystems' ability to provide vital ecosystem services. Carbon sequestration potential declines, along with its contribution to climate change mitigation. Water regulation is disrupted, plant pollination becomes less effective, soil formation slows and natural protection against dust storms weakens. As these functions are lost, ecosystems become less resilient to drought, erosion and other climatic and human-made pressures. This leads to lower land productivity, greater economic risk and higher costs for maintaining agricultural production. Ultimately, biodiversity loss undermines not only ecological resilience but also the foundations of people's well-being, affecting food security, sources of income and opportunities for long-term development.

This interrelationship is especially acute in Central Asia. In an arid climate, with high dependence on land and water resources and growing pressure from climate change, biodiversity loss intensifies existing land degradation processes. The loss of vegetation cover, the deterioration of pastures, the decline in soil biological activity and the simplification of ecosystem structure reduce landscapes' capacity for natural recovery. As a result, agriculture becomes more vulnerable, desertification risks increase and rural communities become less resilient. It is for this reason that achieving LDN requires treating biodiversity conservation and restoration not as an ancillary task but as one of the key conditions for the long-term sustainability of land systems.

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Section 4.
Legal Frameworks for Combating Desertification, Land Degradation, and Drought

4.1. Constitutional and Legislative Frameworks: National Heritage

An analysis of national laws in Central Asia reveals a remarkable degree of convergence on the central issue. In nearly all of the region's **constitutions**, from Kazakhstan to Tajikistan, land and natural resources are recognized as national heritage under the special protection of the state [1, 2, 3, 4, 5].

In Kazakhstan, land belongs to the people, and the state exercises ownership rights on their behalf; private ownership is permitted only for personal subsidiary farming, gardening, and dacha construction, while agricultural land is leased through open tenders based on temporary, paid, long-term land-use rights, or leases. In Uzbekistan and Turkmenistan, natural resources are the exclusive property of the state. The Constitution of Kyrgyzstan establishes that private ownership of pastures and forests is inadmissible, while Tajikistan retains the institution of lifelong inheritable tenure.

Where land is not a commodity but part of the national heritage, the state has both the right and the obligation to set strict requirements for its rational use, the conservation of degraded land parcels, and the restoration of ecological functions. However, constitutional recognition of this status is not enough: the relevant legal and institutional mechanisms must also be developed and applied.

The region's **common legal challenges** related to land tenure and land use are now clear.

- Land Tenure. When legal protection is weak, or rights are temporary, land is often treated not as long-term capital that requires restoration and investment but as a resource to be used mainly for short-term purposes. Short-term leases, the absence of automatic renewal, and weak protection against expropriation create conditions in which depleting resources becomes more rational than investing in them for the long term [6].

- Fragmentation and a Limited Land Market. In Kyrgyzstan and Tajikistan, land plots are often small, limiting opportunities for rational land use and increasing ecological vulnerability. Underdeveloped formal markets for land and leases make land consolidation more difficult and slow the introduction of modern agricultural technologies.

- Disconnect Between Land, Water, and Environmental Legislation. Codes often operate in isolation, conflict with one another, and leave legal gaps. A typical problem in the region is "land – water dissonance," where land and water rights are regulated by different agencies, leading to conflicts and reducing the efficiency of resource use.

- Weak Integration of Environmental Safeguards. Requirements to prevent degradation, such as grazing rules, crop rotation, and land reclamation, are either absent or merely declaratory, with no adequate monitoring or incentive mechanisms.

4.2. National Action Programmes and Specialized Legislation: From Frameworks to Fine-Tuning

The First Generation of NAPs. In the 1990s and 2000s, all five countries developed National Action Programmes to Combat Desertification. These documents played an important diagnostic role but remained broad frameworks with weak financial support. Responsibility was divided among ministries of agriculture, water management, and environmental protection, while inter-agency coordination remained sporadic.

The Current Stage: From General Frameworks to Fine-Tuning. Regulation is now moving from broad framework rules to more targeted instruments. Previously, the law merely affirmed the need to treat land responsibly; today, it is beginning to answer the question of how.

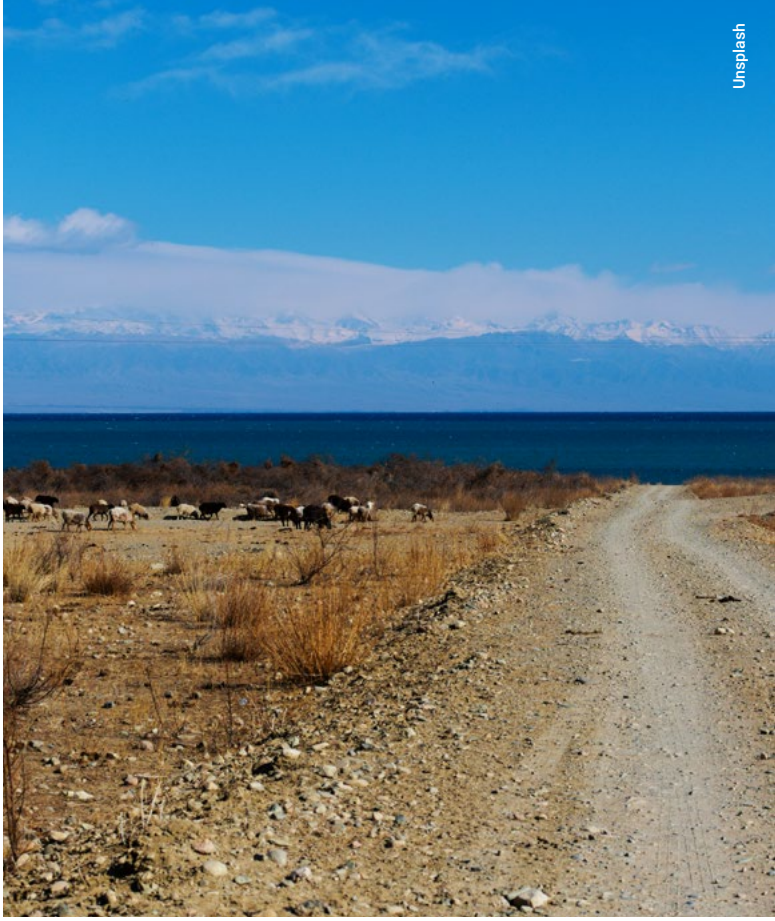
Kazakhstan has adopted a dedicated Law on Soil Protection [7], establishing a legal framework for sustainable soil management, soil protection, and state regulation of soil resources. The law defines and reinforces the responsibilities of land users and strengthens state oversight of the rational use and protection of soils. It introduces a system of soil monitoring, surveys, and assessments, and establishes obligations for landowners and land users to implement soil protection measures, maintain soil fertility, and prevent soil degradation.

Uzbekistan has introduced an indefinite moratorium on tree felling [8, 9] and statutory incentives for farmers switching to drip irrigation. In 2025–2026, work under the RESILAND project [10], supported by the World Bank, UNDP [11], and FAO [12], is focused on improving legislation to achieve LDN targets and establish a National Forest Monitoring System.

Kyrgyzstan in 2009 has adopted a progressive Law on Pastures [13], which legalized community-based management and gave local communities, or pasture committees, the right to develop pasture management plans. This is regarded as one of the region's most successful institutional innovations and is being studied by neighbouring countries. The new Land Code of the Kyrgyz Republic, which entered into force in 2025, systematized and updated individual land standards, including pasture to meet modern realities and challenges of land-market relations.

Tajikistan has included slope terracing and reforestation objectives in its National Climate Change Adaptation Strategy [14].

Turkmenistan is developing rules for phytomelioration and sand stabilization.


Unsplash

4.3. Implementing the UNCCD and Measuring SDG Indicator 15.3.1

4.3.1. Global Methodology and Systemic Implementation Challenges

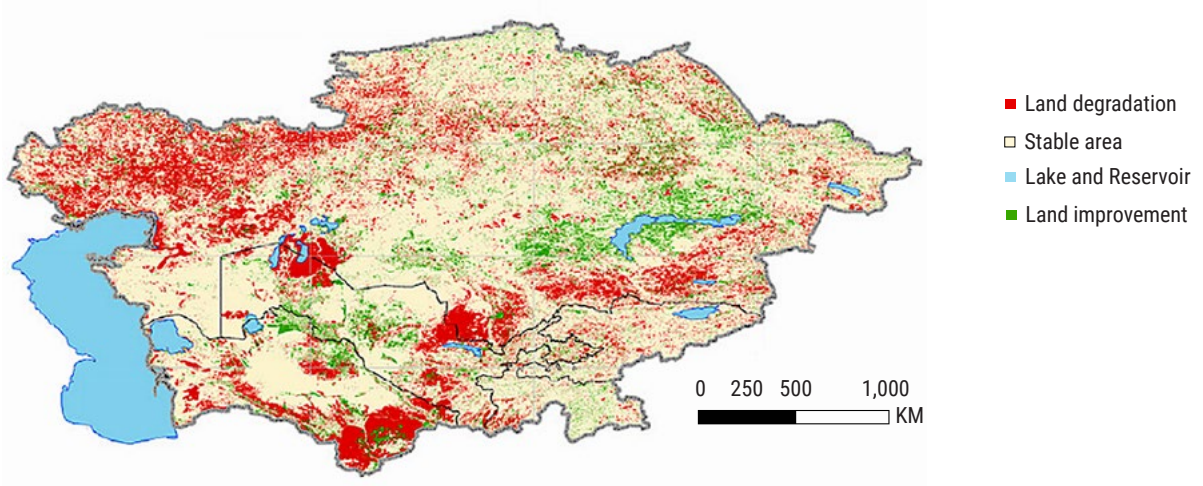
SDG indicator 15.3.1, "Proportion of land that is degraded over total land area," approved as part of the global indicator framework for the Sustainable Development Goals, has become the common measure that has made it possible to move from rhetoric to measurement. The methodology developed by the UNCCD is based on three sub-indicators [15, 16]:

1. Trends in land cover, meaning changes in land cover categories.
2. Trends in land productivity, assessed using NDVI.
3. Trends in carbon stocks, currently represented by soil organic carbon stocks.

