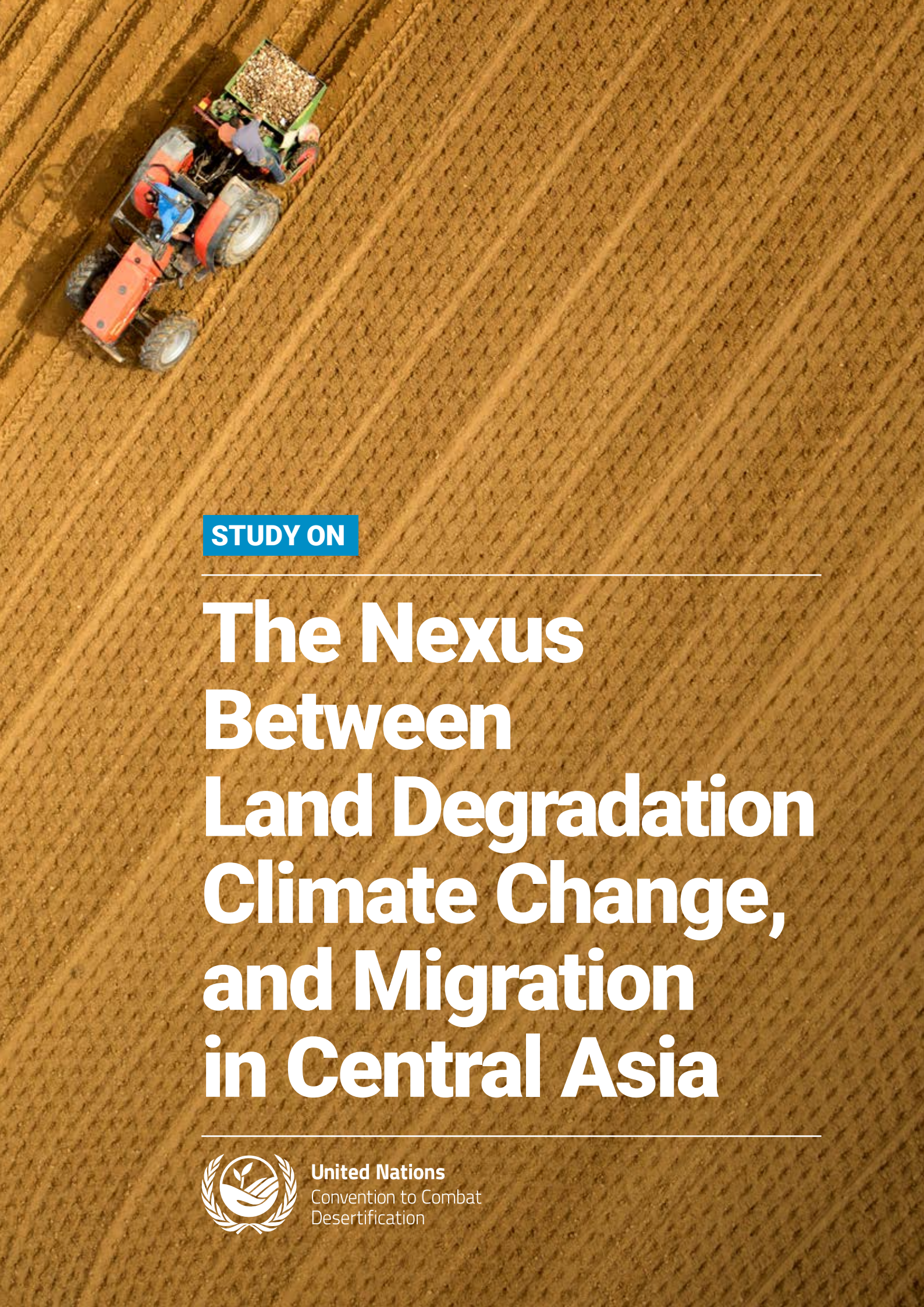

STUDY ON

The Nexus Between Land Degradation Climate Change, and Migration in Central Asia

United Nations
Convention to Combat Desertification

The United Nations Convention to Combat Desertification (UNCCD) is an international agreement on good land stewardship. It helps people, communities and countries create wealth, grow economies and secure enough food, clean water and energy by ensuring land users an enabling environment for sustainable land management. Through partnerships, the Convention's 197 Parties set up robust systems to manage drought promptly and effectively. Good land stewardship based on sound policy and science helps integrate and accelerate achievement of the Sustainable Development Goals, builds resilience to climate change and prevents biodiversity loss.

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The Nexus Between Land Degradation Climate Change, and Migration in Central Asia

United Nations
Convention to Combat
Desertification

United for land

ACRONYMS AND DEFINITIONS

CA	Central Asia
CACILM	Central Asian Countries Initiative for Land Management
CCA	Climate Change Adaptation
CIS	Commonwealth of Independent States
EAEU	Eurasian Economic Union
FAO	Food and Agriculture Organization of the United Nations
GDP	Gross Domestic Product
ICARDA	International Centre for Agricultural Research on Dry Areas
IOM	International Organization for Migration
IPCC	Intergovernmental Panel on Climate Change
LDN	Land Degradation Neutrality
PRAIS	UNCCD Reporting Platform
SLM	Sustainable Land Management
SLU	Sustainable Land Use
TE	Trends Earth
SDGs	Sustainable Development Goals
UNCCD	United Nations Convention to Combat Desertification
USSR	Union of Soviet Socialist Republics
WOCAT	World Overview of Conservation Approaches and Technologies

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PREFACE

The United Nations Convention to Combat Desertification (UNCCD) prioritizes the nexus between land degradation, climate change and sustainability. As early as 2014, the Executive Secretary of UNCCD noted that in many areas degradation has rendered much of the land, especially in arid regions, infertile (Monique Barbut, 2014). That being the case, voluntary migration may be part of the solution. Conversely, a warming climate could eventually result in forced migration becoming the new norm. Ongoing changes leave little room for doubt and require appropriate solutions. The 3S Initiative (Sustainability-Stability-Security) (UNCCD, 2017) acknowledges that the loss of fertile land compels people to make difficult choices regarding their livelihoods. In rural areas, where people heavily rely on the quality of land resources, land degradation becomes a driver of forced migration.

In recent years, the former Soviet Union countries have faced significant challenges regarding migration. The migration corridor between Russia and the Central Asian countries emerged after the collapse of the Union of Soviet Socialist Republics (USSR). It is considered one of the most stable and largest migration routes in Eurasia (FAO, 2018). However, the nature of migration in the 30 years since the collapse of the USSR, has undergone certain transformations. The 1990s saw a huge influx of forced migration to Russia from countries with turbulent political situations, oppression of certain ethnic groups, and armed conflicts. Currently, labour migration, which is considered 'voluntary', accounts for the bulk of the migration. Migrants from Central Asian countries contribute labour resources to Russia and other countries in different sectors of the economy. In Central Asian republics, the economic decline that followed the collapse of the Soviet Union, combined with population growth in the region, resulted in unemployment and devaluation of the workforce value (Interstate Statistical Committee of the CIS 2016(a)).

The key drivers of labour migration are a hard economic situation, a lower standard of living than in other countries, extensive land use, uncertain regional economic growth prospects and low wages (Interstate Statistical Committee of the CIS, 2016(b)).

Figure 1. The borders of Central Asian countries: Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan (World Sites Atlas, 2018).

Tajikistan, Uzbekistan, Kyrgyzstan, and Kazakhstan are the main sources of labour migrants to the Russian Federation from Central Asia (Chekhovskikh, 2019). According to some estimates, from 2.5 to 4.3 million people, or 10–15 per cent of the economically active population of Central Asia are involved in labour migration annually. It is not always possible to estimate the actual number of migrants. Information provided by many sources is not uniform with the difference in estimates being as high as a million people. On the one hand, not all labour migration is legal, and not all labour migrants cross national borders seeking to make a living. However, all studies indicate that most migrants from Central Asia are low-skilled workers mostly from rural areas, where there has been land degradation, lack of water resources and an associated decline in agricultural productivity combined with a growing population.

This study analyses the reasons behind labour migration in connection with land management and climate change and explores the ways to address the related challenges. This report presents key insights and offers practical recommendations. More comprehensive results will be presented in a dedicated monograph and various journal articles. The study's outcomes could serve as the foundation for a conceptual project that could potentially be carried out in collaboration with the United Nations Convention to Combat Desertification (UNCCD).

STUDY OBJECTIVE

To develop a multidisciplinary research platform for further interregional cooperation between Central Asian countries and the Russian Federation in the area of land degradation, adaptation to climate change, migration, and the nexus between these issues, as well as helping to achieve the objectives of the UNCCD Strategy for 2018-2030 and SDG Target 15.3.

STUDY OBJECTIVES AND EXPECTATIONS

1. To understand the role of land degradation processes, including those related to climate change, in the overall context of socio-economic factors that lead to migration (in the context of the biophysical diversity of the region).

2. To establish recommendations for the development of an interdisciplinary research platform to promote international cooperation in achieving the goals of the UNCCD. To prepare a concept note (project proposal) for the development of the Sustainable Land Management (SLM) objectives, as well as achieving Land Degradation Neutrality (LDN) and cutting down on the undesirable migration.

RESEARCH METHODOLOGY

In the initial phase, an examination of land conditions, primary degradation processes, and climate change-related trends was conducted. This included identifying areas of land degradation, analysing both internal and external migration patterns, and examining the nexus between migration and land degradation in all Central Asian countries (see Figure 3). This part of the research relies on the analysis of archival footage, publicly available resources, national statistics, scientific publications, and international and national databases using international land assessment tools (Trends.Earth, 2018).

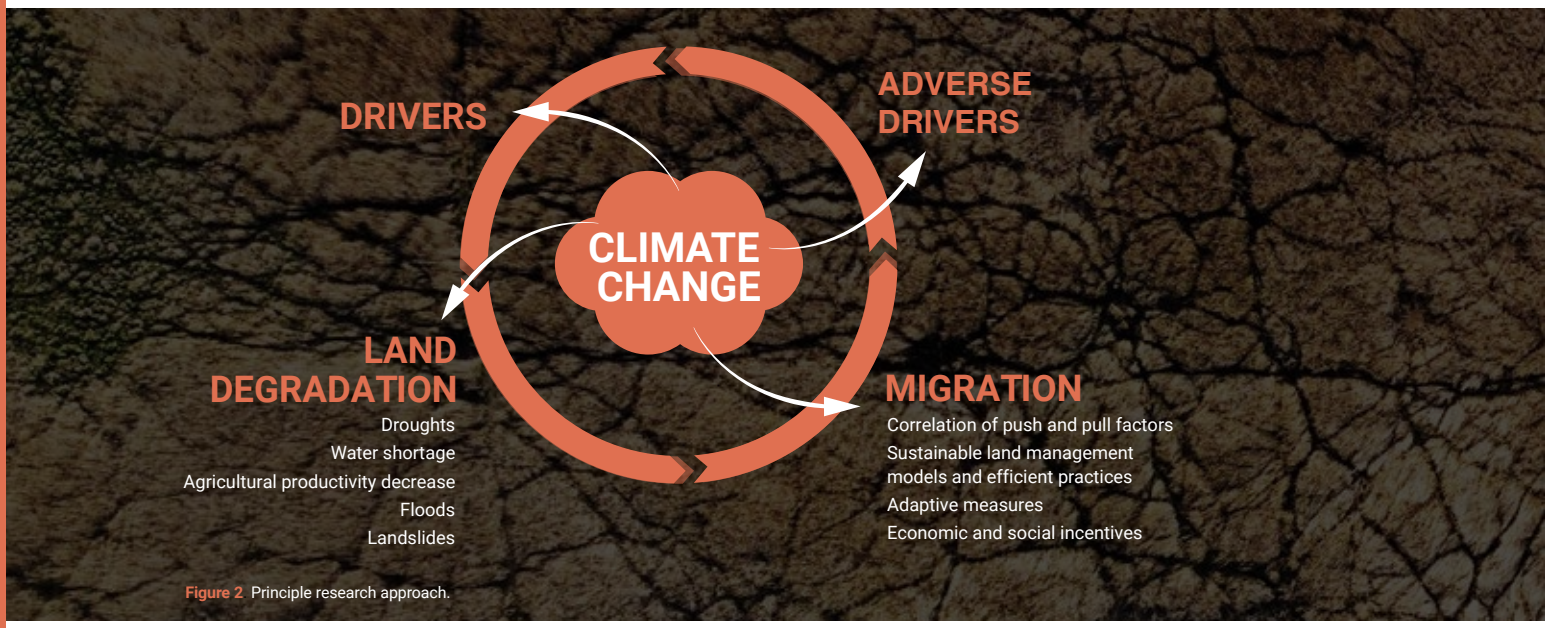


Figure 2 Principle research approach.

