Chapter 7

# SUSTAINABLE LAND-USE RESOURCES IN DROUGHT-PRONE REGIONS OF KAZAKHSTAN

## and Implications for the Wider Central Asian Region

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# 7.1 INTRODUCTION

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Kazakhstan is one of the ten territorially largest states in the world, with a distinctive geopolitical position in the European-Asian subcontinent. Kazakhstan is third in the world in per capita land endowment after Australia and Canada (Committee on Land Resources Management of the Ministry of Agriculture of the Republic of Kazakhstan [CLM] 2022). The country's total area is 272.5 million hectares, of which the agricultural land is 219.6 million hectares (81 percent). Rangelands are the predominant land type, accounting for 184 million hectares (84 percent), while arable land accounts for 26.7

million hectares (12 percent) and about 9 million hectares (4 percent) of other land types.

Being at the crossroads of Europe and Asia, Kazakhstan benefits from an advantageous geographic location through growing investments and developing national and interregional transport and trade corridors. On the other hand, the uneven water distribution within the country aggravates pressure in the water-scarce regions. Furthermore, Kazakhstan still suffers from water mismanagement, soil erosion and degradation, and other environmental consequences resulting from agricultural mismanagement from the Soviet period, which partly continue today. Nearly 70 percent of agricultural machinery in Kazakhstan is at the end of its lifecycle and requires replacement (Government of Kazakhstan 2021a). The situation is exacerbated owing to inadequately skilled labor, lack of access to the commercial credit market — especially for long-term investments — and dependence on government collateral. In addition, the growing demand for imported food products has made Kazakhstan a net importer of agricultural products since 2004 (Privacy Shield Framework 2021).

Sustainable land management is an essential component of the sustainable development goals (SDGs) to ensure food security. The concept of sustainable agricultural development was introduced by the Food and Agriculture Organization of the United Nations (FAO 2011). This concept outlines the principles of increasing resource use efficiency and the conservation, protection, and improvement of natural resources as the essential foundations for the transition to sustainable production. These provisions are highly relevant for Kazakhstan because, despite the considerable amount of arable land (26.7 million hectares), only 11 percent can be considered suitable for sustainable agriculture (CLM 2022). As for pastures, out of 184 million hectares, only 3.2 percent can be classified as compliant with sustainable farming and 61.5 percent with some potential, while at least 14 percent of pastures are completely or highly degraded (CLM 2022).

Significant effects of climate change are observed in almost all regions of Kazakhstan through weather extremes, especially drought, and land erosion and degradation problems throughout the country. In particular, the northern country regions like Kostanay, Akmola, and North Kazakhstan are subject to climate change effects, where extreme aridity has recently been observed. Early warming (by seven to ten days) in these regions in the spring of 2019 led to decreased soil moisture and a decline in crop yields (Vasiliyev 2020). According to the national hydrometeorological service of the Republic of Kazakhstan (Kazhydromet), precipitation was only 63 percent of the established norm in those days. Also, the average temperature exceeded the mean annual value by 5.5°C in the North Kazakhstan region (Vasiliyev 2020). In turn, in 2020, there was no precipitation for 60 days in the Akmola region. This trend changed only by the end of June 2020, when the monthly precipitation norm increased and provided an opportunity to improve harvesting potential.

There was also an increase in weather extremes — mainly drought — in the south and southwest of Kazakhstan, resulting in decreased surface water flows and depletion of groundwater reserves. The southern and western Kazakhstan regions Kyzylorda, Mangystau, and Turkestan experienced severe heatwaves from 2018 to 2021 (Reliefweb 2021). The extensive droughts entailed a water scarcity problem with drying soil up to 50cm, which caused a significant harvest shortage. The drought invoked massive deaths of domestic animals, especially in southwestern areas, owing to the lack of nutrition and water supply. It is estimated that about 2,000 heads of animal husbandry perished in these regions, although the actual number could be higher as some livestock was not officially registered. According to local authorities, residents are unwilling to register livestock to avoid tax payments, although taxes are not levied on registered livestock (Vladimirskaya 2021). The agricultural and livestock impacts have affected harvesting and animal production nationally, mainly in the country's southern and southwestern regions (IFRC 2021).

According to a United Nations Development Program (UNDP) report (2018), about 13 percent of the population in Kazakhstan lived in zones that were at high risk of drought in 2018, while a World Bank and ADB report (2021) projected more intense drought effects in CA and Kazakhstan than in other Asian countries. Various estimations predict that, without the introduction of adaptation measures, the wheat yield in Kazakhstan is likely to be reduced by up to 50 percent by 2050 (Word Bank and Asian Development Bank 2021). Also, the annual land degradation is expected to cost from US$1 billion to US$6 billion (Tokbergenova et al. 2018).

Undoubtedly, drought aggravated by climate change negatively affects the socioeconomic conditions of the population. Poor agricultural land management can lead to a poverty trap for marginalized farmers. Poor land quality leads to low agricultural productivity, hampers profitability, and restricts off-farm employment opportunities, undermining self-sufficiency and rural livelihoods (Ahmadzai et al. 2021, Manandhar et al. 2018). The SDGs propose transformative actions that embrace sustainable and climate-resilient agriculture principles by pursuing food and nutrition security. Investment in agricultural and rural development is required to attain the SDGs of eradicating poverty and hunger by 2030 and feeding an increased population by 2050.

Evidence suggests that a trade-off approach in seizing SDGs should be sustained to avoid negative consequences. Indicatively, SDG 2 target-level interaction assessments (Mollier et al. 2017) prove that attaining SDG 2 'zero hunger' contributes to the achievement of SDG 1 'end poverty in all its forms everywhere' since ensuring food and nutrition security is an integral component of reducing poverty and extreme poverty. However, the SDGs must be attained in a balanced way to maintain a sustainable impact. For instance, intensifying measures towards SDG target 2.3 — 'double the agricultural productivity and incomes of small-scale food producers' — may exhaust natural resources and deteriorate climate vulnerability. Consequently, the SDG 1.5 target—'build the resilience of the poor and those

in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events' — will hardly be met. The joint attainment of SDG targets 2.3 and 2.4 — 'ensure the establishment of sustainable food production systems and agricultural practices' — will be considered for achieving target 1.5 — 'towards a sustainable increase in agricultural productivity and food security.'