All countries in the region now use the **Trends.Earth** GIS platform [17] to calculate this indicator and prepare national reports through the UNCCD Performance Review and Assessment of Implementation System (PRAIS) [18]. In practice, however, the same systemic implementation challenges arise across the region.

MAP 7

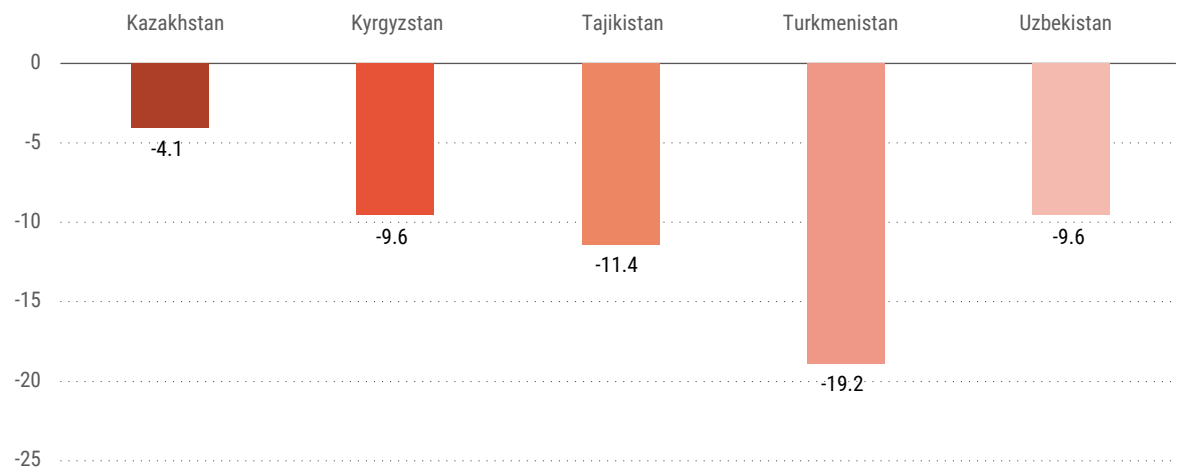
Land Degradation in Central Asia, 2001–2019



Source: Jiang et al., 2022

FIGURE 8

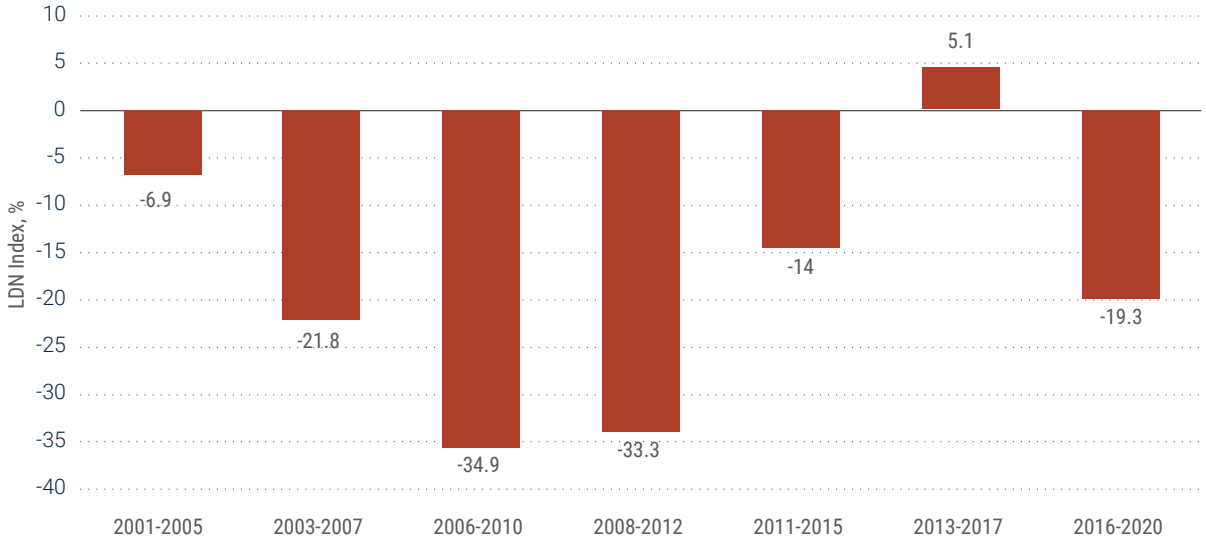
LDN Index in Central Asian Countries, 2001–2018



Source: Trends.Earth calculation module, authors' data

FIGURE 9

LDN Index Dynamics in Central Asia, 2001–2020, by Period



Source: Trends.Earth calculation module, authors' data

The first challenge is fragmented responsibility. The land cadastre is handled by one set of institutions, agrochemical monitoring by another, and forest inventory by a third. Water resources management, agriculture, and environmental protection still largely operate in silos, exchanging data only from time to time. A farmer who receives subsidies reports to the district administration, but this information rarely reaches the people preparing national strategies.

The second challenge is data interpretation in arid conditions. Low green biomass productivity in the desert is not a sign of degradation; it is the norm. Yet global algorithms trained on temperate-zone data are often unable to distinguish a healthy desert ecosystem from one that has passed a tipping point. This requires fine-tuning, attention to local conditions, and input from experts who understand the landscape.

The third challenge is "grey zones" in the mountains. Kyrgyzstan and Tajikistan face the fact that up to 20% of their territory cannot be reliably assessed using remote sensing methods. Complex terrain, mountain shadows, cloud cover, and the absence of ground validation sites all create uncertainty, making sound management decisions difficult.

The fourth challenge is conflicting interpretations. Abandoned land that is no longer used for agriculture often shows positive vegetation trends. Nature is taking over again. Yet the land cadastre often records such parcels as "unused land," "land unsuitable for agricultural use," or "fallow land." Legally, these are low-status categories that do not attract investment or protection. Ecologically, they are areas undergoing recovery and need support.

The LDN methodology has not yet resolved this conflict of interpretations. That is understandable. We are learning to read the land anew, and this process cannot be instantaneous. At the same time, the first effective results are already emerging and are being actively incorporated into national and subnational plans and strategies.

4.3.2. National and Local Indicators: Calibrating the Tool

A satellite passing over Central Asia sees vegetation. It records the vegetation index, counts pixels, and delivers a verdict: productivity is increasing. But it does not see the salt crust beneath this vegetation, built up year after year by water from a canal constructed half a century ago and never cleaned since. It cannot distinguish a healthy pasture, where fescue and feather grass provide good forage, from one where the same vegetation index values come from wormwood – an indicator plant and a clear sign that the forage base has been irreversibly simplified. It cannot distinguish between saxaul woodland that stabilizes moving sands and sparse shrubs beyond which dunes are already advancing.

Global monitoring can reveal broad trends, but it cannot fully capture the local socioeconomic context. This gap between satellite data and the reality on an individual farm field is precisely why national and local indicators are needed. The point is not to replace global approaches but to complement them; not to reject the global methodology but to adapt it more precisely to specific soils, climatic conditions, and land-use practices.

Indicators That Detect Salt. The principal threat to Central Asia's irrigated land is salt. Medium-resolution satellite imagery barely detects it. Uzbekistan and Kazakhstan are now developing other tools. Spectral salinity indices calculated from Sentinel-2 data make it possible to detect salt before it is visible to the naked eye. Soil electrical conductivity, measured with in situ sensors and, increasingly, through remote methods in pilot projects, provides a precise field-level picture of where salinization is just beginning, where it has peaked, and where it has already become irreversible. Uzbekistan has unique long-term experience in monitoring the salinization of irrigated land: data have been accumulated for more than 50 years on electrical conductivity, the chemical composition of salts, and groundwater depth. These data can be used to calibrate global salinity indices.

Indicators Based on Pasture Plants. Pasture degradation is another major concern for the region. The approach developed in Kyrgyzstan, and informed by Mongolia's experience, focuses on something satellites can never fully capture: the species composition of pasture vegetation. Here, high technology and traditional knowledge come together. Satellite imagery can identify risk zones where productivity is unstable or declining. But the final assessment is made on the ground, by herders, pasture committees, and local communities. They know where valuable pasture grasses once grew and where only wormwood and sow thistle remain. They see when a flock comes back from grazing hungry, even though the grass around it is knee-high.

Community-based pasture monitoring methods tested in Kyrgyzstan can now be expanded across the region. Mobile applications, simple checklists, and training for local community leaders make it possible to collect data in places that soil science expeditions reach only once a decade. When aggregated and compared with satellite indices, these data become a precise, verifiable indicator: standing dry forage biomass per hectare, adjusted for species composition.