During the data collection stage, it became apparent that there were gaps in the coverage of country-specific information along with disparities in the indicators used across different countries. Moreover, the study faced challenges due to the COVID-19 pandemic, primarily relying on remote methodologies, which hindered effective collaboration among research team members across different countries. Considering these constraints, the pilot countries selected for an in-depth study were the Kyrgyz Republic and the Republic of Tajikistan. The selection of these countries as the focus of the study was based on several factors. Firstly, these countries were chosen because they provided the most extensive and comprehensive data, enabling a more detailed analysis. Secondly, both countries face significant migration challenges, making them particularly relevant for the study. The Kyrgyz Republic and the Republic of Tajikistan have distinct economies that heavily rely on labour exports, with a notable proportion of their rural populations experiencing rapid growth. These countries face limitations in terms of export resources, job opportunities for local residents, and an abundance of inexpensive labour.

To address the data gaps and conduct a more comprehensive analysis of the situation in the Central Asian republics, the second stage of the study involved the development of specific questionnaires. These questionnaires aimed to gather the respondents' perspectives on the nexus between climate change, land degradation, water scarcity, and rural migration mobility. The respondents included residents of Kyrgyzstan, Tajikistan and Uzbekistan, representing various segments of the population, ranging from rural residents to managers and highly skilled professionals. In addition to field research, surveys were conducted among labour migrants from different Central Asian countries who were working in Russia.

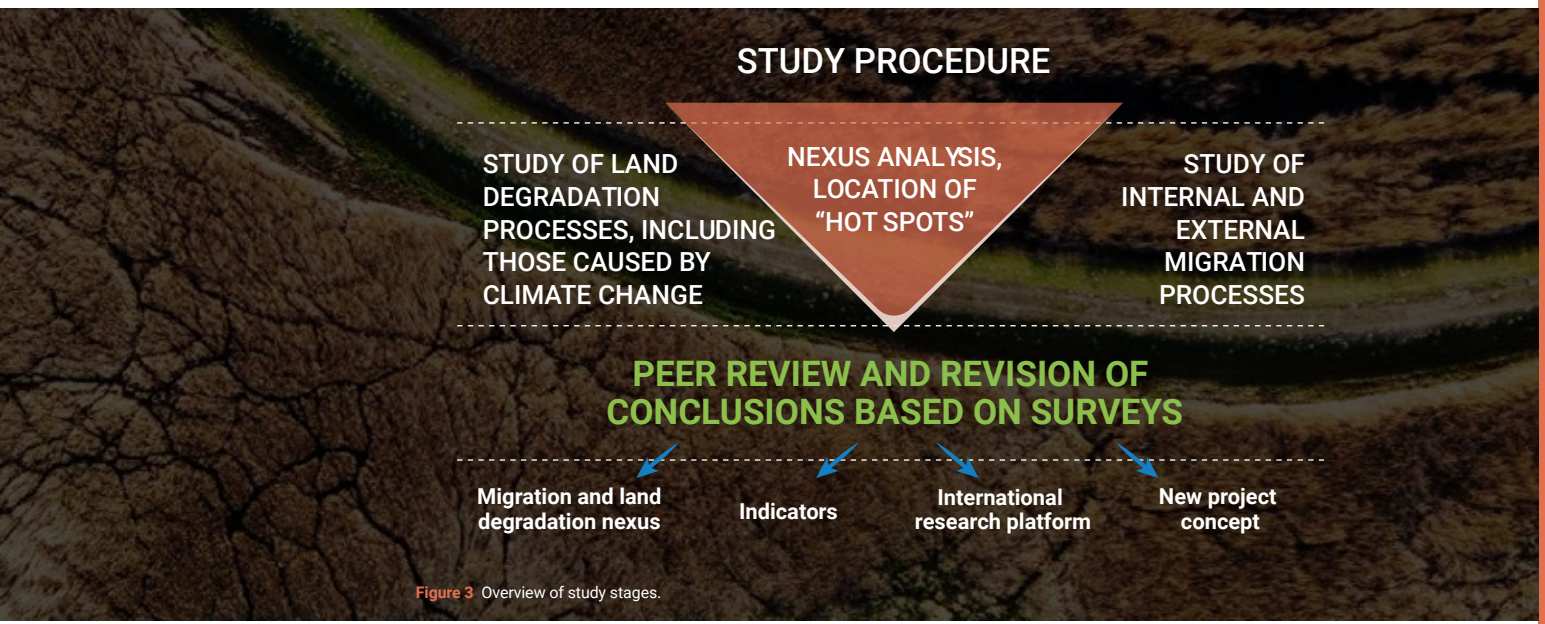


Figure 3 Overview of study stages.

THE NEXUS BETWEEN LAND DEGRADATION, CLIMATE CHANGE, AND SUSTAINABLE LAND MANAGEMENT PRACTICES

Outline of the Problem. The challenge of land degradation and desertification has long been observed in Central Asia. This region, characterised by an arid climate and significant bioclimatic capacity, has witnessed centuries of human settlement along rivers, the cultivation of surrounding lands for irrigation purposes, forestry activities, and the establishment of gardens in foothills and mountainous regions. Furthermore, the region has a history of seasonal livestock grazing on remote desert and high-mountain pastures. The research community is aware of historical instances of desertification in the region, which have been attributed to both climatic factors and human activities (Kust, 1999). The study of desertification occurrences reveals that in the diverse natural and climatic conditions of the Central Asia region (CA region), particularly concerning water supply and the availability of fertile soils, sustainable land management can only be achieved through a balanced approach that does not exceed critical resource limits. Over the past century, there has been a significant increase in human-induced pressure, evident in the expansion of irrigated lands, heightened water extraction for industrial and domestic purposes, substantial growth in the animal population, and consequently, increased grazing pressure on pastures. All these factors, combined with the arid climatic conditions, have resulted in the depletion of fertile soils, deforestation, land degradation, and a reduction in productive water resources. Population growth has also contributed to these phenomena, as a continual increase in agricultural production to ensure food supply was needed, as well as the expansion of production to provide employment opportunities.

Meteorological data, available in the CA region since the late 19th century, demonstrate a consistent rise in annual temperatures, particularly during winter (Jones et al., 1999; Lioubimtseva et al., 2005). Projected climate models consistently indicate a warming trend, with average annual temperatures predicted to increase by 3-5 °C by 2080. This overall warming is expected to be accompanied by a further increase in aridity (Huang et al., 2016). However, due to the region's diverse landscapes and changes in land use, some areas may experience opposite trends. For instance, in the vicinity of major oases in Kazakhstan, Uzbekistan, and Turkmenistan (such as Urgench, Bukhara, Tashkent, Murghab, Tedzhen, and Ashkhabat), this phenomenon has been attributed to anthropogenic climate changes caused by the expansion of irrigated land areas (Pielke et al., 2007), as well as the geographical characteristics of the region. Projections indicate relatively sharp decreases in precipitation in the western and

southwestern parts, with minimal increases in the northern and eastern regions. Notably, there is a significant decrease in spring and summer precipitation, alongside an increase during winter (Malsy et al., 2012).

The consistent decline in snow reserves, with glaciers in the mountains reducing by 37 per cent over 34 years at a degradation rate of 1.1% annually, coupled with deforestation in mountainous regions, has significantly contributed to aridification and the xerophytization of vegetation cover. These factors, along with increased erosion, have intensified the redistribution of materials within the mountain-plains system, resulting in a rise in extreme weather events in the region, such as prolong droughts and high summer temperatures. Climate change is expected to further increase the frequency of severe and moderate droughts, acting as an additional catalyst for desertification processes. In Uzbekistan, for example, an assessment of desertification intensity under changing climatic conditions revealed comprehensive changes across all landscape components (ecosystems), with the most notable transformations observed in the Aral Sea region, lower river basins (ancient dry deltas) and sandy deserts.

Lioubimtseva's research (2009) highlights three key aspects of landscape changes in the region, attributed to climate change. These include alterations in the composition of irrigated and cultivated lands and the exposure of the Aral Sea bed, changes in the agricultural utilisation of uncultivated lands in the semiarid zone, and changes in grasslands within both arid and semiarid environments. These changes, in turn, affect food security, availability of water resources (both in terms of quantity and quality), and the health and well-being of individuals.

The degradation of land and the impact of climate change contribute to a decrease in land productivity, crop yield, and the productivity of livestock farming. Traditional land management practices are no longer sustainable under these new conditions, leading to a decline in the income and living standards of the population. The critical ecological situation further exacerbates the spread of diseases, increased mortality rates, reduced life expectancy, and the prevalence of birth defects, etc. Consequently, people are forced to migrate to more favourable areas (Figure 4). The social implications of desertification also include the loss of recreational and tourism areas, a loss of public trust in government economic policies, and a diminished confidence in local authorities, among other factors.

'The climate is changing worldwide, including here. Winter lacks snow, and summers are scorching hot. In our region, rainfall is virtually non-existent. This year, for instance, we only had three instances of snowfall, there was no rain from March to September.'

Ilyoskhon, a 68-year-old retired agronomist, from Tajikistan's Sughd district, residing Rarz settlement

'The climate is changing, and each year, the volume of water in the springs is decreasing. We keenly feel the water scarcity. Additionally, the air is getting hotter and there's less rain. Consequently, crop yields, like wheat and corn, are declining. The situation has resulted in decreased earnings. As a result, both young and older people migrate, primarily to Russia, in search of employment and to support their families.'

Saykal, a 35-year-old former local council officer from Kyrgyzstan's Issyk-Kul district, living in Svetlaya Polyana settlement.

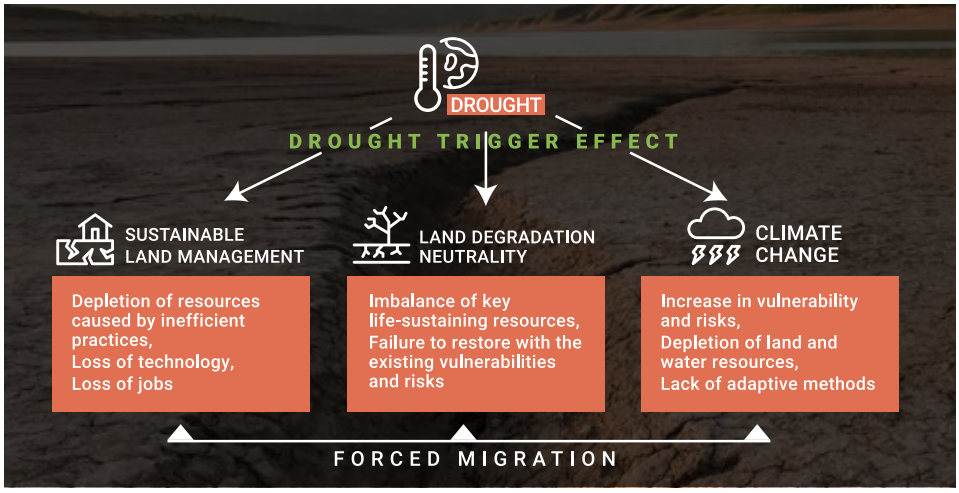


Figure 4. The nexus between land degradation, climate change and sustainable land management in the Central Asia region.

Land Degradation Dynamics

To gain insight into the severity of the situation resulting from climate change and land degradation in both the overall region and specific republics and localities, a cartographic evaluation of land degradation dynamics over the past two decades was conducted as part of this study. The assessment focused on examining the dynamics of land degradation over the past two decades. To facilitate this analysis, the UN Sustainable Development Goals indicator 15.3.1 was employed, which measures the proportion of degraded land over the total land area. It was proposed by the Inter-Agency and Expert Group on SDG indicators (IAEG-SDGs) and adopted by the United Nations Statistical Commission (UNSC) in March 2017 to monitor progress towards achieving SDG target 15.3. This indicator was chosen due to the absence of a standardized assessment methodology across the countries in the region. Utilizing a global indicator not only enables comparisons of the situation among different countries and regions, but also enables a comprehensive consideration of the changes influenced by various factors, encompassing both anthropogenic activities and the impacts of climate change. As stated by Orr et al. (2017), the establishment of SDG indicator 15.3.1 involves incorporating data on three key indicators: Land Cover Dynamics, Land Productivity Dynamics, and Soil Organic Carbon Stock Dynamics. These indicators are computed utilizing the Trends.Earth (TE) Plugin of the QuantumGIS platform. The data used for these calculations are obtained from international databases, ensuring comprehensive coverage in accordance with the principle of 'one out all out', where if any of the three indicators shows significant negative change, it is considered a loss (TE, 2018). To assess the accuracy of the findings obtained using TE, a comparison was made with data derived from national methodologies, as

'Land degradation hot spots prevalent across various areas, including irrigated plough lands, bogharic lands and pastures. It is caused by several factors ranging from farmers' and peasants' limited knowledge of land use to the state's poor agricultural policy.'