Food security is pursued in Kazakhstan through the domestic production of some types of meat and dairy products and fruit and vegetables in the off-season periods. However, there is an upward trend in the prevalence of malnutrition (SDG 2.1.1), although its level does not yet exceed the threshold set by FAO (5 percent) standards. Economic affordability of food, as an integral element of food security, is the share of the population's expenditure on food in the structure of consumer spending. In Kazakhstan, the percentage of food products in households in 2020 reached 58 percent on average, which significantly exceeds the FAO threshold of 35 percent (1.7 times). However, there was a significant rise in the prices of staples from 2019 to 2022, negatively affecting food security. The food price increase began in 2019 during the outbreak of the coronavirus pandemic and continues today owing to the worsening geopolitical situation in the region. Also, it is essential to note that the population with income below the subsistence minimum was 4.3 percent in 2019.

Significant income differentiation remains in urban and rural areas. The share of the population with income below the subsistence minimum was 2.7 percent in urban areas and 6.6 percent in rural ones, where more than 40 percent of the population resides. The poverty level in rural areas is 2.4 times higher than in urban areas. Thus, sustainable agriculture requires a balanced approach to promote sweeping changes that contribute to poverty reduction, food and nutrition security, sustainable management of natural resources, and inclusive growth. The contributions of government and public institutions, based on political will, investment policies, and partnerships, are critical to a more

efficient, equitable, and sustainable agricultural system.

In the last years, Kazakhstan developed national and international strategic programs and policies such as the National Project for the Development of the Agro-Industrial Complex of Kazakhstan for 2021-2025; the national project 'Green Kazakhstan 2021-2025'; and the Concept for the Development of the Agro-Industrial Complex for 2021-2030 aimed at sustainable agricultural development. Also, the country became part of international conventions, such as the Land Degradation Neutrality (LDN) Program to End Soil Degradation and Drought Control by 2030. Kazakhstan adopted the Paris Agreement by providing a nationally determined contribution (NDC) for greenhouse gas emission reductions to 15 percent to 25 percent by 2030 compared with 1990. Nevertheless, the state mechanism faces significant challenges in the timely and comprehensive implementation of national measures and international obligations, as there is a lack of coordination in the actions and areas of responsibility of the relevant agencies and ministries. Also, intense periods of drought are becoming more frequent, burdening the implementation of adequate adaptation measures. According to a CAREC study, Kazakhstan, along with Azerbaijan, Georgia, and Mongolia, will be the most affected nations by drought in the CAREC region, owing to projected changes in the frequency and intensity of drought (Umirbekov et al. 2020). Grain and wheat yields will be decreased by 14-45 percent by 2050 in Kazakhstan owing to increased evaporation rates and high temperatures in the northern wheat-growing areas. Accordingly, the food security of Central Asia will be at risk as Kazakhstan is the leading supplier of wheat and flour products in the region (Umirbekov et al. 2020). International organizations such as FAO and UNDP support Kazakhstan in developing a strategic framework for sustainable land resource use and food security to handle the most vulnerable problems by attaining the SDGs.

This chapter analyses how the drought-vulnerable regions in Kazakhstan confront

environmental pressures on land use and food systems by also pursuing relevant SDG indicators. We review the geographic and climate features of the country by focusing on the impact of drought on agriculture. In turn, the national and global programs related to drought hazards are overviewed through the perspective of SDGs on a national level. The concluding remarks indicate the current progress towards sustainable land use and food systems in Kazakhstan and the remaining challenges.

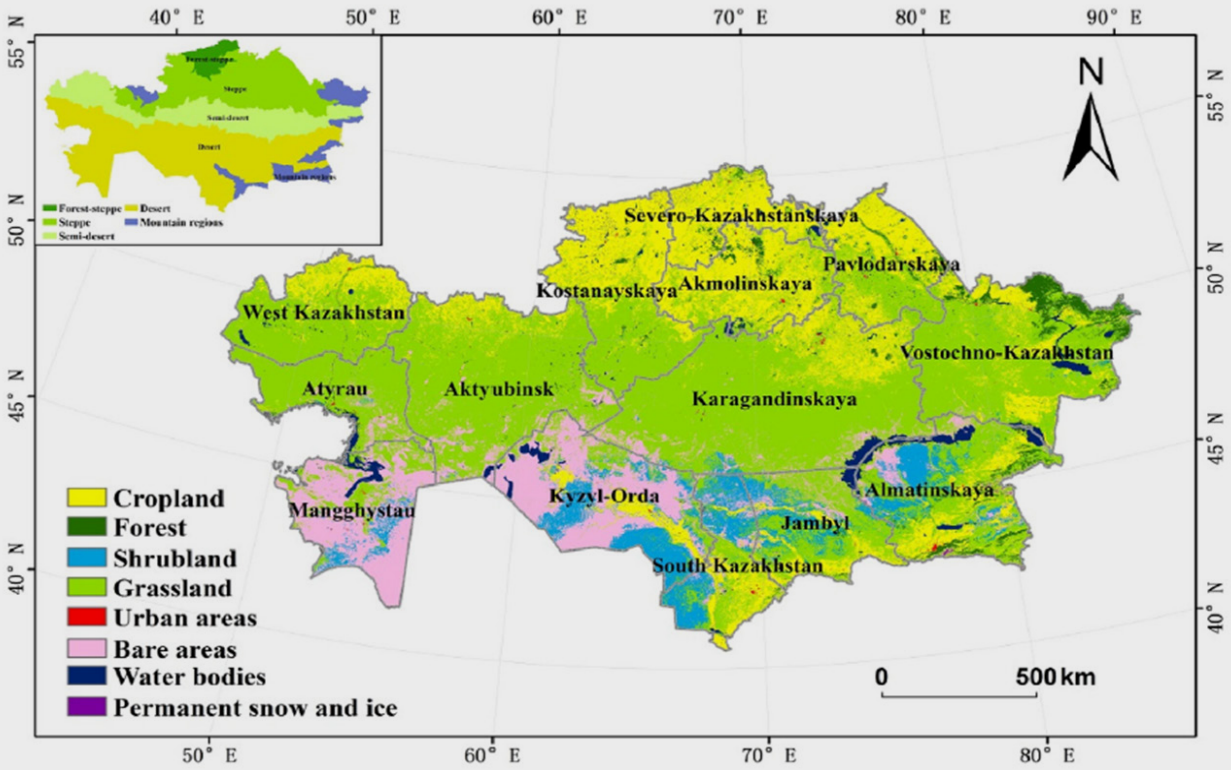
## 7.2 CASE STUDY DESCRIPTION

### 7.2.1 Geophysical and land-use features

Kazakhstan is characterized by a continental climate chaperoned by diametrically cold, dry winters and hot, dry summers. The continental climate intensifies from west to east and from south to north. The annual precipitation varies significantly with alternating dry years and depends on the type of terrestrial ecosystem: for the plains in the north, the precipitation reaches up to 350mm per year; for semi-arid terrains in the south, the precipitation reaches 100mm per year. In the mountainous alpine regions, the annual rainfall rises to 900mm per year (Yan et al. 2020).