Indicators for Carbon Stocks in Saxaul Biomass. Central Asia rarely features in global discussions of soil carbon. It is often assumed that the region's soils – sierozems, takyrs, and sands – are poor in organic matter and that calculating their carbon balance is not worthwhile. This is a misconception. The saxaul woodlands of the Aral Sea region, the tugai thickets along the Syr Darya and Amu Darya, and the phytomeliorative plantings on the exposed seabed are all vast reservoirs of carbon stored in wood and root systems. Moreover, degraded land is precisely where the potential for carbon sequestration is greatest.

Kazakhstan and Uzbekistan are beginning to measure this potential. For now, the work is pilot-based, site-specific, and limited to individual projects. But the principle has already been formulated: carbon stocks in the plant biomass of saxaul woodlands are a national indicator that is absent from global guidelines but essential for properly assessing the region's contribution to climate change mitigation.

Dryland ecosystems can be successfully restored using halophytes [19, 20, 21]. The total carbon uptake of

desert halophytes is potentially comparable to that of temperate-zone forest plantations (Glenn et al. 1992 a, b). As biomass crops, halophytes could directly absorb up to 0.7 billion tonnes of carbon per year worldwide. The key advantage of using halophytes is that they can grow on saline soils, which are less suitable for conventional agriculture and can be irrigated with saline water or seawater.[1] In the context of global climate change, the habitat- and community-forming role of halophytes, including saxaul, is especially important for carbon dioxide sequestration. In Turkmenistan, saxaul plantations with a density of about 500 plants per hectare can sequester an average of about 1.6 tonnes of CO_2 per year. A single saxaul tree aged 20 – 25 years absorbs up to 3 kilograms of CO_2 per year.[2]

4.3.3. A Regional Indicator Framework: An Opportunity for Synergy

No Central Asian country can effectively combat land degradation alone. It is equally difficult for individual states, acting alone, to build a modern, multi-tiered monitoring system that integrates satellite data, drone technologies, ground-based observation stations, and the local knowledge of rural communities.

Experts are increasingly discussing the idea of a **Regional Minimum Set of LDN Indicators for Central Asia**, and this idea is gradually gaining political support. The aim is not harmonization for its own sake but agreement on which indicators should be priorities and how they should be measured in a comparable way. Such a set could include several key indicators common to all countries in the region: a salinity index for irrigated land, standing forage biomass on pastures, and the share of land under sustainable land management.

TABLE 3

Calculation of Land Cover Type Areas and Their Changes in Central Asian Countries, 2001–2020 (km²)

Central Asian Country	Distribution and Changes in Land Cover Type Areas	Forest-Covered Areas	Grasslands and Pastures	Arable Land	Wetlands	Land Allocated for Development	Water Bodies
Kazakhstan	Land distribution in 2001	50208	1610588	592563	10590	2283	70955
	Land distribution in 2020	53607	1607457	651818	10750	4710	62523
	Absolute change	3399	-3131	59255	160	2427	-8432
	Relative change	6.77%	-0.19%	10.00%	1.51%	106.31%	-11.88%
Kyrgyzstan	Land distribution in 2001	12790	115892	38379	0	69	7198
	Land distribution in 2020	14201	103238	49784	0	662	7191
	Absolute change	1411	-12654	11405	0	593	-7
	Relative change	11.03%	-10.92%	29.72%	0.00%	859.42%	-0.10%
Tajikistan	Land distribution in 2001	905	80117	25493	58	144	1344
	Land distribution in 2020	1112	73104	31194	58	633	1352
	Absolute change	207	-7013	5701	0	489	8
	Relative change	22.87%	-8.75%	22.36%	0.00%	339.58%	0.60%
Turkmenistan	Land distribution in 2001	158	89172	44823	15	130	7823
	Land distribution in 2020	167	91624	46174	15	894	7838
	Absolute change	9	2452	1351	0	764	15
	Relative change	5.70%	2.75%	3.01%	0.00%	587.69%	0.19%
Uzbekistan	Land distribution in 2001	680	91400	92247	667	1050	18859
	Land distribution in 2020	946	95432	89484	664	4325	9804
	Absolute change	266	4032	-2763	-3	3275	-9055
	Relative change	39.12%	4.41%	-3.00%	-0.45%	311.90%	-48.01%

Source: Trends.Earth calculation module, authors' data

[1] This estimate is based on the findings of "Carbon Dioxide Sequestration in Terrestrial Ecosystems" (Climate Research, vol. 3: 1-5, 1993).

[2] The data on Populus euphratica are based on "Productivity and Carbon Sequestration of Populus euphratica at the Amu River, Turkmenistan" (Forestry 2013; 86:429–439).

An **open regional data platform**, such as "Digital Earth Central Asia" or an equivalent platform, could become another important element, bringing together not raw satellite imagery, which is already widely available, but calibrated, verified, and regionally adapted analytical products: salinity maps, erosion risk maps, and soil carbon maps at a resolution sufficient for district-level decision-making.

Finally, a **triple verification system** is needed. Satellite monitoring can reveal broad trends; field teams can verify them through targeted measurements; and local communities can report anomalies through a mobile application, including problems with water supply or pasture condition. Only by combining these three sources of information can decision makers obtain a sufficiently complete and reliable basis for effective action.

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Section 5.
Practical Experience: Interregional and National Initiatives

5.1. National Sustainable Land-Use Strategies: Five Paths to One Goal

Despite their shared challenges, each Central Asian country is pursuing its own path towards LDN. This diversity is the region's strength, creating opportunities for the exchange of experience and for avoiding mistakes.

5.1.1. Kazakhstan: Scale, Digitalization and Carbon Farming

Kazakhstan is a land of steppe, wind and open space. It has the world's highest arable land endowment per capita. Yet two-thirds of its territory is arid, and, according to United Nations estimates, around 78% of the country falls within areas at high risk of desertification.

Strategic Approach. Kazakhstan treats land degradation as both a management challenge and a practical policy issue. The Zhasyl Damu ("Green Development") programme has been adopted, integrating LDN objectives into the country's green economy agenda [1]. The country is investing in science and digitalization, including remote sensing, GIS technologies and precision agriculture.

State Forest Fund. The ambition is to expand the State Forest Fund and plant 2 billion trees by 2027. The Green Belt of Semey project is under way, along with large-scale saxaul planting on the dried bed of the Aral Sea. Kazakhstan also practices the establishment of shelterbelts (poplar and willow) on low-productivity sandy soils in river floodplains and along irrigation canals.

Pastures. Efforts are focused on restoring traditional transhumant livestock farming, or zhailau, with solar and wind energy used to pump water from remote wells. By early 2026, the pasture deficit had been reduced to 3.5 million hectares, with the aim of eliminating it completely by the end of the year.

Eroded Land. The goal is to reduce the area of eroded arable land from 29.3 million to 28.4 million hectares by 2030, a reduction of almost 900,000 hectares.

Carbon Farming. Kazakhstan was the first country in the region to treat soil seriously as a carbon store and a potential asset in carbon markets. A road map for 2026–2028 has been approved, and the first carbon agroclimatic test site, KAZ AGRO CARBON, has been launched.

Digitalization. The country has advanced space monitoring infrastructure operated by JSC Kazakhstan Gharysh Sapary. Kazakhstan has proposed extending this system to the entire region[2].

The President of Kazakhstan, Kassym-Jomart Tokayev, emphasizes that "*cleanliness, order and the careful use of natural resources are the key to the country's prosperity*" [3], and notes the importance of joint water resources management with neighbouring countries, including the establishment of an International Water Organization under the auspices of the United Nations[4].

5.1.2. Uzbekistan The Aral Sea, Yashil Makon and RESILAND

Uzbekistan is undergoing a genuine "green turn." The country that bore the brunt of the Aral Sea disaster is turning the dried bed into a testing ground for innovation. The share of land that has lost productivity is still estimated at around one-quarter of the country's territory.

The Yashil Makon ("Green Space") Project. A nationwide initiative launched in 2021 [5]. Every year, 200 million tree and shrub seedlings are planted. The objective is to increase urban green cover from 8% to 30% by 2030. The indefinite moratorium on tree felling is not merely a legal rule but a sign of a broader cultural shift. The Yashil Makon programme covers not only urban greening but also large-scale afforestation in desert and arid zones, including saxaul planting on the bed of the Aral Sea, as well as an indefinite moratorium on tree felling. Between 2018 and 2022, saxaul and other plants were planted on 1.6 million hectares. This is the world's largest phytomelioration project on solonchak saline soils. This makes the programme one of the region's most ambitious efforts to restore degraded land and adapt to climate change.

Water Conservation. Over three years, from 2021 to 2023, drip irrigation and laser land levelling were introduced on 1 million hectares of irrigated land.

Pistachio Plantations. Industrial pistachio plantations are being established on foothill slopes where traditional farming is unprofitable. A tree that can bear fruit without irrigation, in places where almost any other crop requires water, is becoming a lifeline for rainfed land.

RESILAND. A large-scale project supported by the World Bank. It includes components to strengthen legislation, establish a GIS platform for forestry and promote transboundary cooperation in landscape restoration.

The UNDP and the State Committee of the Republic of Uzbekistan for Ecology and Environmental Protection with financial support from the GEF are implementing a joint initiative to conserve lakes, wetlands and coastal corridors in the Aral Sea basin. The project is aimed at increasing the sustainability of ecosystems and achieving the LDN in the lower reaches of the Amu Darya and the Aral Sea basin.