Zhenish, a 42-year-old male farm worker from Svetlaya Polyana settlement in the Issyk-Kul district of Kyrgyzstan

'Land degradation means drought. Pastures lose their grass, rainfed crops fail to yield, springs dry up, and livestock are left with nothing to eat.'

Boiburi, a 60-year-old former shepherd from Kyzyltut kishlak in the Gallyaaralsky district of the Jizzakh region in Uzbekistan

reported by countries in their submissions to the UNCCD regarding the achievement of land degradation neutrality (LDN) targets, and national reporting to the UNCCD. While minor inconsistencies were observed, it can be concluded that, overall, the results obtained through TE effectively evaluate the situation at hand (Figure 5).

Comparison of national and global data on the proportion of degraded land by country

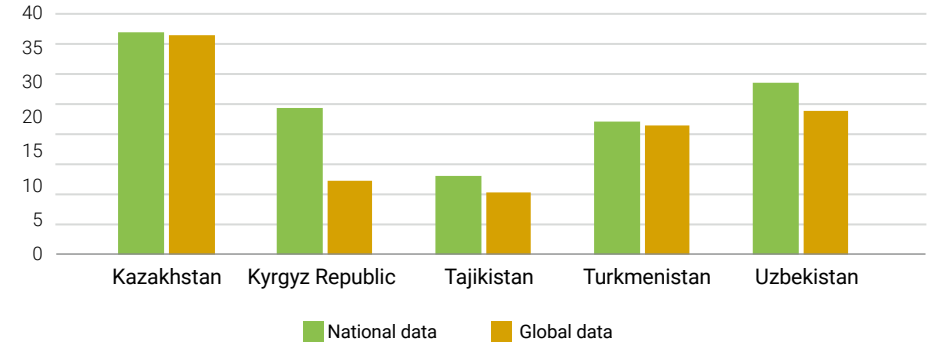


Figure 5. Comparative assessment of the proportion of degraded land by CA country (according to PRAIS3 national reporting for the UNCCD with regard to SDG indicator 15.3.1).

Unlike national data, the TE module offers insights into not only degraded land but also into improved or stable land over varying time periods (Figure 6).

Assessment of the proportion of improved, stable and degraded lands by country

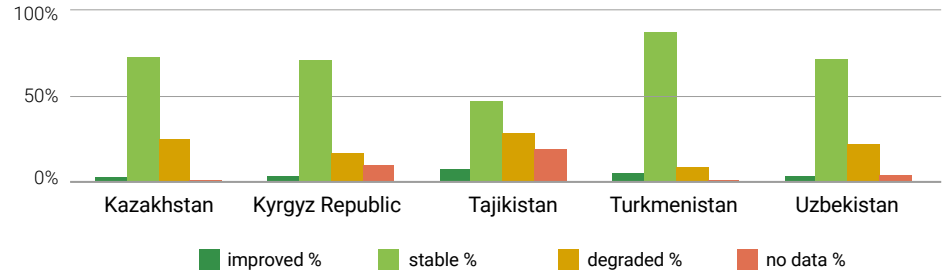


Figure 6. Proportion of improved, stable and degraded lands in CA countries (average of 2000-2020).

Through our analysis, considering the 'one out all out" principle of the indicators comprising SDG 15.3.1 (LDN indicators), we determined that the dynamics of land productivity make the most significant contribution to the overall value. Employing the moving average method enables us to not only calculate the overall proportion of degraded land but also monitor the change dynamics over a specific timeframe (see Figure 7). This is particularly crucial for comprehending the role of land degradation in the emergence of migration waves during specific periods.

Land productivity dynamics in Tajikistan

Land productivity dynamics in Kyrgyzstan

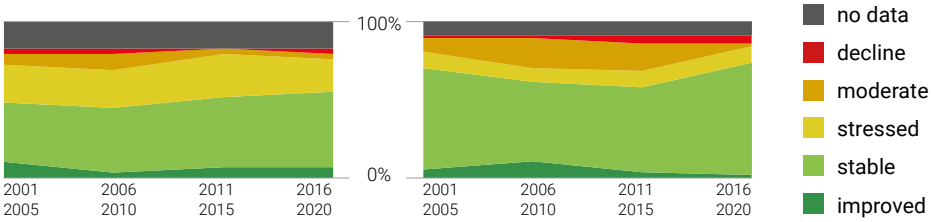


Figure 7. Land productivity dynamics in CA countries in 2001–2020

The revised data displayed in Figures 6 and 7 indicate that Uzbekistan, Kazakhstan, and Kyrgyzstan exhibit the highest proportions of degraded land, which have increased from 22% to 27% of the total land area. Most degraded lands are in a stable condition. However, an analysis of productivity dynamics shows that predominant fluctuations occur not only within the 'declining productivity' category but also within the 'stressed' and 'moderate' categories. This suggests that the lands are particularly vulnerable to a combination of climatic and anthropogenic risks that contribute to their degradation, exhibiting a noticeable sensitivity within a short span of time.

Despite certain limitations identified in our study regarding the method employed[1], its application remains valuable in identifying hotspot – regions where the population migration resulting from land degradation may be most prevalent, assuming all factors are equal. For example, the data obtained for Kyrgyzstan align the identified hotspots of land degradation in the country's national report (Report, 2018), confirming the effectiveness of the method (see Figure 8).

Furthermore, these hotspots are particularly prominent in foothill pastures and surrounding large cities, indicating the concentration of livestock production in these regions alongside an increase in livestock numbers and urban expansion resulting from internal population migration (see Figure 9)

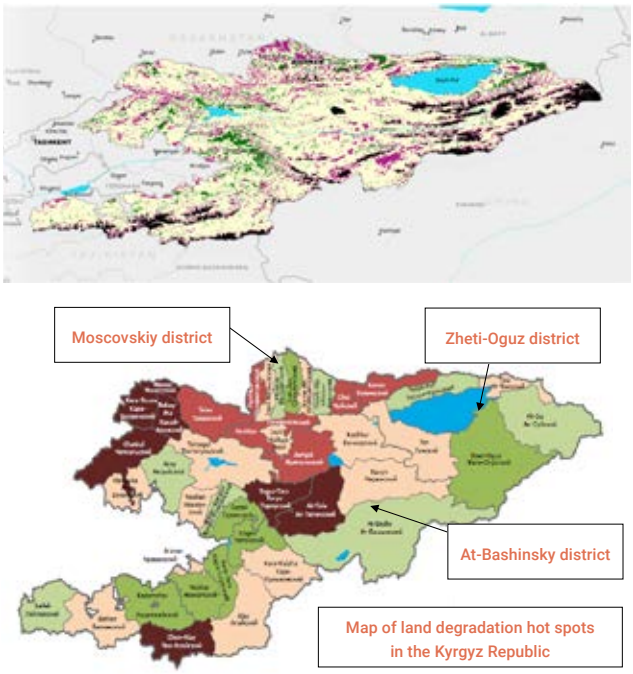


Figure 8. Comparison of land degradation 'hotspots' in Kyrgyzstan based on national data (top image, arrows) and LDN assessment (bellow, yellow spots).

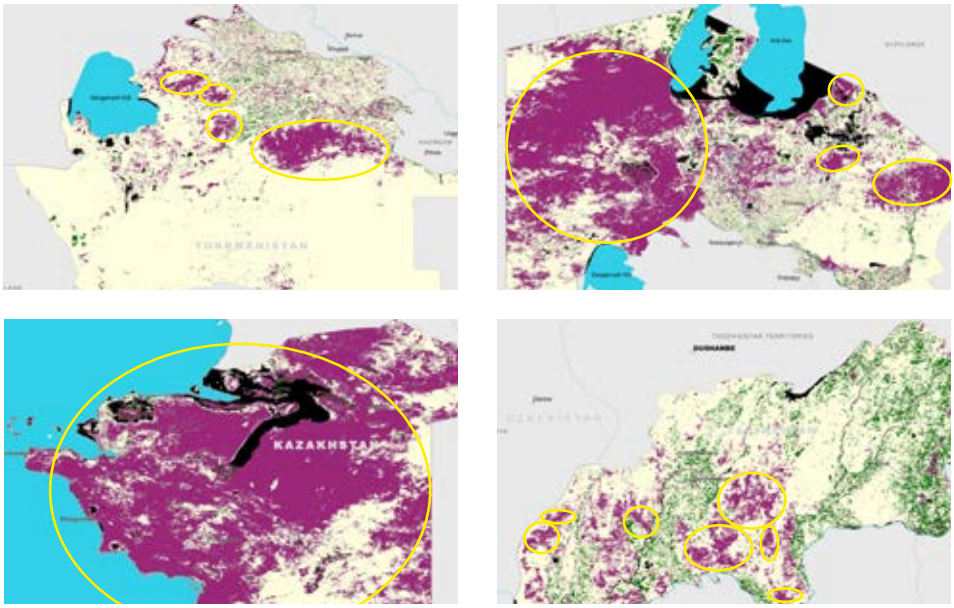


Figure 9. Examples of identifying land degradation 'hotspots' (ovals) in individual regions.

1 Based on the experience with the application of TE, it is evident that the current method of assessing Land Degradation Neutrality (LDN) does not adequately consider important indicators such as the condition of irrigation and drainage systems, as well as the quality of soil and vegetation (e.g., soil depletion, salinization, weed infestation in pastures and croplands, etc.). The issue lies in the insufficient assessment of land quality in relation to the dynamics of global LDN indicators. For instance, regions with poor land quality may exhibit an apparent increase in 'greenness' as indicated by the Normalized Difference Vegetation Index (NDVI), which can be misleadingly interpreted as an improvement in productivity.

The severity of land degradation issues in specific regions/velayats of Central Asian countries can be demonstrated using the LDN index (Andreeva, Kust, 2020), which represents the difference between degraded and improved lands. The most challenging situations are clearly visible in the magnitude of the red bars in the diagram (Figure 10).

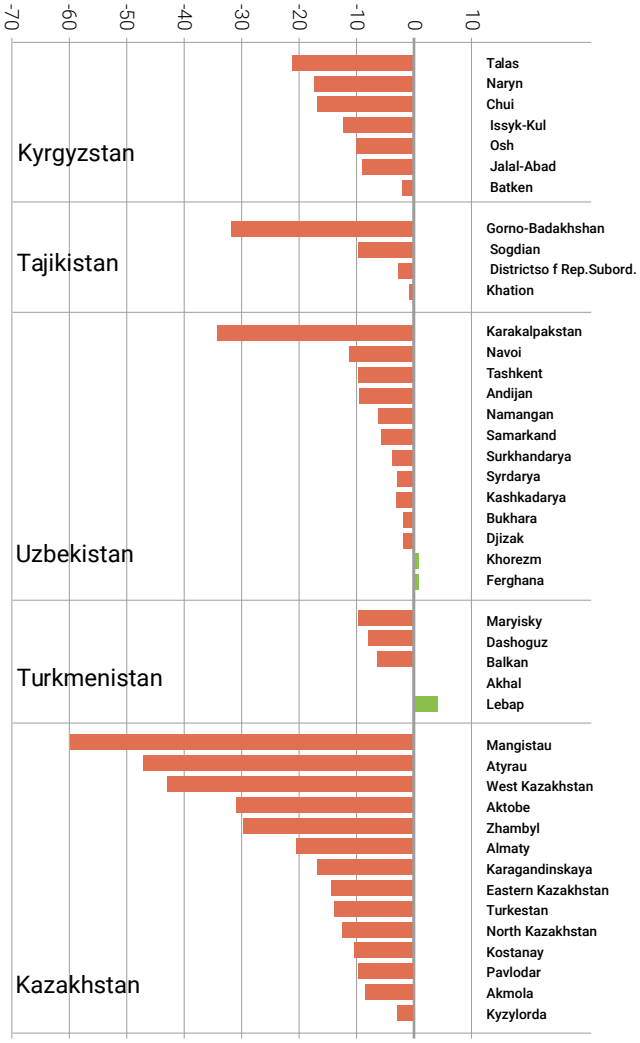


Figure 10. LDN index for individual regions of Central Asian countries.

Sustainable Land Management Problems

The application of sustainable land management (SLM) approaches, implemented in a timely and targeted manner, has proven to be an effective solution for tackling ecological, economic, and social challenges at the farm, landscape, and national levels. In Central Asia, governments and international organizations have undertaken significant efforts since the 1990s to inventory, develop, and promote SLM practices. These practices encompass both traditional methods specific to the region and innovative approaches aimed at mitigating and addressing emerging risks and issues stemming from climate change and land degradation. These challenges are diverse and interconnected, involving aspects such as agricultural restructuring, changes in land ownership, degradation processes impacting arable lands, pastures, meadows, and forests, diminishing areas of cultivable land, legislative limitations, insufficient rural expertise, limited knowledge among land users, and a general lack of ecological awareness within the population.