Kazakhstan's ecoregions and land use are diverse: in the north, there are moderately humid to dry steppes; in the west, there are dry steppe and desert regions; the southern area hosts deserts and semi-arid areas, and forests and alpine grasslands broadly cover the southeast and eastern mountainous regions. Grassland is the most typical land cover in central Kazakhstan, as shown in Figure 7.1. Owing to the steep rise in livestock numbers since the middle of the 20th century, most grasslands and semi-arid zones have been extensively used for grazing. The northern parts have been used mainly for grain cultivation.

Figure 7.1. Spatial land cover distribution in Kazakhstan




Source: adapted from 'Social institution changes and their ecological impacts in Kazakhstan over the past hundred years,' Yan et al. 2020

Bare land is the third most common land cover type in Kazakhstan and is situated mainly in the southwest of Mangystau and adjacent areas of the Aral Sea. Over the past 20 years, the cultivated land area has remained unchanged, with only slight adjustments in the crop structure. Table 7.1 provides an overview of land cover types in the country.

Table 7.1. Land cover types in Kazakhstan in 2015

| Class I name | Class II name | Area, $km^2$ | Percentage of the total area |
|---|---|---|---|
| **cultivated land** | alpine grassland | $12.83x\ 10^4$ | 4.71% |
| | desert grassland | $52.67x\ 10^4$ | 19.33% |
| | semi-desert | $47.46x\ 10^4$ | 17.42% |
| | grassland | $31.44x\ 10^4$ | 11.54% |
| | typical grassland | $1.09x\ 10^4$ | 0.40% |
| | forest grassland | $62.69x\ 10^4$ | 23.01% |
| **shrub** | | $17.25\ x\ 10^4$ | 6.33% |
| **forest land** | | $5.90x\ 10^4$ | 2.16% |
| **urban construction land** | | $0.38x\ 10^4$ | 0.14% |
| **bare land** | | $34.26x\ 10^4$ | 12.57% |
| **water area** | | $6.41x\ 10^4$ | 2.35% |
| **ice area** | | $0.11x\ 10^4$ | 0.04% |

Source: Adapted from 'Social institution changes and their ecological impacts in Kazakhstan over the past hundred years,' Yan et al. 2020

According to the Bureau of National Statistics (2021), in 2020, the cultivated area included 15.9 million hectares of grain crops; 2.9 million hectares of oilseeds; 3.2 million hectares of forage crops; 459,900 hectares of vegetables, melons, and potatoes; and 141,600 hectares of industrial crops (sugar beet, cotton, tobacco). Kazakhstan is one of

the world's largest grain exporters to more than 70 countries (Privacy Shield Framework 2021). According to the Bureau of National Statistics, the main sales markets at the end of 2021 were Uzbekistan, Tajikistan, Afghanistan, Iran, China, Italy, Turkey, and the Russian Federation. In 2020, Kazakhstan ranked ninth in worldwide wheat exports (United Nations Statistics Division 2021). In 2021, the International Grain Council (2021) forecasted wheat and barley production in Kazakhstan for 2021 to 2022 at 12 million tons and 2.5 million tons, respectively.

### 7.2.2 Drought-prone regions of Kazakhstan

The latest hydrometeorological projections for Kazakhstan's northern regions show an increase in the aridity of the climate. Until recently, the north and eastern territories did not exhibit significant risks of droughts owing to relatively high precipitation rates. However, the aggravated effects of climate change (increase in evaporation rate and temperature) in the northern regions have increased vulnerability to drought and require prompt adaptation measures. In the western regions, semi-arid and arid landscapes are dominant, while the southern territories are more prone to dry climatic conditions. However, the trespassing of some river networks (such as the Syrdarya and Chu rivers) in the south provides a considerable water supply for vegetation in these areas (Xenarios et al. 2022).

One representative agricultural area impacted by droughts in south Kazakhstan was the Kyzylorda region, situated in lowland areas on the eastern part of the Aral Sea. The sandy massifs of the Aral desert characterize the north and south parts of Kyzylorda. Another drought-prone region in south Kazakhstan is Turkestan, divided by the Karatau ridge, while in the northern part, there are the Betpakdala desert and the sandy area of Moiynkum. In the south, there is the Shardara steppe and the western outskirts of the Talas Alatau. The other drought-prone southern region, Zhambyl, is located on the eastern continuation of

the Betpakdala desert and the Moiynkum sands. In the east of the Zhambyl region are the Aitau and Zheltau mountains, Lake Balkhash, and the Karatau and Talas Alatau ridges in the south. All three regions share common borders with Uzbekistan and Kyrgyzstan. The perennial deep-rooted vegetation that traditionally grows in these areas is resistant to drought; only the more ephemeral part of the vegetation is sensitive to drought (Rashid and Isakohdzhayev 2021). Most farmers own land plots of up to 50 hectares, as shown in Table A1-1. In addition, Tables A1-2 and A1-3 present types of land use and the main challenges of land productivity.

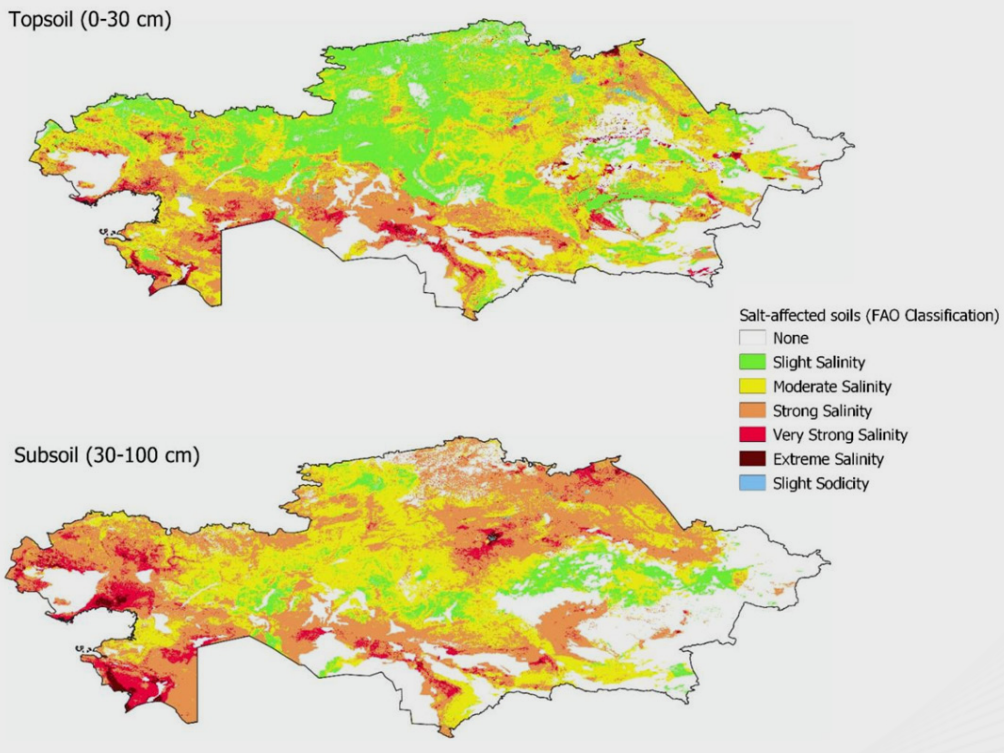
The climate in southern Kazakhstan is arid and continental. The average temperature in winter varies from -2°C to -13°C; in summer, the average temperature ranges from 22°C to 26°C. However, heatwaves above 40°C can last for more than a week and occur several times in summer. The average annual rainfall in the Kyzylorda and Turkestan regions is less than 150mm. In the Zhambyl region, the average rainfall increases from 200mm to 400mm from north to south owing to the mountain ranges' location in the country's south and southeast (Institute of Geography and Water Security 2006a).