A major institutional achievement for Uzbekistan was the establishment of the RI for Combating Desertification and the Development of Desert Economy at the Central Asian University of Environmental and Climate Change Studies, or Green University. The institute can serve as a regional hub, helping countries strengthen coordination, exchange data and best practices more effectively, and improve measures to prevent and mitigate land degradation, drought, and sand and dust storms across the region.

As the President of Uzbekistan, Shavkat Mirziyoyev, emphasizes, *"it is in our common interest to preserve the wealth of biodiversity for future generations,"* stressing the importance of joint efforts by the countries of the region to protect nature [6].

5.1.3. Turkmenistan: The Art of Living in the Karakum Desert

More than 80% of Turkmenistan's territory is covered by the Karakum Desert. Agriculture is possible only where water from the Karakum Canal and rivers reaches the land. Living in such conditions requires a special approach, refined over millennia.

Sand Stabilization. Around settlements in the Central Karakum, mobile sands are being successfully stabilized. Mechanical protection, such as upright barriers, is combined with the planting of saxaul, Calligonum shrubs (kandym), and Richter's saltwort (cherkez). This prevents sand from burying homes, roads and farm buildings.

Reed Cultivation. To protect homesteads from hot winds and dust, Arundo donax, or giant reed, is planted around them. It grows quickly, forms a dense green barrier and improves the microclimate in extreme heat.

Moisture-Harvesting Trenches. On foothill sites intended for afforestation, trenches are dug to collect rainwater and snowmelt. Moisture stays in the soil for a long time, allowing seedlings to survive the dry season without irrigation.

Research and Expertise. The National Institute of Deserts, Flora and Fauna is a unique centre that has spent decades building knowledge on how to improve the species composition of desert pastures and make the Karakum a viable forage base [7].

Regional Initiative. In 2025, the President of Turkmenistan proposed establishing a Regional Centre for Combating Desertification for the countries of Central Asia, to be coordinated from Ashgabat [8]. The initiative is intended to bring together the region's scientific and practical capacities, strengthen cooperation in environmental protection and support progress towards the United Nations SDGs.

The Government of Turkmenistan and the UNDP have signed a project "Conservation and sustainable management of land resources and ecosystems of high natural value in the Aral Sea Basin for multiple benefits", funded by the GEF, which is being implemented jointly with the Ministry of Environmental Protection of Turkmenistan.

As the President of Turkmenistan, Serdar Berdimuhamedov, notes, *"our people have always sought to live in harmony with nature,"* emphasizing the country's historic commitment to sustainable natural resource management [9].

5.1.4. Kyrgyzstan: Guardian of Glaciers and Mountain Pastures

Kyrgyzstan is often called the "water tower" of Central Asia. It is in the glaciers of the Tian Shan that the rivers feeding the entire region originate. Yet Kyrgyzstan itself, paradoxically, suffers from a shortage of irrigation water.

The main institutional innovation was the **Law on Pastures**, adopted in 2009**.** This law was the main institutional innovation. It effectively transferred pasture management to local communities, or pasture committees. They develop pasture management plans, set stocking-rate limits, collect payments and direct them towards infrastructure, including watering points, roads and pasture reseeding. This is recognized as one of the most successful models of decentralized natural resource management in the post-Soviet region. In 2025, the new Land Code of the Kyrgyz Republic was put into effect, which did not formally repeal the Law on Pastures, but integrated its norms into the general system of regulating land relations.

The Jashyl Muras ("Green Heritage") Campaign. It was launched in 2023 [10]. By 2030, the country has committed to restoring 23,000 hectares of forests and 300,000 hectares of degraded landscapes.

Drip Irrigation. Faced with an acute shortage of surface water, farmers have begun combining groundwater use with drip irrigation. This makes it possible to grow vegetables in places where traditional farming is no longer viable. This experience has been documented in the WOCAT database as a successful example of climate change adaptation.

Landscape restoration and community resilience. A pilot project under the global PFI was launched in Kyrgyzstan and neighbouring countries [11]. Its objective is to restore degraded landscapes and pastures, strengthen ecosystem resilience, support local communities through green income opportunities and promote cooperative approaches to sustainable resource management.

As President Sadyr Japarov of Kyrgyzstan notes, "*we all breathe the same air,*" highlighting the interdependence of the region's countries in natural resource management and environmental protection [12].

5.1.5. Tajikistan: Slope Terracing and Leadership in WOCAT

Mountains account for 93% of Tajikistan's territory. Arable land is critically scarce, and what little exists is vulnerable to water erosion. Landslides, mudflows and the loss of fertile topsoil are the main threats facing Tajik farmers.

Stone Terraces. A unique technology developed by the NGO 'Man and Nature'. Stone terraces are built on steep, rocky slopes that were previously considered unsuitable for agricultural use. They literally capture water and soil, hold back mudflows and make it possible to grow forage and fruit crops. This is not merely agriculture – it is engineering and geography in their purest form.

Documenting Experience. Tajikistan is the clear regional leader in the number of SLM technologies documented in the WOCAT database, with 124 technologies and 57 approaches. This reflects the very high level of engagement of local communities and researchers, as well as the constant search for solutions in extreme conditions [13].

National Strategy for Glacier Conservation. Tajikistan initiated the Dushanbe Water Process [14] and is promoting the protection of glaciers internationally as a strategic resource for all of Eurasia. The key documents are the National Strategy for Adaptation to Climate Change and the SLM programme.

As the President of Tajikistan, Emomali Rahmon, emphasizes, "*environmental protection and the rational use of natural resources require urgent and effective action, as the current situation – pollution, resource depletion and the disruption of ecological balance – poses a threat to the sustainable development of humanity and the biosphere,*" reflecting the priority given to sustainable natural resource management across the region.

5.2. Interregional Cooperation: From National Ambitions to a Shared Future

Sand and dust storms do not recognize national borders. Water originating in the glaciers of Tajikistan irrigates agricultural land far beyond the country's borders, while salt from the dried bed of the Aral Sea is carried by air currents to the glaciers of the Tian Shan, accelerating their melting. The environmental problems of Central Asia are inherently transboundary, and the solutions must therefore also be coordinated across borders.

5.2.1. The UNCCD Interregional Group "Central Asia – Russia"

The creation of the UNCCD Interregional Group "Central Asia – Russia" (IRG) in 2019 represented a distinctive institutional mechanism for strengthening cooperation among participating countries in implementing the objectives of the Convention and the UNCCD 2018–2030 Strategic Framework [15]. The IRG provides a platform that brings together representatives of relevant ministries, researchers, policymakers and practitioners to facilitate dialogue and knowledge exchange on land degradation and related environmental challenges. An important contribution of this platform is its ability to foster constructive, science-based and solution-oriented discussions on environmental issues. Within the IRG, discussions have been supported by remote sensing data, historical archives and joint scientific research, helping to promote evidence-based approaches to addressing shared environmental challenges.

The participation of countries in the IRG is not accidental: it is shaped not only by historical ties but also by scientific and environmental logic. Windblown dust and sand are carried across borders, from the Caspian region to the Altai. Wind erosion, or deflation, and salinization processes characteristic of the northern Caspian region and southern Russia are identical to those occurring in the plains of Kazakhstan. Russian research institutions, including the Institute of Geography of the RAS and the FSC of the RAS, share methodological traditions with their Central Asian counterparts and have decades of experience in arid-zone research; they continue this work in close cooperation with research and expert communities in Kazakhstan, Kyrgyzstan, Uzbekistan, Tajikistan and Turkmenistan, which also have substantial experience studying desertification, rangeland degradation, salinization, dust storms and sustainable land management. This cooperation creates a shared scientific space for comparing data, harmonizing approaches, and developing joint monitoring methodologies. Established with support from the UNCCD and the Ministry of Natural Resources of the Russian Federation at the Institute of Geography of of the RAS, the N. F. Glazovsky Scientific Coordination Centre has become an expert hub for data validation and methodological support across the region. At the same time, the IRG remains open to other interested UNCCD Parties.

The IRG roadmap is not a statement of intent but a practical plan for joint action in four areas: harmonizing approaches to land monitoring and assessment, with SDG indicator 15.3.1 as a key reference point; exchanging technologies and best practices in carbon farming, phytomelioration, and agroforestry; carrying out joint projects to restore degraded landscapes in transboundary river basins such as the Ural, Irtysh, and Syr Darya; and strengthening professional capacity and public awareness.

To implement the IRG road map [16], the participating countries have launched a dedicated website, www.land-irg.org, in support of the UNCCD, publishing news and analytical materials on land issues in Central Asia, promoting information exchange and making resource management more transparent.

5.2.2. The Revival of IFAS and New Regional Strategies

The International Fund for Saving the Aral Sea (IFAS) was established in the early 1990s by the heads of state of Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan to finance joint projects and programmes to save the Aral Sea and improve environmental conditions in the surrounding areas [17]. For many years, IFAS was criticized for excessive bureaucracy and limited effectiveness. Over the past five years, however, IFAS has seen a revival.