> 'I'd make my own humic fertilizers by buying some worms. I'd buy a plough for tilling the soil. The local tractor drivers all have the same type of plough. I'd plant fruit trees along the field edges, not just poplars. They'd provide protection from winds as well as yield fruit.'
>
> **Zhanysh**, a 49-year-old male farmer from Naryn region, Kyrgyzstan

According to Gupta et al. (2009), it is recommended to define four main agroecological farming areas in the CA region: irrigated arable lands, rainfed arable land, pastures, and mountainous areas. It is emphasized that pastures, arable lands, and forests serve as the foundation for food security and provide income opportunities for many people in the region (Henning et al., 2020). However, a more in-depth analysis conducted in our study reveals that geography of land management practices and technologies is much broader at present and is not limited to these four groups.

Sources such as the World Overview of Conservation Approaches and Technologies (WOCAT) database, materials from the CACILM and CACILM II projects, ICARDA, World Bank data, regional databases (Batjargal et al., 2012), and national materials (Gupta et al., 2009, Shigaeva et al., 2013, Pasture Management, 2019) were analysed. For each region or country, a specific set of sustainable land management models and effective practices is identified, depending on their regional characteristics and accumulated experience reflected in the available sources of information.

> 'There are farmers who know how to make the most of their land and water. They willingly share their experience. But what they always lack is resources.'
>
> **Ryskul**, a 47-year-old female homemaker from Orgochor village, Issyk-Kul region, Kyrgyzstan

Examples of the analysis of such combinations of models and practices are presented in Figure 11.

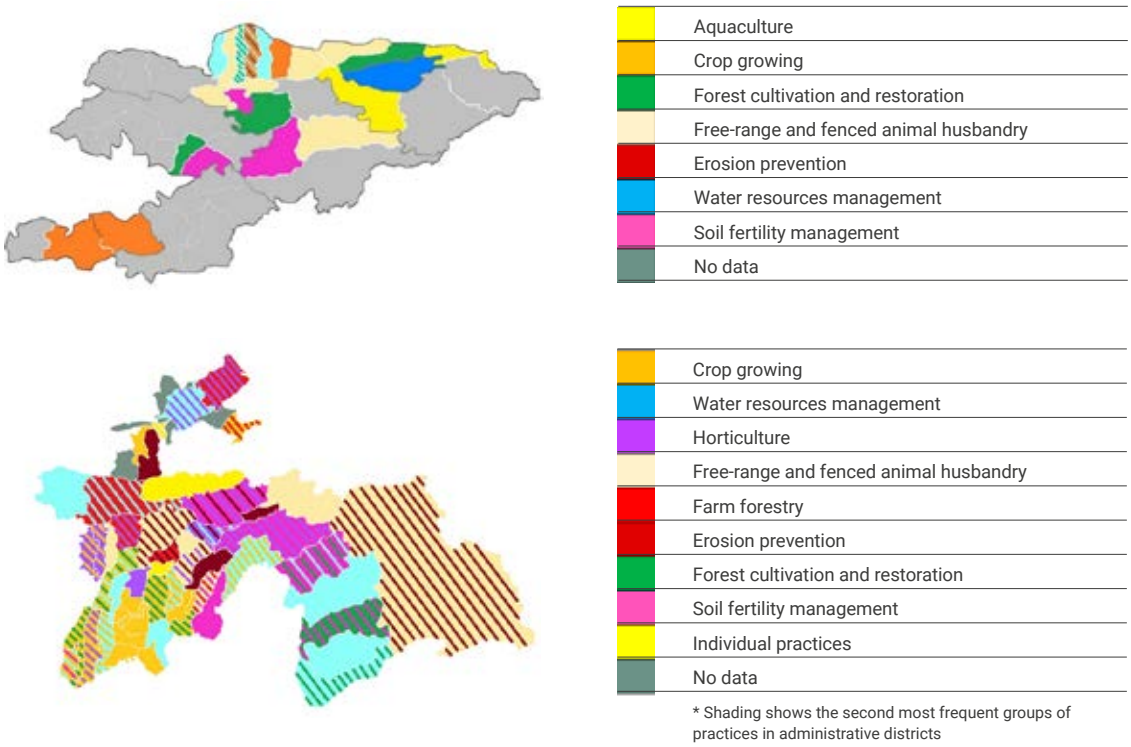
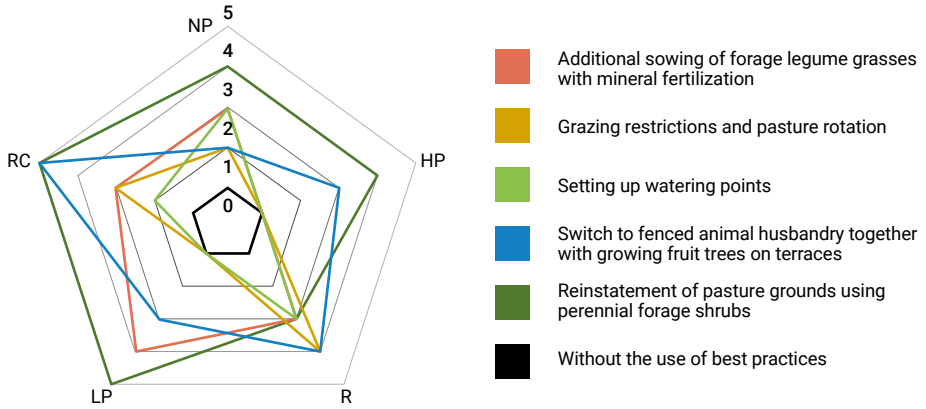


Figure 11. Primary categories of land management practices in Kyrgyzstan (top) and Tajikistan (bottom), as documented in international sources from 2000 to 2020. The evaluation was conducted at the administrative district level.

In the CA region, a distinct collection of land management models has emerged, consisting of specific effective practices. However, the sustainability of these practices varies depending on their combination and suitability within specific landscape and socio-economic conditions. We refer to this set of practices and technologies as a land management model (Andreeva et al., 2021). Unlike individual local practices, a land management model represents a central notion characterized by a consistent set of practices and technologies, natural and socio-economic conditions, land potential, land degradation risks (including human impacts), opportunities, and strategies to achieve Land Degradation Neutrality. The overall sustainability of the land management model relies on the synergistic combination of practices (Andreeva et al., 2022). Assessing the sustainability of the land management model entails an integrated analysis of practices, considering quantitative and qualitative criteria within a defined area. A visual representation of this approach is provided in Figure 12.

A. Restoration and maintenance of productivity of mountain pastures



B. Irrigated farming on saline soils

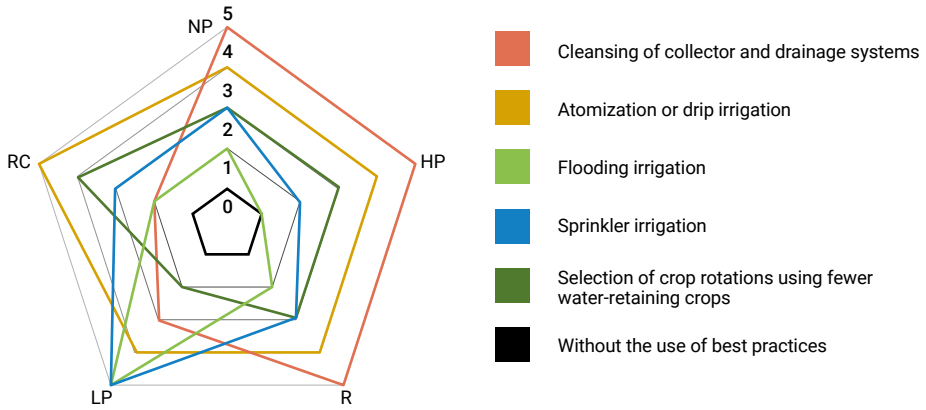


Figure 12. Examples of SLM model analysis. Individual best practices are shown in different colours. The model's combined sustainability parameters: NP – adverse natural processes and phenomena (relevant); HP – adverse human impacts and resulting processes (relevant); R – risk of degradation phenomena (potential degradation processes); LP – natural and/or extended land potential; R – self-restoring capacity of land, adaptive methods, compensatory and rehabilitative measures.

As shown in the picture, the size of each coloured polygon represents a relative measure of the overall effectiveness of the corresponding practice. Typically, each practice focuses on improving specific parameters of the model, such as reducing the intensity of unfavourable anthropogenic and natural processes, mitigating risks, enhancing adaptive capacity, or promoting self-recovery. Other parameters may be indirectly improved or may not be directly impacted by a particular practice. To maximize sustainability, the SLM model should incorporate practices with high values across all parameters. This can be achieved by including practices that target the improvement of poorly performing parameters. This approach is crucial for identifying constraints in land management and justifying the adoption of necessary practices and technologies that aim to achieve specific sustainability targets. The primary criterion for assessing the sustainability and effectiveness of each SLM model, particularly in the context of climate change, is the attainment of LDN within the scope of its implementation.

The set of recommendations on Sustainable Land Management (SLM) outlined in the 'Sub-regional Action Programme for Combating Desertification in Central Asia' (SRAP/CD) in the context of the UNCCD (2003) gains new significance within the described approach.

In addition to the need for improving:

i. Crop production technologies.

ii. Water use.

iii. Agricultural land management.

A comprehensive analysis of land use priorities in Central Asia (CA) since 2003 reveals that there have been certain shifts in emphasis depending on the market situation and gradual changes in land use priorities. However, the major directions for improving land management practices in CA are as follows:

iv. Monitoring and assessment of desertification processes; establishment of an early warning and mitigation system for droughts.

v. Development of direct and indirect methods to combat desertification manifestations, such as water and wind erosion, salinization, and waterlogging.

vi. Pasture management.

vii. Development of agroforestry techniques and effective management of forest resources and watersheds.

viii. Development of a market for ecosystem services and biodiversity conservation.

ix. Increasing the economic potential of local communities.

In this context, the implementation of SLM models, coupled with investments in creating a conducive environment for environmental policy development and enhancing human well-being, will help alleviate socio-economic tensions and mitigate negative migration factors (Figure 13).

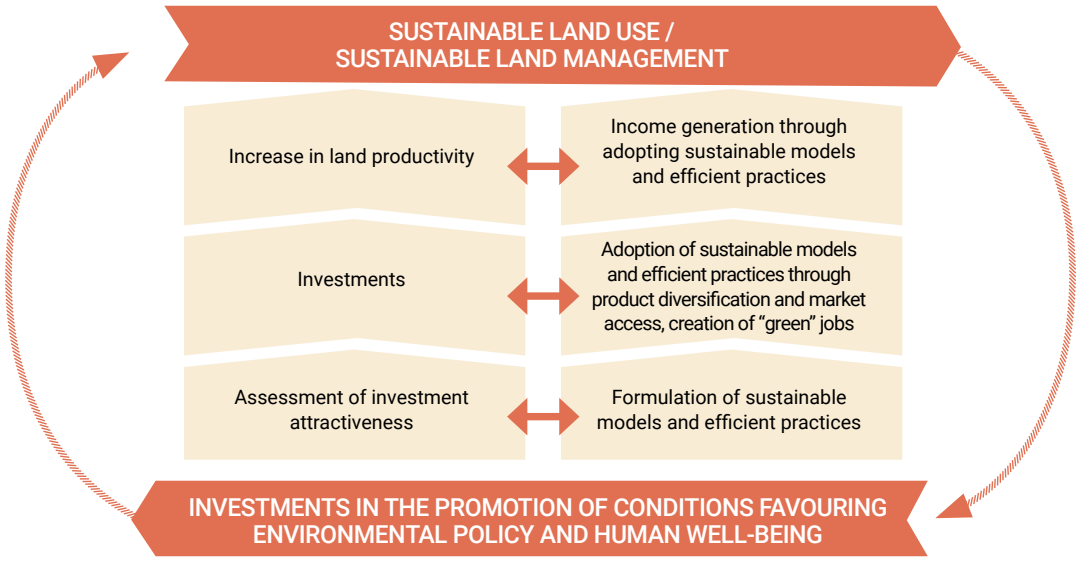


Figure 13. Recommended directions of the investment policy in CA countries.