Sands and sandy pastures occupy a considerable territory of the Kyzylorda region; they are deserted, unproductive lands with homogeneous, slightly saline, brown and grey-brown soils and meadow marsh with slightly saline soils. In the Turkestan and Zhambyl regions, there are also piedmont-foothill desert steppe lands with light, ordinary grey soil and light chestnut soil, while brown and grey-brown soils are also found. The Turkestan region also has highly productive lands endowed with black dirt. The agricultural development of these lands is challenged by the current drought conditions (Rashid and Isakohdzhayev 2021).

One of the main problems for the agricultural economy of Kazakhstan relates to the

overexpansion of agricultural land during the Soviet era (Funakawa et al. 2000). Owing to the massive water withdrawal of farming needs, mainly from the two largest rivers in CA — Syrdarya and Amuradarya — the ecological state of the Aral Sea has deteriorated. The crops cultivated in the southern regions (cotton, sugar beet, yellow tobacco, rice, orchards, and vineyards) are primarily determined by the volume of water from surface freshwater systems (Tokbergenova et al. 2018). Over the decades, intensive irrigation water use owing to rising groundwater levels and inadequate drainage has led to widespread secondary salinization of soils and watercourses. In Kazakhstan, 33 percent of irrigated lands are subject to salinization, especially in the southern agricultural areas, which challenges agricultural land use (Zan et al. 2022). Subsoil analysis data (30cm to 100cm) shows that salinization covers both non-irrigated lands and rangelands (FAO 2022a). Figure 7.2 presents the soil salinity at topsoil and subsoil levels in the country.

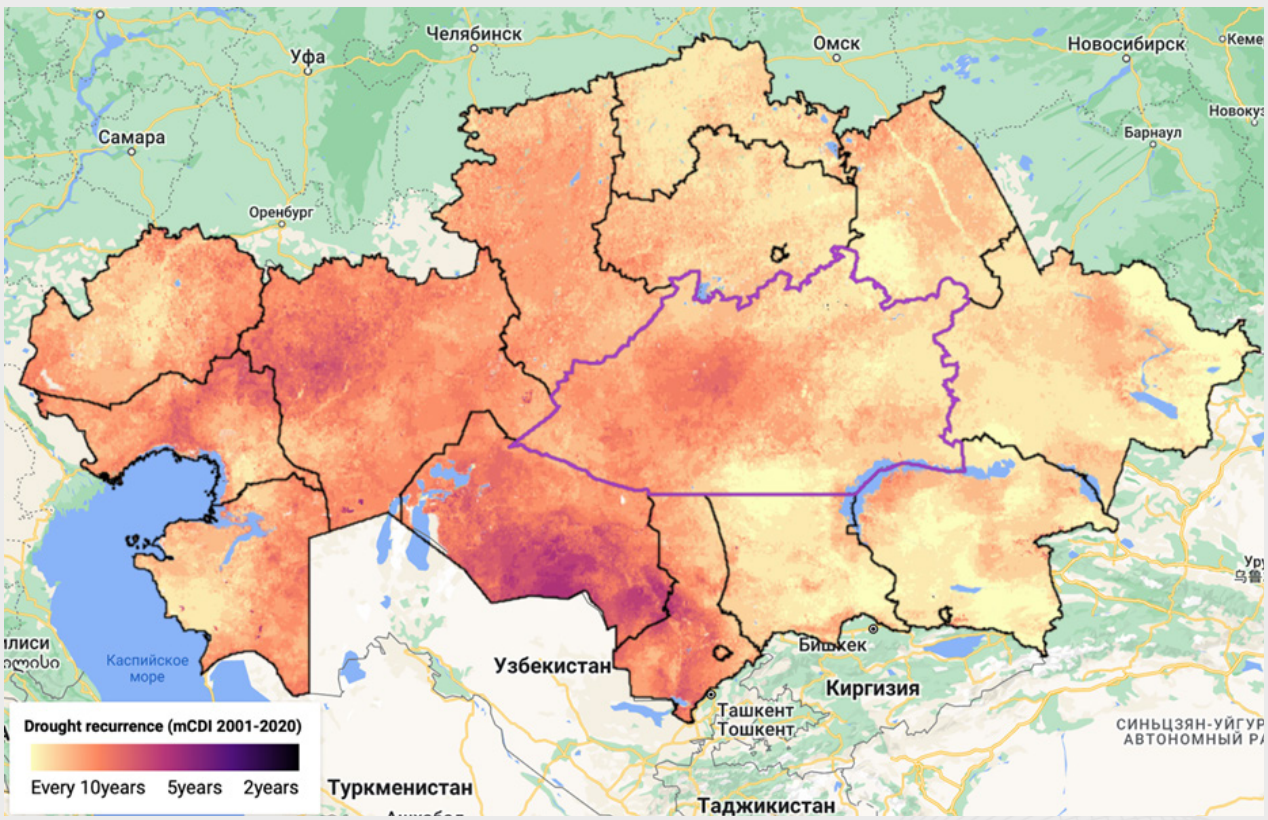
Figure 7.2. Soil salinity of Kazakhstan




Source: adapted from the 'Topsoil and subsoil salinity map of Kazakhstan' by FAO 2022a

The salinized areas gradually become abandoned fields devoid of vegetation. Also, desertification and soil degradation have contributed to the instability of land use in the Aral Sea area and its surroundings. Indicatively, in Kyzylorda province, 30 percent to 40 percent of soils in irrigated areas have experienced deprivation of soil organic matter (Low et al. 2015). The desiccation of the Aral Sea increased the temperature in the vicinity and the frequency of 'dry' cyclones (Aleksandrova et al. 2014). The Aral desiccation also contributed to the recurrence of droughts in the southern areas, as shown in Figure 7.3.