The Interstate Commission on Sustainable Development (ICSD), operating under the Fund, has become a platform for developing legally and politically significant documents rather than mere declarations. Among the most significant results of recent years are the following: the REP4SD CA [18]; the Regional Strategy for Drought Risk Management and Mitigation in Central Asia for 2021–2030 [19]; the Regional Medium-Term Strategy for the Management of Sand and Dust Storms [20]; and the Programme of Action to Assist the Countries of the Aral Sea Basin (ASBP-4) [21].

Within IFAS, the Interstate Commission for Water Coordination (ICWC) was established to support the joint management, sustainable use and protection of shared water resources in the Aral Sea basin, and it remains the only interstate regional body for cooperation on water issues. This creates unique opportunities to integrate projects around the water – energy – food security nexus in Central Asia.

It also reflects a fundamentally important shift: the countries of the region have moved from words to action and have learned to reconcile the interests of upstream and downstream areas, pasture zones and irrigated lands. For the first time, drought is no longer seen as a natural disaster beyond human control. It is now recognized as a manageable risk. This marks a shift in thinking.

5.2.3. CAREC and Regional Initiatives

The Regional Environmental Centre for Central Asia (CAREC) is an independent, non-profit and non-political international organization established in 2001 by the five Central Asian countries with support from the European Union and and the UNDP [22]. The Centre helps the region address pressing environmental challenges, apply international standards and best practices in natural resource management and promote sustainable development.

Today, CAREC is one of the region's key platforms for dialogue and cooperation on environmental protection. The Centre operates through its head office in Almaty, Kazakhstan, and a network of national offices, bringing together government agencies, the scientific community, businesses and civil society. CAREC participates in the development and implementation of regional programmes on climate change, the sustainable management of water and land resources, biodiversity conservation and environmental resilience. The Centre also supports knowledge exchange, the introduction of new technologies, expert capacity-building and public participation in decision-making, thereby strengthening regional cooperation and helping lay the foundation for an environmentally sustainable future for Central Asia.

5.2.4. Peace Forest Initiative: Forests as Bridges of Trust

The PFI, a UNCCD flagship programme, advances nature-based approaches that connect land and ecosystem restoration with climate resilience, social cohesion, regional cooperation and sustainable development. In Central Asia, PFI supports dialogue and collaboration

among countries to address shared challenges related to land degradation, climate change, sustainable resource management and ecosystem restoration.

Building on regional consultations involving all five Central Asian countries that identified shared priorities, the PFI Pilot Project *"Nature-Based Solutions for Climate Resilience and Social Cohesion in Central Asia"* was launched in September 2025. The initiative supports community-led actions in three countries: restoration and sustainable pasture management in the western Tian Shan watershed in Kyrgyzstan; drought-resilient agriculture, salinity management and shelterbelt planting in the Fergana Valley in Uzbekistan; and soil and water conservation and rangeland restoration in the Lebap region of Turkmenistan. The project promotes participatory dialogue, local cooperation and the development of a regional scale-up strategy, generating lessons and good practices to strengthen regional cooperation and support the wider adoption of nature-based, peace-positive approaches across Central Asia.

The regional consultations have also contributed to discussions on transboundary conservation areas and ecological corridors. Complementing these efforts, the World Bank, through RESILAND CA, is advancing discussions on a potential transboundary Peace Park[23] involving Kyrgyzstan, Tajikistan and Uzbekistan. The initiative illustrates how large-scale landscape restoration can contribute to climate resilience, regional cooperation and peace-positive outcomes while supporting the conservation of shared ecosystems and biodiversity.

5.2.5. Cooperation within the "Greater Central Asia" Region

The China Dimension: The Great Green Wall (TNSFP) and Silk Road Cooperation

A separate and highly promising area of interregional cooperation lies in strengthening engagement with the People's Republic of China. China has accumulated extensive experience in combating desertification and has developed innovative technologies and practical solutions that can be effectively adapted and applied in other countries. Of particular relevance for Central Asia is China's expertise in the selection and cultivation of drought-resistant species, the commercialization of green plantations, and the integration of renewable energy into land restoration initiatives. In Inner Mongolia, for instance, numerous large-scale projects demonstrate how sand stabilization efforts can be combined with the expansion of solar and wind energy infrastructure, creating synergies between environmental restoration and sustainable economic development.

Among them: one of the best-known initiatives is the Three-North Shelterbelt Forest Programme [24], also known as the Great Green Wall (TNSFP). Launched in 1978, it is considered the world's largest afforestation project. The programme covers 13 provinces and regions and approximately 4 million km², more than one-third of China's territory.

A scientific approach plays a key role in its implementation. Chinese specialists have compiled a detailed catalogue of 178 tree species, 177 shrub species and 143 herbaceous plant species suitable for shelterbelt establishment. In northern areas, conifers, including Manchurian pine, are widely used, while in desert and arid zones preference is given to saxaul (Haloxylon spp.), tamarisk (Tamarix spp.), and other drought-tolerant species. Grasses and other herbaceous plants are used as the first line of defence: they reduce erosion, stabilize the soil and create conditions for the subsequent growth of woody vegetation.

Mongolia: A Long-Standing Partner with Relevant Experience and Development Prospects

Although Mongolia lies somewhat outside the group of countries discussed here, its experience and challenges are typical both of Central Asia and of the wider belt of arid steppes across Eurasia. An estimated 77% of the country's territory is affected by degradation, making Mongolia one of the world's most vulnerable countries in this regard. Overgrazing under climate change conditions has led to severe rangeland degradation. In response to these challenges, the country has adopted a national "Billion Trees" National Movement and introduced measures to support sustainable pasture use. However, the combination of market incentives, the specific features of nomadic livestock systems and the increasing frequency of severe winter events known as dzuds creates a complex set of social and ecological problems that require long-term solutions. At the same time, Mongolia's experience in issuing carbon credits on the voluntary carbon market is attracting growing interest in Kyrgyzstan and Kazakhstan.

UNCCD COP17. Of particular significance is the fact that Ulaanbaatar is UNCCD COP17 host (August 2026) [25]. This is seen as recognition of the role of Mongolia and the wider region in the global sustainable land management agenda. Mongolia has also expanded public engagement and youth participation through national dialogues and outreach activities, including the "Youth for Land" National Forum. Through the Mongolia Business Council, the COP17 Presidency has been engaging the country's private sector in support of UNCCD "Business for Land" Initiative that aims to accelerate private sector action for

sustainable land management. For COP17 Mongolia also introduced a long-term strategic platform and a practical legacy framework 'the Steppe Action Agenda'.

Thanks to Mongolia's initiatives COP17 will have additional symbolic importance because the United Nations has declared 2026 the International Year of Rangelands and Pastoralists (IYRP) [26], creating further opportunities for Central Asian countries to present and discuss their regional experience in sustainable rangeland management.

5.3. Mechanisms for Disseminating Best Practices, Approaches and Technologies

5.3.1. The WOCAT Platform and CACILM II: An Encyclopaedia of Living Experience

For Central Asia, the World Overview of Conservation Approaches and Technologies (WOCAT) has become much more than a catalogue—it is a genuine encyclopaedia of practical experience.

The CACILM II project [27], implemented with the support of FAO and the GEF, played an important role in systematizing, documenting and disseminating successful SLM practices. The interactive WOCAT map shows the geographical distribution of technologies implemented across all five countries of the region.

Within CACILM II, the WOCAT platform was designed to support adaptation, innovation and decision-making in SLM. It contributed to increasing land productivity and water-use efficiency, improving the provision of ecosystem goods and services, promoting the sustainable use of biodiversity, strengthening food security, supporting climate change adaptation and mitigation, and reducing the risk of disasters and conflicts related to the use of land and water resources.

Examples of successful WOCAT cases that have received international recognition include:

Rotational grazing system in the desert, Uzbekistan [28]. The pasture around two wells is divided into four sectors. Livestock graze strictly by season: in spring, sector 1; in summer, sector 2; in autumn, sector 3; and in winter, sector 4. The following year, the sectors are rotated. The plants have time to recover. It seems simple. But it requires agreement among herders, and special commissions are established under local administrations for this purpose. The rotational grazing mechanism is formalized at the level of village assemblies, a rare example of traditional nomadic knowledge acquiring the force of law.

Stone terraces on steep slopes, Tajikistan. Retention of soil and moisture, prevention of mudflows and the return to productive use of land that had been considered permanently lost.

Conversion of fallow land into forage areas, Kazakhstan. Perennial drought-resistant grasses are sown on abandoned arable land. This makes it possible not only to feed livestock but also to sequester carbon in the soil.

Community forestry in Karakalpakstan, Uzbekistan. Local residents are allowed to carry out maintenance cutting, removing dead or damaged trees, and to grow vegetables between the rows of young forest plantations. This provides them with quick income and employment, while the state obtains restored forest without large budgetary expenditures. Community participation has sharply reduced the need for budgetary funds and created jobs in places where almost none remained.

Agroforestry-based land reclamation on farms in the Fergana Valley, Uzbekistan. Fast-growing salt-tolerant trees, including oleaster, willow and poplar, are planted on degraded arable land and act as "biological pumps": they lower the groundwater table and desalinize the soil. After several years, the plot is returned to crop rotation.

Pistachio orchards in the foothills, Uzbekistan and Tajikistan [29]. Industrial pistachio plantations are established on marginal land unsuitable for rainfed farming. The tree stabilizes slopes with its roots, prevents erosion and produces a high-value export crop.

Cultivation of Arundo donax, or giant reed, Turkmenistan. Living walls of giant reed are created to protect against hot winds and dust.