Conclusion of the Section

The assessment of land degradation using LDN concept has yielded positive outcomes in terms of comparing countries and their respective administrative divisions, analysing the trends of essential indicators, and assessing their vulnerability to integrated climatic and anthropogenic risks. Furthermore, this assessment has allowed for the identification of critical hotspots that require specific attention regarding potential migration sources and directions. Nonetheless, it is crucial to use the "one out all out" approach considering additional **environmental factors**, including their quantitative and qualitative attributes, when developing these methodologies for the **understanding of internal and external migration**. Such factors include:

i. Irrigation practices leading to waterlogging and soil salinisation;
ii. Deforestation;
iii. Wind and water soil erosion;
iv. Persistence of cotton monoculture in certain regions and farms;
v. Overgrazing of mountain and desert pastures;
vi. Degradation of mountain ecosystems;
vii. Occurrence of dust, sand, and salt storms;
viii. Technogenic and domestic pollution.

The degradation of land and water resources, coupled with inadequate measures and strategies to address negative phenomena, low levels of awareness, and limited implementation of sustainable land management practices, pose a substantial threat to the well-being of rural communities.

Researchers, decision-makers at different levels, local populations and migrants all point to these factors as drivers of forced migration and escalating conflicts over scarce natural resources. To address the numerous regional challenges arising from climate change, land management practices, and political and socio-economic transformations, Central Asian countries need to develop and implement sustainable adaptation strategies.

DEMOGRAPHIC, SOCIO-ECONOMIC AND SOCIO-POLITICAL FACTORS OF MIGRATION

Analysing push and pull factors

Population migration is an exceedingly complex phenomenon, and its causes cannot be attributed to a single set of factors. Therefore, migration is frequently analysed using the theory of push and pull factors. These factors are classified into two groups: those that operate in the migrants' place of departure (push factors), and those that operate in the potential destination (pull factors) (Lee, 1966).

Demographic factors reveal significant disparities in the demographic situation between Russia and most Central Asian countries. The CA region experiences substantial population growth, particularly in rural areas, creating a significant 'migration overhang' (Vichnevski, 1995). In contrast, Russia has been facing a long-term trend of natural population decline alongside a reduction in its working-age population. Socio-economic factors in Russia and Central Asian countries during the post-Soviet period are influenced by distinct economic models, structures,

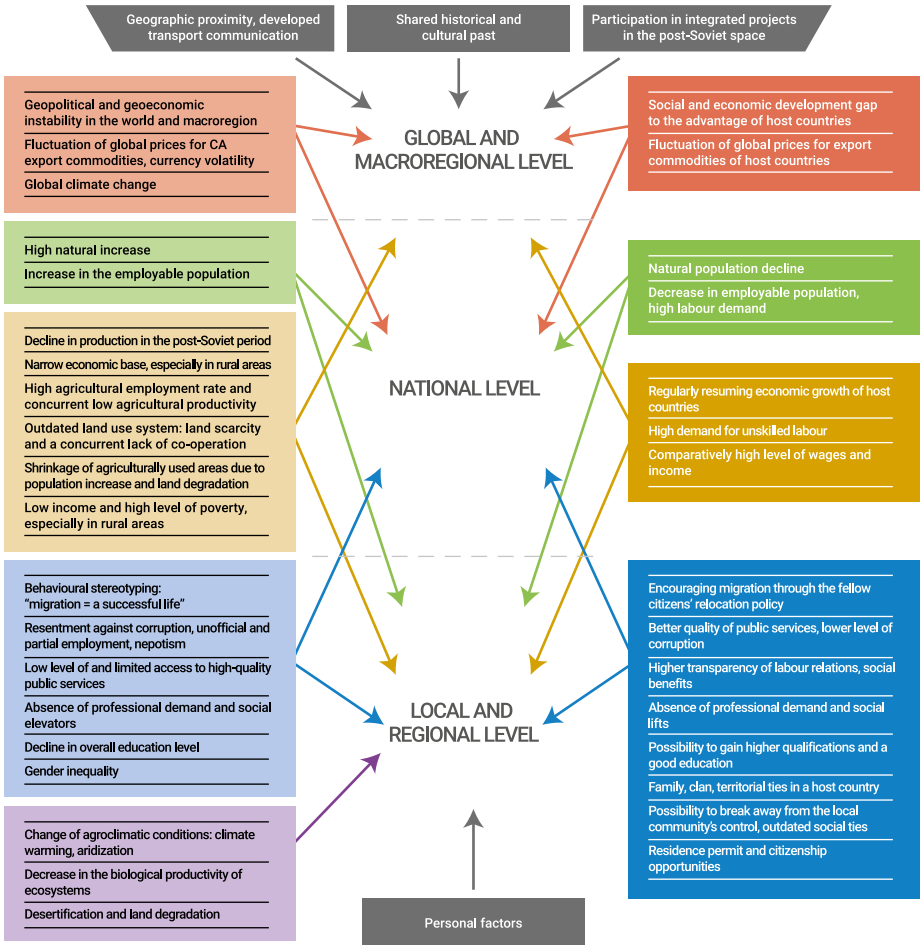


Figure 14. Integrated chart of migration factors.

levels government, social security, and income disparities. Additionally, there are variations in public administration, access to services, the labour market, government policies concerning migration and labour relations, and educational levels, among other factors.

In addition to the factors mentioned above, which primarily affect migration at the national and local levels, there are also global and local factors that play a significant role in shaping migrant flows. Some of these factors are related to the global geopolitical and geoeconomic structure, such as world prices, and participation in trade and economic unions. Other factors are linked to changes in the natural environment and climate.

Migrant flows are also greatly influenced by shared conditions, such as geographical proximity and transportation connections, common historical and cultural backgrounds, and participation in integration projects within the post-Soviet region. Migration is a result of a complex interplay of these objective factors and conditions (Figure 14), individual life circumstances, the emotional assessment of the situation in both recipient countries and home countries by migrants, as well as their social involvement in migration networks (Savoskul, 2015; Turaeva, Urinboyev, 2021).

During the Soviet period, the authorities acknowledged the rapid population growth in the republics, coupled with low migration mobility, as a significant socio-economic problem due to the lack of job opportunities, particularly in rural areas (Breeva, 1984). The outflow of the 'European' population in the late Soviet and early post-Soviet years partly concealed the ongoing demographic explosion. After the breakup of the USSR and until the mid-1990s, the population of most Central Asian countries remained stagnant or even declined. However, by the early 2000s, the rate of natural increase had risen, especially in Kyrgyzstan and Tajikistan. Over the years of independence, the population of Kyrgyzstan increased by 1.9 million, or 1.4 times, and Tajikistan's population grew by 4.2 million, or 1.8 times (Figures 15 and 16).

Overpopulated agricultural areas secure the bulk of the population growth

Population growth is a common phenomenon in all regions of Central Asia. However, it is particularly pronounced in overpopulated agrarian areas, surpassing the overall population growth rate (Denisenko, Strozza, Light, 2020). Many regions have witnessed deurbanization and a rise in the proportion of the rural population. For instance, in Kyrgyzstan, rural areas contributed to 65.8% of the total population growth in 2020, while in Tajikistan, this figure was 73.8%. Notably, during the period from 2010 to 2020, Kyrgyzstan's southern regions, including Batken, Osh and Jalal-Abad regions, experienced record growth rates. However, this population surge has resulted in significant demographic pressure on land resources and ecosystems in rural areas overall.

Population of Central Asian countries (1950–2020 with forecast until 2100)

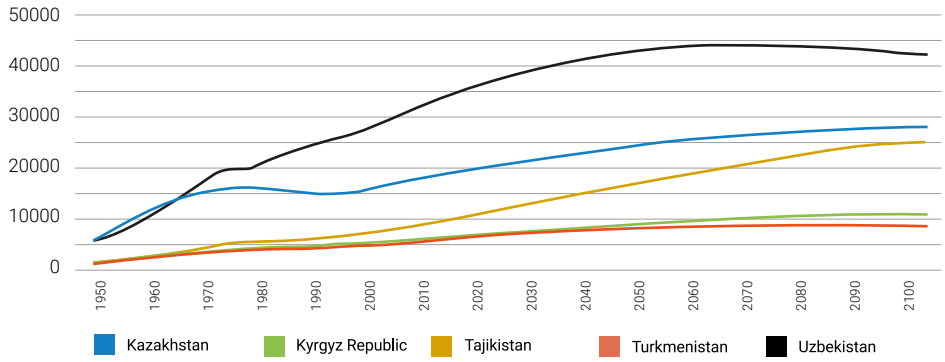


Figure 15. Population dynamics (World Population Prospects 2019)

Total rate of natural increase, people per thousand population (based on five years' average)

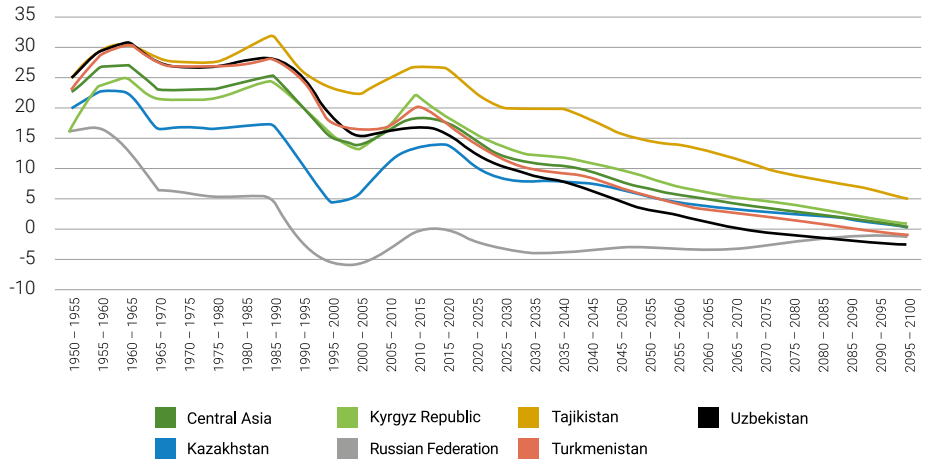


Figure 16. Natural population growth in CA countries (World Population Prospects 2019)

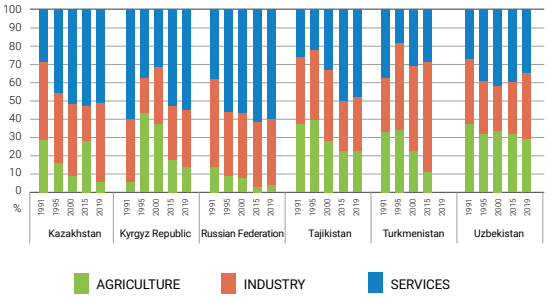
In recent years, there has been a noticeable trend towards population ageing, which could result in a decrease in natural growth in the medium term (Avdeev, 2021). However, even with this development, population growth and the subsequent demographic pressure on natural resources in Central Asian countries are expected to continue until at least the end of this century. By 2050, the population of Kyrgyzstan is projected to exceed 9 million people, representing a 50% increase compared to 2020. In Tajikistan, the population is expected to grow even faster, reaching approximately 16.9 million people, which is 1.7 times higher than the current figure (World Population Prospects, 2019).

Economic migration factors

The collapse of the USSR, and the subsequent disruption of economic ties, along with the shift from a planned economy to a market economy, caused a contraction and significant transformation of the economies in all post-Soviet republics. During the recovery growth phase in the late 1990s and the early 2000s, a common trend emerged in all countries of the region: a decline in the share of agriculture and industry, and a gradual increase in the services sector (Figure 17 A).

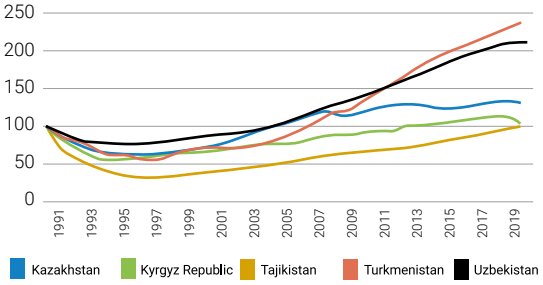
Economic structure of Central Asian countries

17 A



GDP per capita growth, % vs. 1990

17 B



Per capita GDP by PPP in 2020 (USD per capita)

17 C

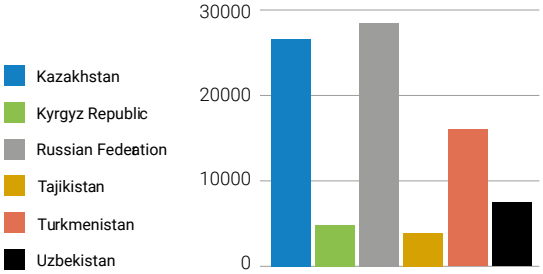


Figure 17. Dynamics of economic migration factors (according to the World Bank WDI)

By early 2000s, the Institute of Economics of the Russian Academy of Sciences had identified three distinct economic models in Central Asia, each characterized by its leading development resources. Kazakhstan and Turkmenistan relied heavily on their natural resources, particularly in the oil and gas sectors (Turaeva, Vardomskiy, 2020). These countries attracted foreign investors, enabling them to rapidly increase oil and gas production and use the revenue to diversify their economies, develop infrastructure, and invest in social welfare. On the other hand, Kyrgyzstan and Tajikistan followed a different economic model. Their lack of abundant and highly marketable natural resources, as well as their geographical position outside major international trade routes, hindered their ability to attract significant foreign investment (Pylin, 2021). As a result, their economies struggled to keep up with their rapidly growing populations. Low income levels and an oversupply of labour in the market contributed to the adoption of a labour-export model, with remittances from migrant workers becoming a significant driver of their economies.