Figure 7.3. Drought recurrence in Kazakhstan (Modified Combined Deficit Index [mCDI] 2001-2020)

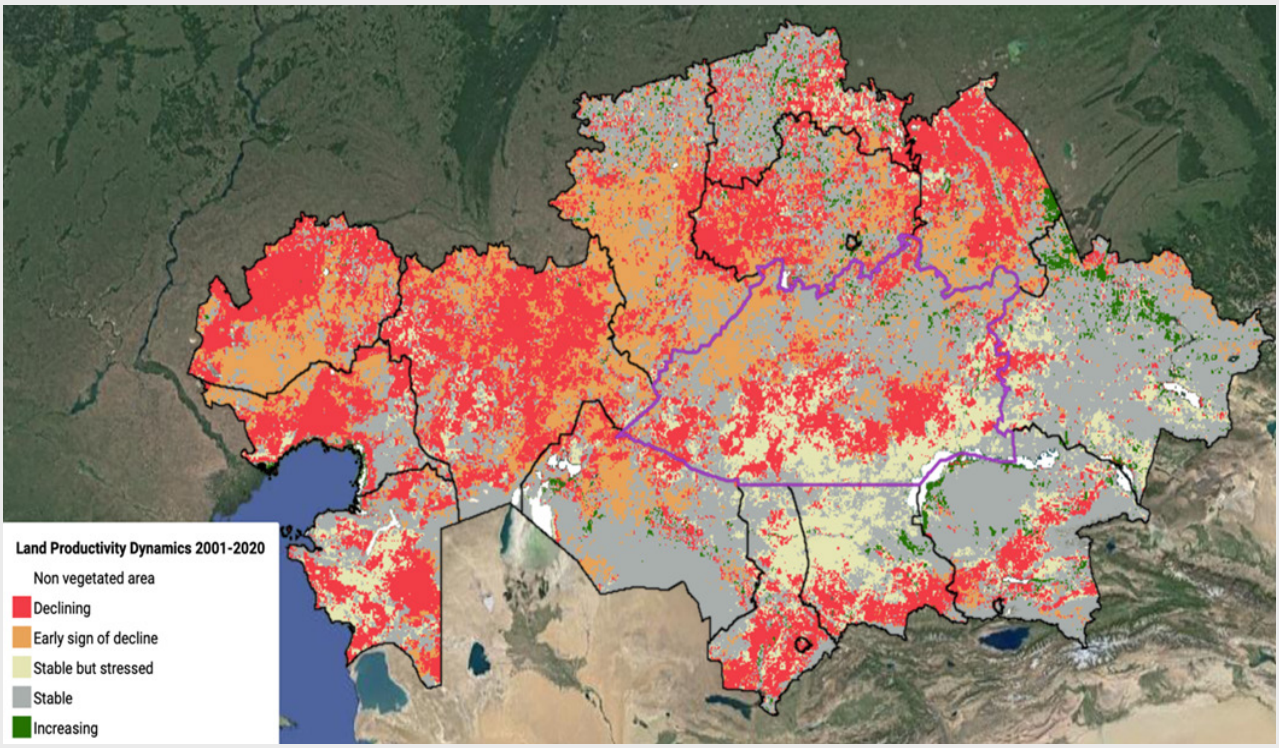



Source: adapted from FAO-GEF Earth Engine Apps by FAO 2022b

In 2020, drought intensification was observed throughout the country: central and eastern regions experienced moderate to severe drought, while in western and southern Kazakhstan, drought intensified even more (Rashid and Isakhodzhayev 2021). The intensity and duration of dry periods in the growing season have increased from the north to south and east to west parts of the country.

Soviet agricultural management practices have also contributed to the current aggravation of drought impacts. In the southern regions of Kazakhstan, an excessive expansion of agricultural land was aimed at the water-demanding cotton and rice plantations in areas with high evaporation rates (Assubayeva et al. 2022). Also, in Kazakhstan's northern and central regions, a large-scale Virgin Lands Campaign was carried out. The grassland soil surface structure was degraded during these campaigns, resulting in a humus content of 5 percent to 30 percent (Yan et al. 2020). The large-scale aggressive land exploitation in the entire country has led to extensive land degradation, as shown in Figure 7.4.

Figure 7.4. Land productivity dynamics 2001-2020




Source: adapted from FAO-GEF Earth Engine Apps by FAO 2022b

Agricultural land productivity across the country is three to four times lower than in many other countries with similar geophysical features (FAO 2016). About 4.75 kilograms of mineral fertilizers are applied per 1 hectare of arable land, equal to 1/12 of the actual needs (Kazakhstan Today 2015). Organic fertilizers are used in limited quantities in irrigated agriculture, primarily for potato and vegetable cultivation. The application of

pesticides per 1 hectare has increased by 1.6 times: from 0.409kg in 2013 to 0.640kg in 2020 (Bureau of National Statistics 2022b). In 2022, only about 19.4 percent of agricultural land is not subject to degradation and desertification processes, and 43 percent of irrigated land requires reclamation. About 13 percent of the land is susceptible to wind and water erosion (CLM 2022). An overview of land degradation and erosion is shown in Table 7.2.

Table 7.2. Land areas subject to wind and water erosion in Kazakhstan

| Indicators | 2005 | 2010 | 2015 | 2021 |
|---|---|---|---|---|
| **Total agricultural land area (thousands of hectares)** | 222,625 | 222,408 | 222,143 | 214,192 |
| **Farming land under water erosion (thousands of hectares), (percentage of total agricultural land)** | 4,989 (2.2%) | 4,989 (2.2%) | 4,950 (2.2%) | 4,950 (2.3%) |
| **Farming under wind erosion (thousands of hectares), (percentage of total agricultural land)** | 25,493 (11.5%) | 25,493 (11.5%) | 24,168 (10.9%) | 24,168 (11.3%) |

Note: Data adapted from the Bureau of National Statistics' five-yearly report (2019) and consolidated report on the state and use of land of Kazakhstan for 2021 (CLM 2022)

Drought is affecting not only the traditionally dry southern and western regions of Kazakhstan but also the northern, central, and eastern regions are becoming more arid, making them more vulnerable to climate change and less productive owing to the lack of measures to combat drought. Heatwaves severely damaged about 1,407,000 hectares

of cultivated land in traditionally precipitated areas in northern regions in 2012 and 2014. Also, owing to the droughts in 2014, 95.6 percent of crops were impacted in the Aktobe region (Khobdinsky district) and 18 percent in the Pavlodar region. In the Turkestan drought-prone region, due to to a heatwave in 2012, 50 percent of livestock breeders went bankrupt without feeding reserves, and the wheat and barley harvests were destroyed. A catastrophic situation also occurred in 2019 in the Kostanay region, where only 400kg/hectare to 500kg/hectare of grain could be harvested, which is much lower than the region's average level (Rashid and Isakohdzhayev 2021).