5.3.2. Demonstration Plots and Field Schools

Demonstration plots, established with support from UNDP, the GEF, the World Bank, the GIZ and USAID in many districts across the region, have become a classic and proven approach. They demonstrate in practice the results of no-till farming technologies, drip irrigation in orchards and vineyards and phytomelioration, including the planting of saxaul and tamarisk.

The key principle is to locate such plots on the land of farmers who are trusted and respected in the community. When rural communities see real results on neighbouring farms – higher yields, a resilient forage base and reduced risks during dry periods – the spread of new practices becomes much faster. Informal exchange of experience often proves more effective than the administrative promotion of innovation.

5.3.3. Digital Tools and Early Warning Systems

The digitalization of monitoring is already becoming a standard tool in natural resource management. In Kazakhstan, an automated information system for pasture monitoring has been established. In Uzbekistan, applications for irrigation planning based on satellite data are being introduced.

Drought early warning systems (DEWS) [30] are being developed with support from the WMO. Studies show that investments of USD 800 million in early warning systems could prevent annual losses of USD 3–16 billion in developing countries. Even 24 hours' warning can reduce damage by 30%.

When farmers receive advance warning of a dry period, they can adjust cropping patterns, select drought-resistant crops and modify irrigation schedules. This is how a proactive approach to risk management takes shape, substantially reducing agriculture's vulnerability to climate-related stress.

5.4. Awareness-Raising and Training for Land Users

5.4.1. The Language of Trust: From Lectures to Dialogue

Early education and awareness-raising efforts in the region had limited communication impact. Researchers came to rural clubs with posters and lectures on global warming and soil degradation. Although audiences listened politely, local residents often found the content difficult to relate to: terms such as "ecosystem" and "biodiversity" remained abstract and far removed from their everyday experience.

Communication became much more effective once programmes moved from "teaching" to dialogue. Analysis showed that terms such as "combating desertification" did not resonate well with target audiences, while messages about "increasing economic returns" and "using resources more efficiently" generated far greater engagement and practical interest.

5.4.2. Farmer Field Schools and the Farmer-to-Farmer Approach

The most successful and widespread practice has been Farmer Field Schools (FFS) [31], actively promoted by FAO. The approach is built around learning by doing and peer-to-peer dialogue. Farmers test methods directly in their own fields, compare traditional and new practices and draw their own conclusions. This builds trust and makes them more willing to adopt new practices.

The method relies on the gradual transfer of knowledge: first, experts train a small group of respected farmers, who then mentor their neighbours. Communication is based not on complex scientific terminology but on practical examples and everyday experience.

WOCAT data show that technologies spread through informal exchange of experience are much more likely to continue being used after donor projects end than solutions promoted solely through administrative channels.

5.4.3. Women as Agents of Change

At first glance, combating drought and land degradation in traditional rural communities may seem to be men's work. In practice, the picture is more complex. While men often leave for work or spend long periods away on seasonal pastures, women remain in the villages, caring for children and elderly relatives and tending household plots and vegetable gardens. Over time, it became clear that land degradation affects not only large-scale farming but also the day-to-day food security of households. As a result, training programmes for women were expanded to include sustainable land-use practices such as composting, organic fertilizers, drip irrigation on small plots, and other adaptation measures. For example, in Gorno-Badakhshan, Tajikistan, women learned to build sunken greenhouses, using stones to retain heat. This did not stop the glaciers from melting, but it helped protect children from hunger in winter. The experience had a strong social effect: family incomes rose, and pressure on the land closest to the village declined. Projects involving greenhouses, drought-resistant varieties, and agroforestry often start with women's groups.

5.4.4. Cultural Codes and the Role of Traditional Leaders

Modern awareness programmes try to speak in terms that local communities recognize, drawing on local cultural and social traditions. In Turkmenistan and Karakalpakstan, for example, programmes often work through elders and imams. During saxaul planting events, caring for the land and planting trees are presented as a "pious act," a form of sadaqah, or charitable giving. Sermons increasingly include calls to use water and natural resources carefully. This approach often proves more effective than purely administrative measures.

No project can be sustainable without a local leader – whether a mahalla committee chair, a schoolteacher, or simply a respected older herder. These are the people who carry the knowledge forward after international programmes end, helping change continue at the community level.

5.4.5. Youth Education Programmes

Recognizing the demographic challenge – more than half of the region's population is under 30 – governments and international organizations are increasingly placing young people at the centre of environmental action.

In Kyrgyzstan, the Jashyl Muras ("Green Heritage") campaign, launched in 2022 on the President's initiative, aims to improve environmental conditions, conserve and expand forests, and support climate change adaptation. The campaign includes mass tree-planting activities involving schoolchildren and students, accompanied by environmental lectures and practical classes. In Uzbekistan, a similar role is played by the nationwide Yashil Makon ("Green Space") initiative, mentioned above, which was launched in 2021. The programme combines the large-scale expansion of green spaces with the active involvement of volunteers and young people. School environmental clubs, field training, and participation in nature conservation activities are gradually shaping a new environmental outlook in which land is seen not as an inexhaustible resource, but as a living system that requires responsible stewardship and long-term care.

5.4.6. Technology and Digital Tools: The Steppe in a Smartphone

For a long time, training remained "analog": learning by example, printed materials, and face-to-face lectures. Over the past decade, however, the spread of mobile communications and digital technologies has significantly changed access to information.

Farmers, herders, and rural administrations are increasingly being trained to use digital GIS tools, including NDVI maps and other vegetation indices. Even for people who had never previously worked with digital technologies, satellite data are gradually becoming a practical tool for pasture and farm management.

During the COVID-19 pandemic, many international organizations adapted their educational programmes by developing short audio materials in local languages. Radio, which many considered outdated, experienced a revival: in remote areas of Turkmenistan, where internet access remains limited and expensive, broadcasts on drought management methods became the main source of information.

One successful example of digital engagement has been the use of messaging apps for rapid alerts on pests and plant diseases. A farmer takes a phone photo of locusts in his field, sends an image of the affected areas to specialists, and receives remote advice on the level of threat. Training thus becomes a rapid-response service.

5.4.7. Lessons from "Living" Land

Looking back over the past several decades of experience, three main lessons can be drawn from Central Asia.

First lesson: Never start with blame and choose your words carefully. Any programme that begins by

Pexels

blaming the land user – "You have depleted the land!" – is doomed to fail. Successful approaches always begin by recognizing the difficulty of farmers' work. Training is an offer of support, not criticism.

Second lesson: The economy underpins everything. A land user will adopt a technology to combat desertification only if it offers a short-term benefit or reduces risks. All successful training activities emphasized business planning. Farmers were taught to do the math: how much they lose to erosion and how much they can earn from phytomelioration.

Third lesson: Communityled leadership. No project survives without a local leader. UNCCD programmes today are geared towards setting NVT, and those documents already include a commitment to supporting such leaders.

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Section 6.
Priority Areas for Development

6.1. Strengthening Strategic and Legislative Frameworks

The analysis shows that the countries of the region have made a remarkable transition from fragmented declarations to coherent strategies. Today, however, the key challenge is not to draft new laws but to ensure their implementation, coordination, and integration.

6.1.1. Long-Term and Secure Land-Use Rights

The key step is to provide land users with guaranteed rights for a period of 20–50 years, with automatic renewal in cases of good-faith use. This will create an economic incentive to invest in land improvement, adopt water-saving technologies, such as drip irrigation, carry out phytomelioration of pastures, and restore soil fertility.

Kyrgyzstan's experience with private ownership of arable land and Kazakhstan's experience with long-term leases of up to 49 years show that the longer the planning horizon, the more willing farmers are to invest in the land. It is necessary to move in this direction by eliminating legal uncertainty [1].

6.1.2. Special Legal Regimes for Degradation-Prone Land

Areas at high environmental risk – those affected by desertification, salinization, or erosion – should be formally designated and given special legal status. Such land should be subject to binding requirements: soil-conserving crop rotations, restrictions on ploughing slopes, limits on livestock numbers, and mandatory shelterbelts.

Kazakhstan offers a model that could be scaled up: after pilot surveys in three regions confirmed the critical condition of pastures, regional desertification control plans were adopted in all 17 regions [2].

6.1.3. Legislative Recognition of New Concepts

New concepts should be incorporated into land and environmental codes, including "land degradation neutrality," "soil carbon," "carbon unit," "ecosystem services," and "climate project." Without them, countries cannot participate in carbon markets, properly assess damage, or create incentives for restoration practices.

6.1.4. Inclusiveness as a Principle

Targeted support for women farmers, young people, and herders using remote pastures. Quotas in pasture committees, easier access to long-term leases, and priority access to training and grant programmes. Vulnerable groups should be treated not as recipients of assistance but as participants in land policy.

6.2. Building the Capacity of Public Authorities

6.2.1. Digital Land Administration and Monitoring

The priority is to move from paper-based records to GIS-based centres. Kazakhstan's use of Trends.Earth, space-based monitoring, and the Information System for SLM, together with Uzbekistan's RESILAND pilot project to establish a National Forest Monitoring System, shows that today's environmental officials must be able to work not only with legal codes but also with satellite imagery [3].

The ability to verify NDVI-based data and see actual grazing pressure, rather than rely on paper reports, represents a major improvement in decision-making. Kazakhstan is already using space-based monitoring to identify unused land [4].