This trend was especially evident in rural areas, where the new individual farms (dehkan farms) did not effectively replace the Soviet collective farm system that used to provide rural employment. Due to a lack of cooperation in constructing and maintaining irrigation systems, organizing storage and marketing of agricultural products, most farms remained small-scale and focused on non-commodity production (Malakhov et al., 2015).

The economic model of Uzbekistan follows a combination of resource and labour-export models. With abundant resources and a sizable population, the country experienced more stable conditions for development and relatively successful modernization.

In Kyrgyzstan and Tajikistan, remittances play a significant role in stimulating overall demand and increasing consumption (Figure 17 B and C). The rise in household disposable income leads to poverty reduction and greater investment in human capital. Consequently, sectors like wholesale and retail trade, catering, and financial intermediation experience growth. The food and light industries, along with construction, also benefit from this trend. However, the volumes of remittances are quite unstable, influenced by the price environment of key commodity exports in host countries and their currency exchange rates (Ryazantsev, 2016). In 2019, remittances constituted 27.2 and 27.9 per cent of Kyrgyzstan and Tajikistan's GDP, respectively. The percentages increased to 31.3 and 26.7 per cent in 2020 (WDI, 2022). The COVID-19 pandemic has further highlighted the direct correlation between the well-being of these countries and the volume of remittances. In rural areas of Kyrgyzstan and Tajikistan, interviews revealed that up to 60% of an average household's budget comes from migrant remittances. Consequently, the inability of migrants to travel abroad and the decline in remittances have become significant factors in exacerbating socio-economic issues (Information on preliminary..., 2020).

Typically, migrant remittances are not channelled into savings or investments in agriculture and SLM practices. Instead, they are primarily used to expand short- and long-term consumption, support relatives, pay off debts, and fulfil social obligations like rituals, weddings, and gifts.

> 'We mostly spend money to repay debts and loans and buy the things we need, such as cattle and cars. Improving the situation with auxiliary facilities only happens if someone saves a lot and keeps good control over expenses.'
>
> **Zhyldyzbek**, a 52-year-old male farmer from the Naryn district in Kyrgyzstan

Social-political factors: the labour market situation

In the first decade after the collapse of the Soviet Union, there was a rise in unemployment due to a decline in economic activity. However, the labour market has since stabilized based on formal indicators (Figure 18). Despite this, the situation in rural areas remains tense. Labor force participation rates have slowly declined, especially among women, who have fewer opportunities for formal employment in rural areas and access to appropriate social benefits compared to men (Mogilevskii, 2020). Migration further affects the population's sex and age composition and increases the burden on women, the elderly, and children (McAuliffe, Triandafyllidou, 2021).

The level of urbanization is inversely related to the economic activity of the population. Overcrowded rural areas face a significant shortage of jobs, kindergartens, and other social infrastructure. Informal employment, self-employment, part-time, and seasonal jobs (Figure 19) are widespread in non-commodity and small-scale farms (Karabchuk et al., 2015; Labour Market Situation, 2016; Brück et al., 2018).

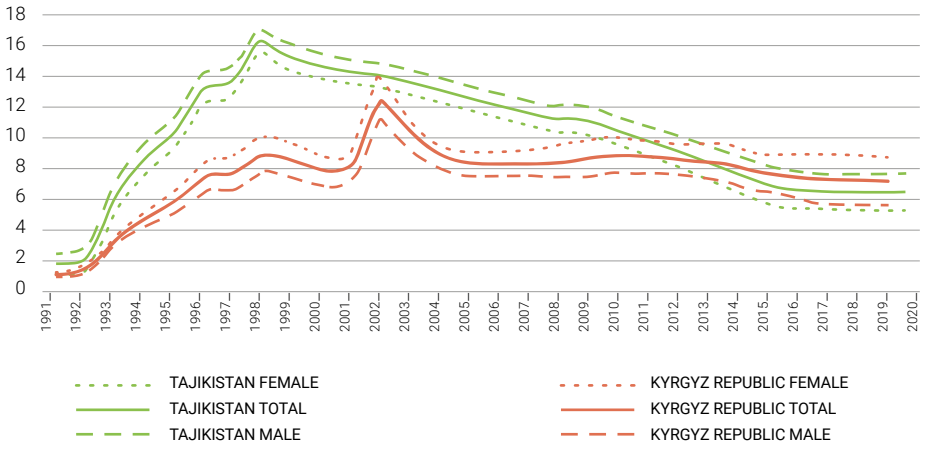


Figure 18. Unemployment dynamics. According to the WDI, 2022

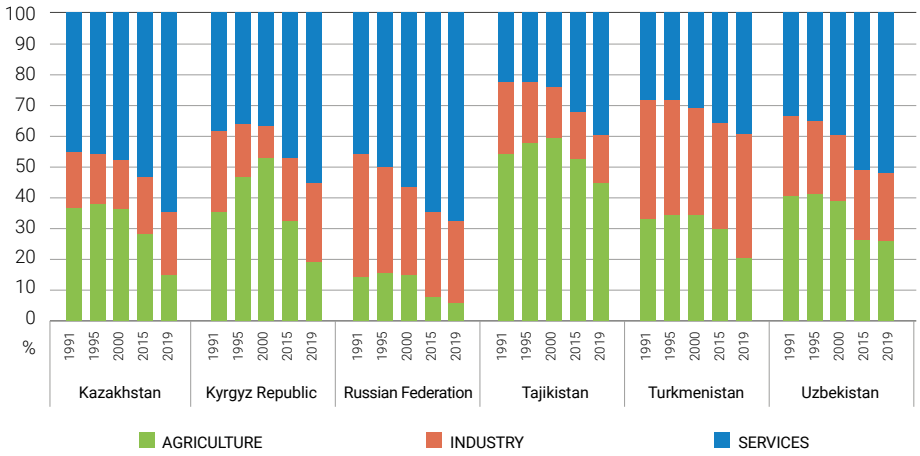


Figure 19. Employment dynamics by sector (WDI, 2022)

The emigration of workers to better-paying labour markets in Russia and Kazakhstan creates a catch-up effect in wage growth, which, in certain sectors, increases at a faster rate than the overall economy (Mogilevskii, 2020). As a result, migration contributes to higher wages for workers who stay in the national economy compared to what they would have earned without migration (Table 1).

> '...our migrants in Russia earn around 70–80,000 roubles per month, which is approximately 15,000 somoni. In contrast, here, they earn only 15,000 somoni per hectare for 7–8 months of work.'
>
> Dehkan farm chairperson, 40, male, Tajikistan, Hisor district

Table 1. The average nominal accrued wages per person in USD, based on data from Indicator Monitoring (2018), Population and Social Indicators (2020) and Monitoring of Sustainable Development (2021)

COUNTRY / YEAR	2014	2015	2016	2017	2018	2019
Kazakhstan	675	568	418	463	472	488
Kyrgyzstan	229	209	212	228	239	247
Russia	856	561	549	672	699	733
Tajikistan	165	143	123	134	135	140
Turkmenistan	405	364	395	401	...	...
Uzbekistan	436	456	436	285	226	263

Current migration situation in the region

The example of Kyrgyzstan and Tajikistan. According to various researchers, Central Asian countries are part of the Eurasian migration system (Ivakhnyuk, 2008), which also includes Russia and Kazakhstan as the main destinations for migration, along with other post-Soviet countries. In this system, a single visa-free migration space has been established, except for Turkmenistan, allowing for the development of migration policies on both bilateral and multilateral levels. Since 2015, Kazakhstan and Kyrgyzstan have been members of the Eurasian Economic Union (EAEU), enabling their citizens to travel and work without restrictions in Russia, Belarus, and Armenia. During the 1990s, migration in Central Asia was largely involuntary and driven by factors such as the civil war in Tajikistan, outbreaks of violence in other countries, economic crises, and political instability. Most migrants were Russian speakers returning to their historical homeland (Vichnevski, 1995).

> 'Our migrants choose foreign countries to get jobs with a good income. Those with a good profession and a good level of knowledge are also able to get a job in the city. Those who don't have those are forced to choose migration to other countries.'
>
> Dehkan farm former head, now a school teacher, 58, male, Tajikistan, Vakhsh district

Today, the main type of migration is labour migration, mainly involving the local population. Estimating the exact number of labour migrants is challenging as not all of them arrive and work legally. Additionally, the visa-free regime and simplified employment procedures for citizens of the Eurasian Economic Union (EEU) contribute to the complexity of migration accounting. According to some estimates, each year, between 2.5 to 4.3 million people, accounting for 10-15% of the economically active population of Central Asia, participate in labour migration (Monitoring of… 2020).

Most of the migration consists of low-skilled labour force, mainly from rural areas. These labour migrants typically occupy non-prestigious jobs with challenging conditions and low pay.

The Ministry of Internal Affairs of the Russian Federation provides a relatively accurate representation of the migration scale through its data on the registration of foreign citizens and stateless persons with the migration register (Figure 20). Over the past five years, this figure has increased by nearly 1.5 times for Central Asian countries, reaching 9.7 million registrations in 2021 from 6.7 million. Uzbek nationals account for more than half of the registrations, followed by Tajik nationals at around 30%, and Kyrgyz nationals at approximately 11%. Migrants constitute about 20% of the working-age population in Uzbekistan, 26% in Kyrgyzstan, and 50% in Tajikistan (Mogilevskii, 2020).

> I guess the main reasons for migration are economy related: unemployment, especially in the winter months; overall low standard of living; looking for better labour and living conditions. Land degradation and lack of water are significant in the south of the country. In our region, we are also beginning to feel the lack of pastures for cattle grazing. But I can hardly say that this is a reason to leave the country. It's more about a disconnect between the expectations of young people and the income level from agricultural labour.'
>
> **Taalai**, economist, 49, male, Kyrgyzstan, Naryn district

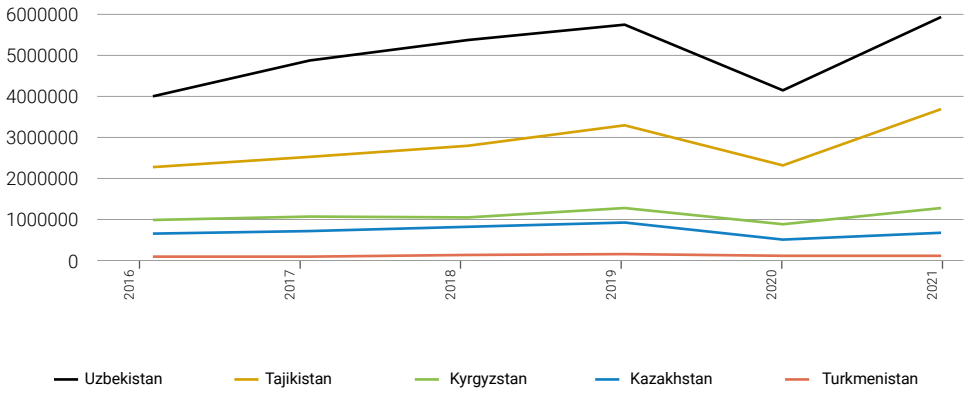


Figure 20. Migrants from Central Asian countries registered by Russian authorities (per million registrations). According to: Individual indicators of migration, 2020

By the end of the Soviet era, over 60 per cent of Kyrgyzstan's population resided in rural areas. Following the collapse of the USSR and an economic crisis, there was a significant migration of people to the capital and its surrounding regions, with rural inhabitants replacing many Russian-speaking residents who had left (Mkrtchyan, Sarygulov, 2011). This trend continued, leading to further out-migration as Bishkek faced challenges with job opportunities and affordable housing. During the 2000s, nearly two-thirds of the growth in the working-age population resulted in migration abroad. In the subsequent decade, external migration decreased, and most of it was directed to Russia (73.6 thousand people from 2011 to 2019). According to Rosstat data, during the same period, the influx from Kyrgyzstan amounted to 164 thousand people, more than twice as much as reported by Kyrgyz statistics.

Since 2015, the accession of Kyrgyzstan to the Eurasian Economic Union (EAEU) has led to an increase in labour migration from the country to Russia and Kazakhstan. However, during the same period the proportion of degraded land in Kyrgyzstan has also risen. By the end of 2019, the number of Kyrgyz labour migrants in Russia was 747 thousand people, but due to pandemic-related restrictions, it decreased to 599 thousand by the end of 2020 (Gurevich et al., 2020).