Climate change and increasing drought challenge agricultural land productivity, harming the national economy. Moreover, the turbulent political and socioeconomic world situation may exacerbate the preconditions for food insecurity in the CAREC region (Xenarios et al. 2020). In 2021, Kazakhstan's adjusted seeded area was 1.5 percent more than in 2020 (23 million hectares). However, the 2021 yield figures for main export-oriented crops, such as grain (including rice) and legume crops, decreased by as much as 19 percent. The gross harvest of grains (including rice) and pulse yields decreased by 18.4 percent compared with 2020, and oilseeds decreased by 4.9 percent (Bureau of National Statistics 2022a). More detailed statistics on crop yields and seeded and harvested crop areas are available in Tables A2-1 and A2-2.

## 7.3 LAND USE AND DROUGHT RELEVANCE WITH SUSTAINABLE DEVELOPMENT GOALS IN KAZAKHSTAN

Conserving resources for developing sustainable food systems and agriculture management is essential from a long-term perspective, as most natural resources ensuring food security have reached their carrying capacity limits (FAO 2021a). An additional burdening factor is the intensity of weather extremes, driven mainly by climate change. A compromise between ensuring the nutritional value of food produced, crop productivity, and building climate change resilience is required. The above situation is highly relevant to the agrifood systems of Kazakhstan, which is located in the zone of so-called risky farming owing to various global environmental challenges (CLM 2022).

Climate change aggravates land degradation in Kazakhstan by amplifying extreme events, soil erosion, and loss of vegetation. The average annual air temperature across Kazakhstan from 1976 to 2020 has increased by 0.32°C every ten years (MEGNR 2021). By 2085, according to the prevalent climate scenarios, the humid zones may shift significantly to the north (Ministry of Environmental Protection of the Republic of Kazakhstan 2009). In this case, the northern regions of Kazakhstan will be in the semi-arid zone, while the arid zone will occupy a larger area, as already demonstrated by some studies (Rashid and Isakohdzhayev 2021, FAO 2022b). The deficiency of water resources will lead to the degradation of pastures and severe impacts on crops, including spring wheat, one of the country's primary export commodities (Ministry of Environmental Protection of the Republic of Kazakhstan 2009).

To reduce the risks of climate change and its impact on the degradation of agricultural land, the United Nations Convention has made a significant attempt to combat desertification (UNCCD) through land degradation neutrality (LDN). UNCCD defines land degradation neutrality as 'a state whereby the amount and quality of land resources, necessary to support ecosystem functions and services and enhance food security, remains stable or increases within specified temporal and spatial scales and ecosystems' (UNCCD 2022). The concept of land degradation neutrality is based on maintaining a balance between land degradation processes and measures to restore it. To achieve soil neutrality, restoring as many soils as are degraded is necessary.

Another attempt to measure the progress of sustainable agriculture in Kazakhstan is conducted through various SGD-related indicators. The indicators 2.4.1 'proportion of agricultural area under productive and sustainable agriculture,' 15.3.1 'percentage of land that is degraded over a total land area' (LDN indicator), 6.4.1 'change in water use efficiency over time,' and 6.4.2 'level of water stress: freshwater withdrawal as a proportion of available freshwater resources' were aimed at ensuring rational use of land and water resources were introduced.

### SDG indicator 2.4.1: sustainable agriculture

Indicator 2.4.1 considers the balance of three components of sustainable production: economic, environmental, and social. It links the themes of productivity, profitability, resilience, land and water use, decent work, and wellbeing, reflecting the multifaceted nature of sustainable agriculture. Kazakhstan has made specific efforts to implement SDG 2.4.1 in the national context. However, national indicators do not fully reflect the content of this indicator as per international standards. Table 7.3 provides an overview of the targets, challenges, and recommendations for improving SDG 2.4.1 in Kazakhstan.

Table 7.3. Performance of SDG indicator 2.4.1 in Kazakhstan's food and agricultural systems

| | |
|---|---|
| **SDG indicator** | 2.4.1 'Proportion of agricultural area under productive and sustainable agriculture' |
| **SDG target** | By 2030 ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, help maintain ecosystems, strengthen capacity for adaptation to climate change, extreme weather, drought, flooding, and other disasters, and progressively improve land and soil quality |
| **Current status in Kazakhstan** | Partly established as follows:<br>2.4.1. the share of implemented precision farming technology in the total sown area (drip irrigation, sprinkling)—monitoring—is held by only two indicators. In comparison, the international standards require the monitoring of 11 sub-indicators:<br>1. Farm productivity per hectare<br>2. Profitability<br>3. Mechanisms to reduce sustainability risks<br>4. Prevalence of soil degradation<br>5. Changing water use in water availability<br>6. Fertilizer pollution risk management<br>7. Pesticide risk management<br>8. Use of practices that support agrobiodiversity<br>9. Agricultural wage levels<br>10. Food insecurity experience scale (FIES)<br>11. Land tenure and secure tenure rights |
| **Recommendations** | The national methodology should be aligned with the global methods, and the indicators should be monitored continuously. A 'sustainable land resources management' concept should be included in policy documents, and the notion of 'responsible land user' should be implemented. |

Monitoring of indicator 2.4.1 in the national Kazakhstani SDG system is carried out according to only two national indicators. Thus, the methodology differs from international standards. Hence it does not allow us to fully track the progress of the sustainable development of the agricultural sector in Kazakhstan.

### SDG indicators 6.4.1 and 6.4.2: sustainable water use

FAO has made some noticeable attempts to incentivize the better monitoring of SDG 6 in Kazakhstan and ensure water and sanitation are available for all. Various globally approved SDG targets, such as target 6.4, have been proposed to improve water use efficiency significantly in all sectors by 2030. The global indicators for improving sustainable agriculture are 6.4.1. 'change in water use efficiency over time, by economic activity' and 6.4.2. 'level of water stress: freshwater withdrawal as a proportion of available freshwater resources.' These indicators have been incorporated into the country's monitoring system.