6.2.2. Inter-Agency Coordination

The familiar problem – water agencies not speaking to agricultural agencies, while both fail to hear environmental authorities – can be addressed by creating permanent national UNCCD coordination committees with real budgetary powers. This means moving from advisory bodies to project offices that bring together specialists from agriculture, water management, and forestry to implement concrete land restoration tasks.

6.2.3. Economic Expertise

Introducing green finance mechanisms, carbon farming, and ecosystem services valuation requires a fundamentally new skill set. Today's civil servants must understand how the carbon market works, how to verify a climate project, and how LDN differs from simple restoration.

Training such specialists is a challenge for civil-service professional development systems. In Kazakhstan, this work is already under way as part of preparations for a carbon project with BCarbon and FAO.

6.2.4. Legislative Drafting

Scientific concepts – achieving LDN, synergies among the Rio Conventions, and agroforestry-based land reclamation – must be translated into legal norms. Developing a cadre of environmental lawyers and specialists in international water law who can turn scientific knowledge into high-quality legislation is one of the priority tasks [5].

6.3. Strengthening Institutional Capacity at the Regional and Local Levels

6.3.1. National Level: Governance Architecture

The countries of the region have developed different institutional models. In some, including Kazakhstan and Uzbekistan, National Coordination Committees that bring together all stakeholders play the central role. Their strength is broad representation; their weakness is the lack of direct budgetary leverage.

In Turkmenistan, desertification control is closely integrated into the work of the Ministry of Environmental Protection and the Land Resources Service of the Ministry of Agriculture. In Tajikistan, RI and hydrometeorological agencies responsible for drought early warning are the main drivers.

It is important to note that there is no single "ideal" model. However, successful examples reveal a clear pattern: progress is visible where coordination is backed by political will at the highest level and permanent working bodies with expert staff are in place.

The Special Role of Science. Research institutes – including the Kazakh RI of Forestry [6], the National Institute of Deserts, Flora and Fauna of Turkmenistan [7], the RI for the Development of Desert Economy and Combating Desertification at the Central Asian University of Environmental and Climate Change Studies, the Forestry RI in Uzbekistan [8], the Institute of Water Problems of Tajikistan [9], and the Institute of Geography of RAS and the FSC of RAS [10] – are not simply "knowledge generators"; they are full participants in the management process. They develop adaptive technologies: salt-tolerant varieties, sand fixation methods, agroforestry-based land reclamation techniques, and land monitoring methods. Without transferring these technologies into practice through agricultural extension services, institutional reforms will remain on paper.

6.3.2. Local Level: Where Theory Becomes Practice

It is at the local level – in villages, at community meetings, on farms, and within water user and pasture user associations – that resource management takes practical shape. Here, strategies and laws either take practical effect or, if not properly applied, remain merely formal documents.

Pasture Committees in Kyrgyzstan. Established under the Law on Pastures, they have been given the right to develop management plans independently, set stocking rates, collect payments, and invest the proceeds in infrastructure. This is not merely decentralization but the transfer of responsibility and resources to those who work with the land every day. The experience of Kyrgyz pasture committees is now being studied and adapted in the mountain areas of Tajikistan and the pasture zones of Kazakhstan.

Community forestry in Karakalpakstan. Faced with severe budget constraints for forest planting on the dried bed of the Aral Sea, a community forestry model was tested. Local residents are allowed to remove dead or damaged trees and use the spaces between rows to grow forage crops in exchange for participating in saxaul planting. The state gains vegetation cover; local people gain jobs and forage.

Water User Associations (WUAs). Despite persistent problems with financial sustainability, WUAs in all countries where they have been established have demonstrated the main lesson: more transparent and participatory water allocation directly reduces the risks of secondary salinization and irrigation erosion. Where water is distributed transparently, on schedule, and with the participation of farmers themselves, soils suffer less [11].

6.3.3. Skills and Competencies: The Main Challenge

Human capital remains the most critical resource. At the local level, there is a shortage of specialists who possess a combination of agroecological expertise, practical experience in land reclamation, and proficiency in modern GIS technologies. Developing such expertise through education, professional training, and knowledge exchange will be essential for designing and implementing effective land restoration and sustainable land management initiatives.

High staff turnover represents an additional challenge. Specialists trained through international projects

who acquire expertise in land condition monitoring methodologies and LDN principles often transition to the private sector or international organizations, where they can access more competitive remuneration and greater opportunities for professional development. As a result, public institutions face difficulties in retaining qualified personnel and maintaining the long-term capacity needed to implement SLM initiatives.

Kazakhstan: although the State Scientific and Production Center for Land Resources and Land Management has 600 specialists, there is demand for new skills in MRV, big data, and AI for carbon farming [12].

Kyrgyzstan: there is a widespread shortage of competent agronomists, geobotanists, hydraulic engineers, and foresters. Specialists are needed in digital agricultural technologies, soil carbon measurement, and GIS.

Tajikistan: the large body of documented WOCAT technologies requires specialists who can scale them up [13].

Creating a system of long-term incentives to retain qualified personnel in public land resource management is one of the key tasks. Without such incentives, any investment in equipment, digital technologies, and software will have only a limited and temporary effect.

6.4. Expanding Regional and Interregional Cooperation

6.4.1. Deepening Cooperation within the IRG and IFAS and Expanding International Partnerships

The IRG Road Map [14] should be put into operation through regular, standing mechanisms. Key tasks include creating a unified GIS system for land degradation monitoring that is accessible to all participating countries; harmonizing land cover classifications and the methodology for calculating SDG indicator 15.3.1; and implementing joint pilot projects on carbon farming and phytomelioration in transboundary river basins.

The IFAS agenda needs to move beyond the Aral Sea alone and address the integrated management of water and land resources across the entire basin. It is important to strengthen the Fund's executive capacity, moving it from a dialogue platform to a full-fledged project institution.

The fundamental issue is to strengthen responsible, professional state oversight of land and water resources under a changing climate and growing human pressure,

relying on scientific evidence and regionally agreed measures for sustainable development across the region.

It is important to use the potential of CAREC as an independent, non-political, and non-profit international organization. The Centre facilitates regional cooperation among government institutions, the scientific community, the private sector, and civil society. The Centre's main objective is to put in place the technical and financial conditions needed to develop and implement regional programmes on climate change, sustainable water and land management, biodiversity conservation, and greater environmental resilience.

It is necessary to develop partnerships with different regions and countries, strengthen trust-based dialogue. In particular, in cooperation with Russia and China, the region needs to move from studying the Great Plan for the Transformation of Nature and the TNSFP to concrete projects that adapt relevant technologies to Central Asian conditions. Priority areas include joint research and the breeding of drought- and salt-tolerant species; the transfer of technologies for stabilizing mobile sands, including polymer composites and mechanical barriers; the use of renewable energy in combating desertification; and joint monitoring of glaciers and transboundary waters.

6.4.2. The Economics of Cooperation

The countries of the region are gradually moving from the role of grant recipients to that of equal partners with unique expertise in managing arid ecosystems. Kazakhstan is attracting investment through AFoCO and its partnership with BCarbon, Uzbekistan is implementing projects jointly with the Japan – Uzbekistan Silk Road Fund, and Tajikistan is advancing the Dushanbe Water Process. Pilot projects have been launched between Kazakhstan and the United Arab Emirates to monitor the carbon balance of pastures, while Uzbekistan is cooperating with the Saudi Fund for Development to restore the oases of Bukhara and Samarkand. Turkmenistan's initiative to establish a Regional Centre for Combating Desertification and Kazakhstan's initiative to establish a Regional Forestry Training Centre have received support from several donors.

The consolidated position of the five countries at UNFCCC COP28 and UNCCD COP16 demonstrated the potential benefits of enhanced regional coordination and collective representation in international negotiations. Recent COP processes have shown that coordinated regional approaches can contribute to a more coherent articulation of shared interests. Building on this experience, a possible next step would be to establish