Most of these labour migrants are young men who have left their families behind and regularly send remittances back home (Figure 21). The southern regions of Jalal-Abad, Batken, and Osh are particularly active in international migration (Karabchuk et al., 2015). These regions face economic challenges exacerbated by ethnic conflicts. For instance, in the Batken district of Kyrgyzstan, the conflict between Kyrgyz and the Tajiks is driven by issues related to land scarcity, uncertainty around borders and the movement of residents from numerous exclaves (Elebaeva, Omuraliev, 1998; Olimova, Olimov, 2017).

In Tajikistan, during the first national census in 2000, 74 per cent of the population resided in rural areas, which was significantly higher than during the Soviet era (Olimova, 1998). Despite facing significant challenges such as strong migration outflows and the civil war from 1992 to 1997, the population continued to grow rapidly.

The first peak of migration outflow occurred in the early 1990s when the Russian-speaking population left the country. The second peak occurred during 2010–2013, with an estimated 736,000 to 793,000 people leaving annually to work abroad every year, coinciding with a period of intense land degradation in rural areas due to droughts from 2005 to 2010. According to data from Rosstat, from 2011 to 2017 Russia's net migration

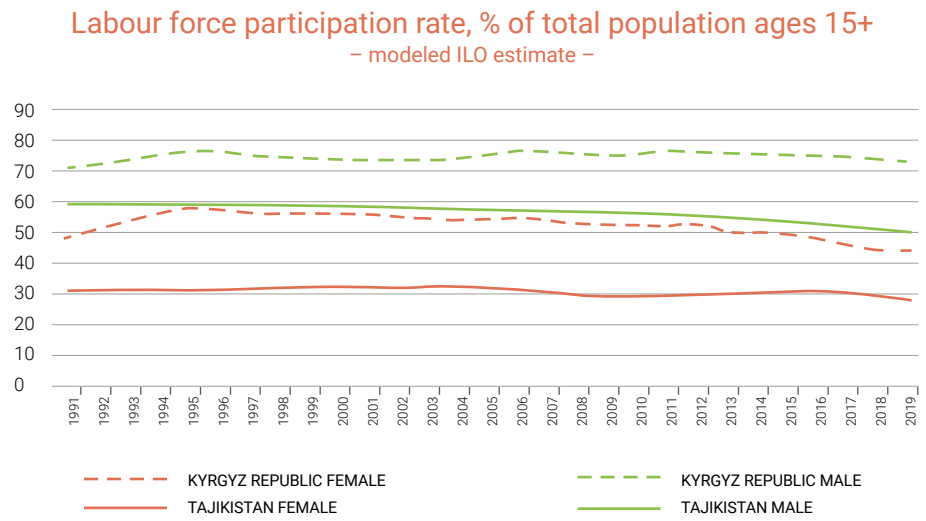


Figure 21. Migrants' age and gender composition (WDI, 2022)

exchange with Tajikistan was around 192,000 people. By the end of 2019, there were 836,000 Tajik labour migrants in Russia, but due to the pandemic, their number decreased to 698,000 by the end of 2020 (Gurevich et al., 2020; Denisenko, Mukomel, 2020).

After Kyrgyzstan became a member of the Eurasian Economic Union, there was increased competition between migrants from Kyrgyzstan, Tajikistan, and Uzbekistan in the Russian labour market. Moreover, there were high risks of deportation if they failed to comply with migration laws. This situation created difficulties for them in the labour market compared to migrants from other Central Asian countries.

Migrants from Kyrgyzstan faced challenges in finding legal employment opportunities and had to bear the costs of obtaining a patent in the Russian Federation.

Conclusion of the Section

Migrations are influenced by a complex set of push and pull factors, such as demographic, social-cultural, economic, political, biophysical, and climatic, all operating simultaneously at global, regional, and local levels. Most Central Asian countries experienced a demographic explosion after a brief decline in population growth in the early 1990s, leading to labour surplus, particularly in rural areas, and putting immense pressure on essential services. In Turkmenistan and Kazakhstan, the export of fuel and minerals became the driving force of economic development by the early 2000s, enabling the redistribution of export revenues to alleviate the pressure. However, Kyrgyzstan and Tajikistan, lacking significant reserves of highly liquid raw materials, struggled to keep up with the rapid population growth. In their rural areas, small-scale and non-commercial peasant farms were unable to provide sufficient employment. Low income and a surplus of labour in the market contributed to the emergence of a labour export model, with migrant remittances serving as the primary driver. Uzbekistan occupied an intermediate position between these countries and faced its own unique economic circumstances and demographic challenges. The principal pattern of internal migrations in all Central Asian countries continues to be the steady attraction of the population to the capital cities and their surrounding regions. These areas are at risk of becoming new hotspots of land degradation.

The study revealed that quantifying the contribution of the natural and climatic factors to mass migration is challenging. Despite the weak correlation between the increasing shares of degraded land and migration activity, surveys conducted in Kyrgyzstan, Tajikistan, Uzbekistan, and Russia indicate that the primary reason for migration is the lack of jobs, particularly in rural areas, and a significant difference in wages between the countries of origin and destination. However, while land degradation is not the primary and direct cause of migration, it does play a significant role and is particularly emphasized by the more educated segment of the population in these countries. Desertification, coupled with growing anthropogenic pressure, due to population growth and density on productive land, along with the impact of climate change, leads to a decrease in land productivity, water availability, and water supply, resulting in reduced crop yields and livestock productivity. Consequently, the population's income and living standards decline, contributing to both outward migration and the more extensive utilization of land resources.

STUDY RESULTS

Task 1. To understand the place of land degradation processes, including those influenced by climate change, within the broader spectrum of socio-economic issues that lead to migration, considering the region's biophysical diversity.

1.1. DIFFERENT TYPES OF LAND DEGRADATION PROCESSES AND THE IMPACT OF CLIMATE CHANGE

The Central Asian region experiences a wide range of land degradation processes, including declining soil fertility, soil loss, and reduced water resources. These manifestations take various local and zonal forms, with the most common being pasture degradation, overgrazing, soil salinization, formation of barkhans and sand dunes, washing away and irrigation erosion of soil, pollution by toxic compounds, and human-induced desertification. Different types of erosion dominate in different countries, with wind and pasture erosion being prevalent in Kazakhstan, Uzbekistan and Turkmenistan, and water erosion dominating in Kyrgyzstan and Tajikistan. Across the region, the main limiting factor in agriculture is the lack of water resources during the growing season, further exacerbated by transborder issues. Climatic changes worsen the situation, leading to more frequent and widespread droughts, intensifying the negative impact of these processes.

1.2. THREE TYPES OF MODERN ECONOMIC MODELS

In Central Asia, three distinct economic development models have been identified according to the model of economic development which determined along the political factors the intensity and trends of external migration, its correlation with internal population redistribution. Kazakhstan and Turkmenistan follow a resource-based model, Kyrgyzstan and Tajikistan, on the other hand, rely on a labour-export model and Uzbekistan boasts a mixed model. Kazakhstan has long surpassed the Soviet level in terms of GDP and, like Russia, acts as a center of attraction for migrants from neighbouring countries. Turkmenistan as a country benefiting from their abundant natural resources is not in need of an influx of relatively low-skilled labour. These countries, however, are characterized by internal migration, especially from ecologically unfavourable regions. Kyrgyzstan and Tajikistan, on the other hand, rely on a labour-export model, as their economies struggle with lower GDP per capita in comparison to other ex-Soviet Republics and heavily depend on remittances from migrants. Uzbekistan adopts a mixed model, occupying an intermediate position between the two groups in terms of economic size and complexity.

The varying economic development models in the five Central Asian countries lead to distinct patterns of external migration. However, internal migration trends are quite similar, with population concentration around capitals and major cities creating attractive zones for migrants, often serving as a starting point for further migration to Russia and other foreign destinations.

1.3. DIRECT CONNECTIONS BETWEEN MIGRATION, LAND DEGRADATION AND CLIMATE CHANGE

At this stage, the direct connections between migration, land degradation and climate change cannot be definitively established, due to several key reasons:

- Quantifying the natural and resource component of migration is practically impossible due to the influence of numerous natural and socio-economic factors. Land degradation, though a complex factor with natural and socio-economic aspects, typically acts as a trigger for other processes. The primary causes of migration are often rooted in the socio-economic sphere, such as declines in aggregate income, unemployment, increased social discontent, and sanitary and epidemiological problems;
- The direct impact of migration on land degradation is typically observed at the local level and has a transient nature, depending on the extent and severity of degradation processes. These effects are particularly evident in the livestock (pasture) sector and irrigated agriculture;
- It's worth noting that not all individual land management practices or technologies can effectively prevent land degradation. The key is using the right combination of specific practices or sustainable land management models to promote land conservation or achieve sustainable land recovery trends;
- Moreover, not all land management practices and models are efficient enough to deliver immediate socio-economic benefits within the existing capacities.

1.4. INDIRECT DEPENDENCE OF MIGRATION ON LAND DEGRADATION: IDENTIFYING THE MAIN TRIGGERS

Land degradation, while not the primary or direct cause of migration, significantly contributes to the phenomenon. Its effects are observed at various levels of society, from small-scale farmer households to government administration. The combination of desertification and increasing anthropogenic pressure due to population growth and density leads to a decline in the natural potential of land and water resources. This results in reduced access to water, lower crop yields, and decreased livestock productivity. Consequently, the population experiences a decrease in income and living standards, and unemployment rates rise. The deteriorating environmental conditions, in some regions reaching critical levels, lead to higher rates of morbidity and mortality, reduced life expectancy, and increased birth of children with health issues. As a result, people are forced to migrate to more favourable regions. The social implications of land degradation include the loss of recreational and tourism areas, declining public trust in government economic policies, and weakened authority of local administration. In some cases, these issues escalate into inter-ethnic border conflicts, and in extreme cases, even armed clashes. These processes have become more severe due to climate change, particularly evident in increased aridity, and intensity of extreme events such as landslides, mudflows, floods, sand and dust storms. These climatic changes further exacerbate negative socio-economic impacts.

The lack of awareness and education contributes to a misunderstanding of the indirect causes of increasing socio-economic issues at the household level. Many individuals are not familiar with the terms 'desertification' and 'land degradation' and lack the knowledge to identify their signs and underlying reasons. As a result, effective land management models that aim to prevent, reduce, and restore land degradation are not widely promoted or adopted. Additionally, remittances from migrants are often not used for long-term investments in land but rather directed towards meeting the immediate needs of their families.

1.5. THE IMPORTANCE OF CLIMATE CHANGE ADAPTIVE EFFORTS

The natural and biophysical diversity in rural areas of Central Asian countries leads to a wide range of established management patterns, including variations in animal husbandry and farming, crop selection and yields, per capita income levels, land management technologies, and living conditions. As the natural environment and climate

undergo changes, these established ways of life need to adapt and respond accordingly. Additionally, other non-climatic natural and socio-economic pressures, such as declining soil fertility, deteriorating irrigation and drainage systems, population growth, and energy constraints, further add to the vulnerability of Central Asian countries, especially their arid regions, to the impacts of climate change. These pressures can also reduce the adaptive capacity of the region as it faces growing demands and competition for energy, water, and land resources. Interestingly, migration, whether internal or external, can also be viewed as an adaptation strategy in response to changes in the natural environment and climate under specific conditions. Understanding and addressing these factors is crucial for developing effective climate adaptation measures in the region.

1.6. POOR ADAPTABILITY OF FARMS

The strategy of reverting to outdated production methods, which was forced upon certain regions in the 1990s following the collapse of the USSR and the economic decline, is inadequate in addressing new challenges. This approach has been a significant factor contributing to both internal and external migration. Small farms and broken cooperative networks in the agricultural sector are ill-equipped to handle the growing problems and challenges, nor do they facilitate a more efficient organization of production in the primary and secondary sectors. To effectively adapt to changing circumstances, it is crucial to focus on improving production capabilities and methods. This includes the development of adaptation technologies in farming and livestock breeding, the use of new crop varieties, and the establishment of seed farms and plant nurseries. Additionally, modernizing storage, processing, and marketing of agricultural products is vital to enhance their competitiveness in international markets. By adopting these key areas of adaptation, Central Asian countries can better respond to current challenges and foster sustainable development.

1.7. MIGRATION PUSH AND PULL FACTORS

Whether the consequences of land degradation might directly or indirectly act as factors that push people to migrate, cultural and linguistic compatibility between countries and the appeal of urban life, primarily in capital cities and especially for young individuals, serve as incentives for both internal and external migration flows. The combination of these factors determines the intensity of emerging migration corridors. Our research aligns with the findings of IMO-FAO, which highlight that labour migration from Central Asian countries to Russia and Kazakhstan forms one of the largest migration corridors in Eurasia. Among these countries, Kyrgyzstan and Tajikistan contribute significantly to the migration flow, with recent increases in migration from Uzbekistan catching up and even surpassing them in absolute terms.