The monitoring findings on water use efficiency (6.4.1) demonstrate that the indicators have improved regarding water productivity (water consumption per production unit). Still, the use of water resources in Kazakhstan has low efficiency compared with other countries, given that Kazakhstan uses three times more water per dollar of GDP compared with Russia or the United States and six times more than Australia. While 13,222$m^3$ million were used for irrigation in 2017 (Bureau of National Statistics 2019), agricultural water losses are as high as 66 percent (World Bank and Samruk Kazyna 2018). Water-saving techniques supply only 7 percent (95,800 hectares) of irrigated land. The projected average volume of water withdrawal for agricultural needs is 21$km^3$ per year (Government of Kazakhstan 2018). In the case of indicator 6.4.2, there has been a 2.6 percent increase in water stress since 2016, although this is not yet critical on a national level. However, there is significant pressure in the southern regions, where 80 percent of irrigated land is located (Bureau of National Statistics 2019).

### SDG indicators 6.4.1 and 6.4.2: sustainable water use

The UN has also stressed the need to assess SDG 15 to protect, restore, and promote the sustainable use of terrestrial ecosystems and sustainable forest management to

combat desertification, prevent and reverse land degradation, and halt biodiversity loss. To measure the progress of 'combating desertification and restoring degraded land and soil, including land affected by desertification, droughts and floods, and creating a land degradation neutralized world' by 2030 (SDSN 2022), indicator 15.3.1 was developed. This indicator is customarily monitored through the combined use of three sub-indicators: land cover, land productivity, and carbon stocks above and below ground. Unfortunately, these sub-indicators have not been implemented in Kazakhstan's monitoring system, and no targets have been set to achieve them by 2030.

Instead, the global indicator 15.3.1. is interpreted through a national indicator named 'area of eroded land in the composition of agricultural land as a percentage of the total land area.' The scale of combating desertification and restoring degraded lands has been underestimated as the national SDG-related statistics present only 13.7 percent of eroded lands, which corresponds to the misrepresentation of the indicator. Thus, achieving neutrality against the deterioration of agricultural land by 2030 becomes a challenging task. Efficient use of land resources cannot be achieved without a permanent system of control and monitoring of the qualitative and quantitative state of the land and its usage. Despite proclaimed statements from national agencies, sustainable agricultural production processes and carbon neutrality in land degradation are not yet prioritized in the national policy of the farming sector.

# 7.4 INITIATIVES TO ALLEVIATE THE EFFECTS OF DROUGHT IN KAZAKHSTAN

### 7.4.1 Drought management in the Central Asian region

Incorporating SDGs related to agriculture and the environment with efficient monitoring is essential for developing sustainable and more efficient approaches in Kazakhstan. In addition to SDG monitoring, which reflects the interconnectedness of sustainable development's environmental, economic, and social elements, it is necessary to establish a set of institutional and technical measures in the land, soil, and water resources management. Approaches such as sustainable land management (SLM), sustainable management of soil resources and integrated water resources management (IWRM) should be integrated at both agricultural and food systems scales to identify solutions to land degradation and droughts in Kazakhstan and CA countries (Rashid and Isakohdzhayev 2021).

Climate change is a significant stressor in Kazakhstan's agricultural lands and the CA region, bringing an increasing number of aggravated environmental, social, and economic challenges. All CA countries in the region are prone to drought; however, the intensity, frequency, and impact vary from country to country. From 1930 to 2014, Turkmenistan turned out to be the driest country in CA, followed by Uzbekistan, Tajikistan, and Kyrgyzstan, with a lower frequency of drought and Kazakhstan in the bottom line. In Kazakhstan, drought frequency in the northern and northeastern regions is traditionally lower than in the central and western areas (Rashid and Isakohdzhayev 2021). It is also essential to add that the CA region generally accounts for 31 million hectares of land degraded by human activities — 2 percent of the total area of degraded land worldwide (FAO 2021a). Increasing drought, land degradation, soil erosion and salinization, and water scarcity can undermine the region's water, energy, and food security (FAO 2017).

CA countries have signed and ratified major international environmental conventions such as the Convention on Biological Diversity, the Framework Convention on Climate Change (along with the Kyoto Protocol and Paris Agreement, and submitted nationally determined contributions), the Convention to Combat Desertification, and the Convention on the Protection and Use of Transboundary Water Resources and International Lakes (by Kazakhstan, Uzbekistan, and Turkmenistan), which determine the national and regional development of the CA countries according to the SLM and IWRM principles (FAO 2021b, FAO 2022c, FAO 2022d). CA countries have systematically used the SDG targets mentioned in the previous section to mainstream international frameworks and conventions by aligning with relevant standards. In Table 7.4, we outline crucial SDG indicators related to agriculture and the environment in the CA region by reviewing the integration into national policies.

Table 7.4. Integration of SDGs 2, 6 and 15 through relevant indicators in national programs of the Central Asian countries

| # SDG indicator | Global SDG indicator | National SDG indicator | | | | |
|---|---|---|---|---|---|---|
| | | Kazakhstan | Kyrgyzstan | Uzbekistan | Tajikistan | Turkmenistan |
| **2.4.1** | Proportion of agricultural area under productive and sustainable agriculture | (2.4.1.1) Proportion of land under precision farming of the total sown area | (2.4.2.1a) Share of arable land fertilized with mineral fertilizers, organic fertilizers | Proportion of agricultural area under productive and sustainable farming practice | Proportion of agricultural area under sustainable farming practices | N/A |
| | | **Correspondence of the national indicators and measures to international standards** | | | | |
| | | -Two national indicators replaced the global indicator<br>-National indicators do not correspond to the global indicator, and national methodology differs from the global methodology<br>-Monitoring is conducted and accessible to the public | -Two national indicators replaced the global indicator<br>-National indicator does not correspond to the global indicator<br>-National methodology differs from the global methodology<br>-Monitoring is conducted and accessible to the public | -National indicator corresponds to the global indicator<br>-Monitoring is not accessible to the public | -National indicator corresponds to the global indicator<br>-Monitoring is not accessible to the public | N/A |
| | | **Integration of SDGs into national programs and strategies of the CA countries to combat drought** | | | | |
| | | 1. The concept of development of the agro-industrial complex for 2021-2030; indicators are not integrated<br><br>2. National project for the development of the agro-industrial complex of Kazakhstan for 2021-2025; one indicator is integrated, alignment with international standards is needed | 1. State Irrigation Development Program of the Kyrgyz Republic for 2017-2026; indicator is not integrated; however, the 'improvement of lands' is identified<br><br>2. Concept of the green economy 'Kyrgyzstan is a country of the green economy'; indicators are not mentioned; however, emphasis is given to water-saving irrigation methods (drip, discrete, and spraying) | 1. The Agricultural Development Strategy of the Republic of Uzbekistan for 2020-2030; some components of the indicator are integrated; however, alignment is needed<br><br>2. Concept for the Development of Water Resources for 2020-2030 in Uzbekistan; some components of the indicator integrated through 'the total area of land covered by water-saving technologies for irrigating crops is up to 2 million hectares, including drip irrigation technologies—up to 600,000 hectares' | National Climate Change Adaptation Strategy of the Republic of Tajikistan for the period up to 2030; indicator is not integrated | National strategy of Turkmenistan on climate change; indicator is not integrated<br><br>Information not available for other national policies |