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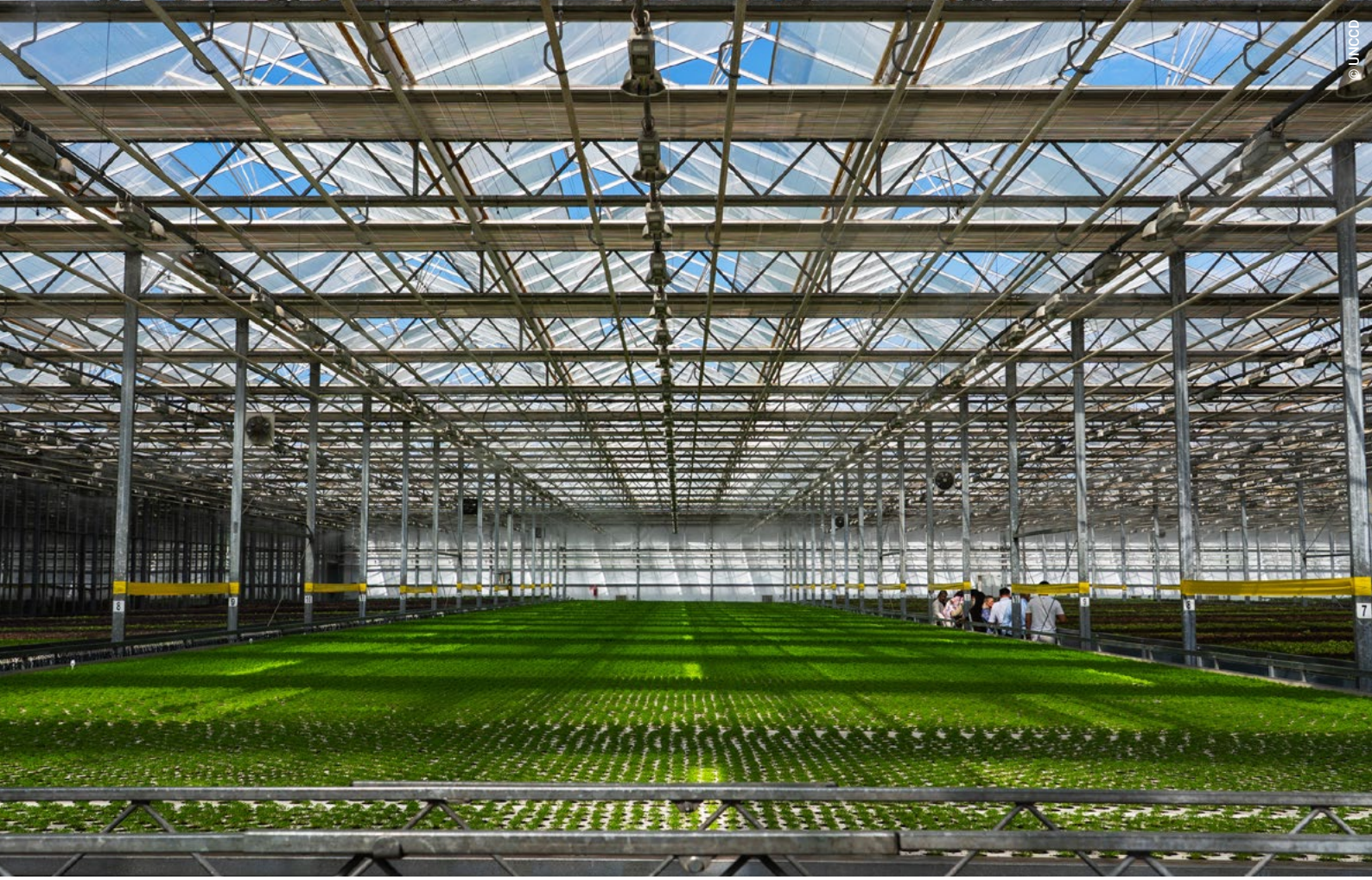

a regional coordination mechanism for negotiations that complements existing arrangements under the Rio Conventions. Such a mechanism could facilitate the exchange of positions and among Central Asian countries, support the identification of common priorities, and improve coordination of proposals related to land degradation, climate adaptation, and sustainable land management. It could also help align national initiatives with regional programmes and strengthen engagement with international partners and donors.

6.4.3. Investment Opportunities

Central Asia has traditionally been recognized for its strategic geographic location, abundant natural resources, social stability, and the capacity to sustain agricultural production under challenging desert and mountain conditions with limited water resources. Today, these traditional advantages are complemented by new opportunities, including digital land mapping and monitoring systems for assessing land condition at national and regional levels, the development of transboundary agricultural production clusters supported by advanced digital and agricultural technologies, and the strengthening of human capital through education and training in integrated land and water resources planning and management, taking into account the interests of all countries of the region.

The countries of the region maintain broad international partnerships and pursue a multi-vector approach to international cooperation, creating opportunities for collaboration with governments, international organizations, development finance institutions, and private-sector investors interested in sustainable land management and climate resilience. National experience has also provided the foundation for several regional initiatives aimed at achieving LDN, demonstrating the potential for coordinated action to address land degradation and desertification across national borders.

The region offers significant investment opportunities in sustainable land use and ecosystem restoration. Priority areas include the restoration and sustainable management of diverse landscapes, including desert plains and mountain pastures; climate-resilient agriculture under conditions of increasing drought, erosion, and salinization; carbon farming, afforestation, reforestation, and agroforestry-based land restoration; digital technologies for land monitoring and decision support; and integrated land and water resources management. Investments in these sectors have the potential to generate environmental, economic, and social benefits while contributing to climate change mitigation and adaptation, biodiversity conservation, and improved livelihoods. They can accelerate the adoption of innovative technologies, strengthen institutional and technical capacity, and support the implementation

of large-scale restoration and sustainable land management programmes. Such investments can enhance ecosystem resilience, improve rural livelihoods, and contribute to the implementation of the UNCCD, the Paris Agreement, and the SDGs.

Today's environmental and climate-related challenges do not recognize administrative borders and require coordinated, science-based responses. Droughts and other natural and human-induced processes affecting land resources in Central Asia frequently have transboundary impacts, highlighting the importance of regional cooperation and shared approaches to SLM. International dialogue platforms provide valuable opportunities to exchange knowledge, coordinate policies, strengthen collaboration among governments, scientific institutions, the private sector, and civil society, and facilitate the development of regional investment initiatives.

Regional cooperation can further increase the effectiveness and long-term sustainability of these investments through coordinated planning, knowledge exchange, harmonized approaches, and the sharing of best practices across Central Asia.

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Conclusion


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The Map We Are Creating Together

Central Asia stands at a strategic crossroads. The region faces serious environmental challenges, but it also has significant potential for sustainable development. The countries of the region face a choice: either allow negative trends to deepen, leading to further land degradation and growing forced migration in search of water, food, and safety, or move towards a model for the sustainable development of arid areas – one that shows leadership and the capacity not only to adapt to climate change but also to manage natural capital sustainably and build on the resources already accumulated.

The problem has been clearly defined, and a common framework for action is in place. The concept of LDN has given the countries of the region a common language for describing their challenges and a set of measurable benchmarks. In recent years, the countries of Central Asia have developed unique and complementary areas of expertise, creating a foundation for more coordinated and scalable solutions:

- Kazakhstan – in digital monitoring, pasture management, and the development of carbon farming;
- Uzbekistan – in phytomelioration, afforestation of arid zones, and water-saving technologies;
- Turkmenistan – in sand fixation technologies, water harvesting from takyr runoff (seasonal surface runoff from flat desert clay pans), and adaptation to desert ecosystem conditions;
- Kyrgyzstan – in community-based pasture management and adaptation to water scarcity;
- Tajikistan – in documenting knowledge, sustainable land-use practices, and the development of community forestry.

A range of institutional mechanisms has already been established and is operating in the region – from local pasture committees to others as the UNCCD Interregional Group "Central Asia – Russia." Regional strategies on drought management and dust storms have been adopted. In 2025–2026, the region took an important step towards integration into global carbon markets. More than 100 sustainable land management technologies from Central Asia have been made available to the global community through the WOCAT database.

From the Dust of the Aral Sea to the Green Wall of Eurasia

Despite these achievements, significant challenges remain. Land degradation continues, glaciers are melting faster than we can adapt, and institutional inertia and inter-agency fragmentation are slowing the pace of change. In many areas, pasture management plans have not yet been approved, unique wetlands continue to face pressure from urbanization and agriculture, and the methodology for carbon accounting in arid soils requires further adaptation and calibration.

The main challenge today is to close the gap between setting LDN targets and putting them into practice, to turn fragmented records into an integrated monitoring system, and to ensure that the most vulnerable groups – women, young people, and herders on remote pastures – take part in decision-making.

The land of Central Asia preserves the memory of the Great Silk Road – not only as a route for goods but also as a channel through which knowledge, ideas, cultural codes, and technologies travelled. Along this route travelled not only caravans carrying silk and spices but also agronomists, irrigation specialists, botanists, and travellers who brought seeds of new crops, designs for water-lifting machines, and ways of coping with drought.

Today, we are sending a new "caravan" along this ancient route – a caravan of ideas, technologies, and joint projects. We carry not goods for sale but knowledge for shared use; we seek not competitive advantage but points of cooperation. The success of one becomes the success of all.

In the desert, some values matter far more than money: water, fertile land, ancestral memory, the labour of farmers, and the hope of a harvest in a dry year – real wealth that cannot be measured in cubic metres or hectares.

Achieving LDN in Central Asia is possible only through joint regional action. Otherwise, this goal will remain out of reach for the region as a whole. And the time to make this choice is limited – by the pace of glacier melt, shifts in groundwater levels, and the expectations of millions of young people who will either build their future on this land or be forced to look for it elsewhere. We invite you to be part of this shared journey.

We invite you to walk this path with us.

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This publication is available for download at: https://www.unccd.int/resources/global-land-outlook/overview

GLOBAL LAND OUTLOOK

The United Nations Convention to Combat Desertification (UNCCD) recognizes that addressing and reversing land degradation is one of the key sustainable development priorities for many countries, particularly in the developing world. In response, the UNCCD secretariat produces strategic communications publications under the brand of the Global Land Outlook (GLO) to facilitate insights, debate, and discourse on a transformative vision for land management policy, planning and practice at various scales.

The aim of the GLO is to communicate and raise awareness of evidence-based, policy-relevant information and trends to a variety of stakeholders, including national governments formulating their responses to commitments to better manage and restore land resources, including the SDGs and associated targets, such as Land Degradation Neutrality (LDN). The evidence presented in the GLO reports demonstrates that informed and responsible decision making can if more widely adopted help to reverse the current worrying trends in the state of our land resources.

All GLO reports and working papers, can be found at:
https://www.unccd.int/resources/global-land-outlook/overview

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