However, it's essential to note that the socio-economic situation in the Central Asian countries during the post-Soviet period varied significantly in different regions and at different times. Natural factors like droughts and loss of productivity, as well as socio-economic factors such as political instability, economic reforms, and inter-ethnic conflicts, played a role in these disparities. To address external migration challenges, implementing sustainable land management models based on successful practices could be beneficial in curbing the migration trends. By adopting effective land management strategies, it is possible to create opportunities for better livelihoods and development within the region.

1.8. SUSTAINABLE LAND MANAGEMENT MODELS AND BEST PRACTICES AS CONSTRAINTS TO MIGRATION

In Central Asia, a wealth of experience exists in the successful application of both traditional and innovative practices in farming, animal husbandry, and forestry. However, the widespread adoption of these practices is hindered

by various factors, including limited investment, lack of experience, decline in demand for traditional knowledge and crafts in modern conditions, insufficient financial capacity of rural residents, and the absence of accessible and effective agronomic counselling services. Moreover, remittances from migrants do not typically serve as a full-fledged source of investment for agricultural intensification, even in large farms that could potentially benefit from the adoption of new efficient practices. Instead, households tend to invest more money in the exploitation of natural resources and resource-intensive technologies, rather than preserving and enhancing their potential. For instance, investments are primarily directed towards purchasing machinery for soil tillage and fertilizers, with less emphasis on acquiring equipment for drip irrigation or seeds of new adaptive crop varieties, etc. In countries and areas where livestock farming if traditionally widespread, investing in livestock is a common practice and is considered as a local 'currency' and savings method. However, it is not usually recognized as a potential cause of pasture degradation.

By promoting the adoption of sustainable land management practices and providing support for adaptation technologies, along with social and institutional support from government structures, it is possible to address the imbalance of migration push and pull factors. This can lead to an improvement in living standards in rural areas and help to reduce the driving force behind migration.

1.9. GENDER ISSUES AND INVESTMENT PRIORITIES

Migration has a significant impact on the gender and age composition within communities, leading to an increased burden on women, the elderly, and children. In the face of changing circumstances, many women are forced to assume the role of head the of household, even though they may not be phsycologically prepared for this responsibility and may have relatively lower levels of education due to cultural norms and family traditions. Women in rural areas face limited opportunities for formal employment in the agricultural sector, making it challenging for them to establish their own businesses. As a result, the remittances received from migrants are primarily used for immediate household needs, childcare, and education, rather than for investment in agricultural production.

The feminization of agriculture in Central Asia, particularly in Kyrgyzstan and Tajikistan, should be carefully considered in the development of transformation projects and regional programmes. Nonetheless, some countries and regions have witnessed the formation of women's organizations focused on training their members in effective land and water management practices, land tenure transitions, and entrepreneurial initiatives. These efforts can contribute to empowering women and enhancing sustainable agricultural practices in the region. It is crucial to focus on empowering women in rural areas by providing them with opportunities for entrepreneurship skills development, specialized training, networking, and supporting agricultural cooperatives with formal contracts with their members and other workers.

1.10. COVID-19

The pandemic has worsened the situation for Central Asian migrants working abroad. Border closures and travel restrictions have resulted in reduced remittances, leading to challenges in the countries of origin. This economic downturn has caused political instability and social tensions in both the source and destination countries, particularly in areas with high migrant concentrations. Despite the decline in migration flows, the overall situation has not improved. On the contrary, the established system of migration flows was disrupted, creating an excess supply in national labour markets and causing an economic recession. Consequently, wages and incomes have significantly decreased. The domestic markets are struggling to handle such a burden, making it likely that there will be a sharp increase in migration due to the ending of the pandemic.

1.11. CUMULATIVE EFFECT (THE "VICIOUS CIRCLE")

Without proper regulation and management, the widespread adoption of successful land management practices alone cannot improve living standards in rural areas, prevent migration, or reduce land degradation. In many cases, the growing population in rural regions puts increased pressure on land resources, leading to the degradation of productive land and driving out the population, especially those in their most active working age. The haphazard dissemination and promotion of so-called 'successful' practices often focus on short-term gains rather than long-term land improvement or restoration, particularly in small farms. As a result, many practices intensify land exploitation and make more efficient use of already limited resources. This leads to a long-term reduction in the resource potential and ecological functions of the land, which contributes to the development of additional degradation processes such as dust and sand storms, mudflows, landslides, and floods. Furthermore, some 'successful' practices may reduce the labour intensity of agricultural production, exacerbating the issue of surplus labour resources and not mitigating the push factors of migration.

The study highlights the need to establish decent working conditions in the agricultural sector. To achieve this, long-term investments are crucial, not only to improve the land but also to enhance the appeal of agricultural work for labourers. This can be achieved through the implementation of sustainable land management models and adaptation technologies that require higher levels of skills and education. Strategic investments must consider the interplay between various practices and account for the accumulated stresses arising from climate change, negative land management effects, and political and socio-economic changes over the past decades.

Task 2. Proposing biophysical and socio-economic assessment indicators for predicting and managing migration flows at national and international levels.

2.1. LAND DEGRADATION NEUTRALITY

To evaluate the extent and changes in land degradation on a national and regional level, SDG indicator 15.3.1., which focuses on achieving a land degradation neutrality, can be a valuable tool. This indicator involves monitoring land cover dynamics, land productivity, and soil organic carbon stocks using three global proxy indicators. Among these, land productivity dynamics, analysed through automated algorithms processing space-based information from global sources, stands out as the most effective measure for assessing short-term changes in terrestrial ecosystems and their connection to climate change and weather variations.

Cartographic modelling and monitoring methods enable the identification of 'hotspots' of land degradation at the country and regional levels. They also help track the dynamics of degradation and restoration processes and forecast their influence on migration flows, considering the lingering effects of these impacts.

2.2. NATIONAL LAND INDICATORS

To evaluate the vulnerability of specific regions and their potential for migration, it is more effective to use indicators from national land monitoring systems that reflect the fertility status based on soil parameters, water availability in irrigated areas, the condition of irrigation systems, and the state of forested areas, trees, and shrubs. It is essential to restore lost soils and maintain land and soil quality assessment systems to establish national registries of the quality of land resources.

2.3. CORRELATION AND INTERACTION OF PUSH AND PULL MIGRATION FACTORS

To predict migration flows associated with land degradation, it is crucial to establish a comprehensive set of indicators that reflect the interplay of push and pull migration factors influencing migration. Withing this framework, indicators assessing the attractiveness of working in the agricultural sector and living in rural areas, considering their multifaceted roles, should hold significant importance.

2.4. THE PATTERN OF WOMEN'S PARTICIPATION IN AGRICULTURAL PRODUCTION

The involvement of women in agricultural production, changes in their roles within families, and their attitudes towards migration can be evaluated through qualitative sociological methods like focus groups and expert interviews conducted in various regions of the country. Indicators such as the proportion of women and complete families among migrants to Russia and other countries, the representation of women in agricultural universities and faculties, agronomy courses, etc., can prove beneficial in this assessment.

Task 3. Developing guidelines for the interdisciplinary research platform to facilitate international cooperation (key objectives and anticipated outcomes):

3.1. In the area of enhancing connections and cooperation, the following actions are proposed:

- Reestablish effective forms of scientific collaboration, as well as establish new ones through conferences, seminars, and educational projects.
- Enhance coordination in scientific and organizational aspects, employing multi-level governance principles among financial contributors involved in sustainable development, such as international development banks, international, bilateral, and national funds, and initiatives, as well as central and regional authorities.
- Provide scientific justification to encourage investments from international and national donors in strategic rural development initiatives. Offer scientific support for the establishment of regional clusters focused on farming and livestock development, acting as hubs for knowledge dissemination.

3.2. Research:

- Create a unified regional distributed system of indicators, methodologies, and assessment methods for identifying land degradation risks and manifestations, drawing from the experience of the USSR.
- Develop indicators that account for both push and pull factors influencing migration.
- Propose incentives to transition economic models from labour export to exporting the results of economic activities, encouraging the establishment of new jobs through sustainable value chains, focusing on processing industries, handicraft production, and integrated agricultural cooperatives (from field to retail).
- Design algorithms to select and adapt sustainable land management models based on socio-economic and biophysical conditions (physiographic and climatic factors).
- Evaluate the socio-economic impacts of implementing sustainable land management models.
- Explore the potential of Eurasian integration and bilateral cooperation between Russia and Central Asian countries to improve the socio-economic conditions in rural areas, which are the primary regions of migration outflow. This includes examining possibilities for reducing customs barriers and non-tariff restrictions, enhancing infrastructure for processing, storage, and transportation of agricultural exports to consumers.
- Enhance the situation of women in rural areas by providing specialized training, promoting women-led agricultural cooperatives with formal employment contracts, and fostering entrepreneurial skills.
- Utilize international experience to develop recommendations for expanding various forms of agricultural cooperation at different scales. This aims to increase agriculture and rural areas' resilience to economic challenges, enhance production efficiency, adapt to natural and climatic changes, apply sustainable land management models, and foster horizontal and vertical linkages.
- Investigate opportunities and prospects for investment funds with short payback periods in agricultural projects.

Development of practical solutions and guidelines:

- Formulate national and international risk assessment tools for land degradation and water scarcity. These tools will aid management decision-makers in regional and regional and local planning.
- Establish a register of sustainable land management models, their zoning, and disseminate effective implementation methods.
- Justify and implement methods to promote and disseminate successful practices and models of sustainable land management.
- Develop recommendations and guidelines for agronomic advice on areas and types of activities.
- Provide scientific support to key non-governmental organizations in establishing and expanding national and international platforms for knowledge and experience sharing.
- Establish support, training, and professional development centres.

LAND DEGRADATION, MIGRATION AND SUSTAINABLE LAND MANAGEMENT IN CENTRAL ASIAN COUNTRIES

PROJECT CONCEPT PROPOSAL: INTEGRATED SOLUTIONS FOR SUSTAINABLE LAND MANAGEMENT MODELS, ACHIEVING LAND DEGRADATION NEUTRALITY AND PREVENTING UNDESIRABLE MIGRATION

The project proposal is based on the results of the research and is not addressed directly towards the increase/decrease of migration. Rural exodus is an integral part of the modern development that should contribute to the economic diversification, growth of GDP, income and standard of living. The main idea is to improve life conditions and the well-being of rural population in their places of residence.

PROJECT PROPOSAL OBJECTIVE

Enhancing living standards and agricultural productivity while regulating migration flows in Central Asian countries by increasing investments in land restoration and rehabilitation. The project aims to reduce the risks of land degradation through the implementation of sustainable land management models and adaptation technologies, with a focus on improving the welfare of rural residents in their local communities.

PROPOSED PROJECT COMPONENTS AND KEY ACTIVITIES

Component 1. Institutional support

- Establishing a harmonized regional system and methodology for assessing land degradation under climate change, including risk assessment, mapping, and the use of indicators, local, and national statistics.
- Implementing a system to record regional and overseas migration patterns.
- Promoting the dissemination of information on sustainable land management models and technologies for their effective implementation. Supporting the establishment of national and cross-national registers of Sustainable Land Management (SLM) models and technologies.

Component 2. Support of agricultural production and value chains

- Initiating pilot projects to assist agricultural producers in various areas, such as soil and water management, crop varieties, crop rotations, cultivation techniques, storage,

processing, and marketing models. Focusing on specific areas such as irrigation, pastures, horticulture, and agroforestry.

- Pilot projects to implement regional chains of sustainable management models.
- Pilot projects to support agricultural cooperation.

Component 3. Regulation of migration flows by promoting attractive conditions

- Launch pilot projects to stimulate the growth and expansion of the intellectual component in the agricultural sector, leading to a demand for skilled labour. This may include initiatives like setting up business incubators, training centres, and agronomic advisory services.
- Provide support for private investments using migrants' remittances.
- Offer targeted grants to vulnerable population groups, including women, youth, and the elderly.
- Develop measures to reduce the vulnerability of returning migrants from the COVID-19 pandemic.

PERFORMANCE INDICATORS

Primary

- Area of land under sustainable land management practices.
- 'Social satisfaction' index, reflecting the overall impact of migration, with a target of increasing the proportion of satisfied population.

Secondary

- Improved income and living conditions, measured by factors such as sanitation, access to clean drinking water, and job opportunities.
- Number of developed and implemented models of sustainable land management practices.
- Water and energy savings achieved through sustainable land management practices.
- Gender indicator, measuring the inclusion and empowerment of women in agricultural activities and decision-making processes.

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