| # SDG indicator | Global SDG indicator | National SDG indicator | | | | |
|---|---|---|---|---|---|---|
| | | Kazakhstan | Kyrgyzstan | Uzbekistan | Tajikistan | Turkmenistan |
| 6.4.1 | Change in water use efficiency over time | Change in water use efficiency over time, by economic activity | (6.4.1.2) Losses of water during transportation through the territory | Water consumption for a unit of GDP (m3/US$ GDP) | Dynamics of changes in water use efficiency | N/A |
| | | **Correspondence of the national indicators and measures to international standards** | | | | |
| | | -National indicator corresponds to the global indicator<br>-Monitoring is conducted and accessible to the public | -Global indicator is replaced with a national indicator<br>-National indicator does not correspond to the global indicator<br>-National methodology is different from the global methodology<br>-Monitoring is conducted and accessible to the public | -Global indicator has been replaced with a national indicator<br>-National indicator does not correspond to the global indicator<br>-National methodology is different from the global methodology<br>-Monitoring is not accessible to the public | -National indicator corresponds to the global indicator<br>-Monitoring is not accessible to the public | N/A |
| | | **Integration of SDGs into national programs and strategies of the CA countries to combat drought** | | | | |
| | | 1. National 'Green Kazakhstan' project for 2021-2025; indicators are not integrated; however, one of the components has been identified—'reduction of irrigation water losses by 4km³' to achieve the task 'improving productivity through economical use of water' | 1. Strategy for the development of drinking water supply and sanitation systems in settlements of the Kyrgyz Republic until 2026; indicator is not integrated<br><br>2. State Program for the Development of Irrigation of the Kyrgyz Republic for 2017–2026; indicator is not integrated | Concept of environmental protection of the Republic of Uzbekistan until 2030; indicator is not integrated, however, one of the components has been identified as "Reducing the loss of water resources by 2%." | Water Sector Reform Program of the Republic of Tajikistan for 2016–2025; indicator is not integrated | National strategy of Turkmenistan on climate change; indicator is not integrated<br><br>Information not available for other national policies |

| # SDG indicator | Global SDG indicator | National SDG indicator | | | | |
|---|---|---|---|---|---|---|
| | | Kazakhstan | Kyrgyzstan | Uzbekistan | Tajikistan | Turkmenistan |
| 6.4.2 | Level of water stress: freshwater withdrawal as a proportion of available freshwater resources | Level of water stress: freshwater withdrawal as a proportion of available freshwater resources | (6.4.2.1) Total water withdrawal | Level of water stress: freshwater withdrawal as a proportion of available freshwater resources | Level of water stress: freshwater withdrawal as a proportion of available freshwater resources | Level of water stress: freshwater withdrawal as a proportion of available freshwater resources |
| | | **Correspondence of the national indicators and measures to international standards** | | | | |
| | | -National indicator corresponds to the global indicator<br>-Monitoring is conducted and accessible to the public | -Global indicator is replaced with national<br>-National indicator does not correspond to the global indicator<br>-National methodology is different from the global methodology<br>-Monitoring is conducted and accessible to the public | -National indicator corresponds to the global indicator<br>-Monitoring is conducted and accessible to the public | -National indicator corresponds to the global indicator<br>-Monitoring is not accessible to the public | -National indicator corresponds to the global indicator<br>-Monitoring is not accessible to the public |
| | | **Integration of SDGs into national programs and strategies of the CA countries to combat drought** | | | | |
| | | National project 'Green Kazakhstan' for 2021-2025; the indicator is different with a focus only on the industrial sector | 1. Strategy of drinking water supply and sanitation systems in settlements of the Kyrgyz Republic until 2026; indicator is not integrated<br><br>2. State Program for the Development of Irrigation of the Kyrgyz Republic for 2017-2026; indicator is not integrated | The concept of development of the water sector for 2020-2030 in Uzbekistan; indicator not integrated | Water Sector Reform Program of the Republic of Tajikistan for 2016-2025; indicator is not integrated | National strategy of Turkmenistan on climate change; indicator is not integrated<br><br>Information not available for other national policies |

| # SDG indicator | Global SDG indicator | National SDG indicator | | | | |
|---|---|---|---|---|---|---|
| | | Kazakhstan | Kyrgyzstan | Uzbekistan | Tajikistan | Turkmenistan |
| 15.3.1 | Percentage of land that is degraded over a total land area | The area of eroded land in the composition of agricultural land as a percentage of the total land area | (15.3.1.1) Area of arable land for reasons of non-use: salinization and waterlogging, lack of watering owing to a malfunctioning irrigation network prone to natural disasters (landslides, mudflows) | The ratio of the area of degraded land (irrigated and non-irrigated) to the total land area | Land area degraded as a percentage of total land area | Rate of land degradation |
| | | **Correspondence of the national indicators and measures to international standards** | | | | |
| | | -Global indicator replaced by a national indicator<br>-National indicator does not correspond to the global indicator, and the national methodology is different from the global methodology<br>-Monitoring is conducted and accessible to the public | -Global indicator replaced with national<br>-National indicator does not correspond to the global indicator, and the national methodology is different from the global methodology<br>-Monitoring is conducted and accessible to the public | -National indicator corresponds to the global indicator<br>-Monitoring is not accessible to the public | -National indicator corresponds to the global indicator<br>-Monitoring is not accessible to the public | -National indicator corresponds to the global indicator indicator<br>-Monitoring is not accessible to the public |
| | | **Integration of SDGs into national programs and strategies of the CA countries to combat drought** | | | | |
| | | 1. The concept of development of the agro-industrial complex for 2021-2030; national indicator is integrated, needs alignment with global indicator<br>2. National project for the development of the agro-industrial complex of Kazakhstan for 2021-2025; national indicator is integrated, needs alignment with global indicator | Concept of Green Economy 'Kyrgyzstan is a country of the green economy'; indicator is not integrated | 1. Agriculture Development Strategy of the Republic of Uzbekistan for 2020-2030; indicator is not integrated; there is another indicator, 'reduction of land with high rates of salinity'<br><br>2. The concept of development of the water sector for 2020-2030 in Uzbekistan; indicator is not integrated, there is a broad objective 'reduction of saline land areas on irrigated land areas, including the reduction of highly and moderately saline irrigated land areas' | State program for the development of new irrigated lands and the restoration of lands retired from agricultural use; indicator is not integrated | National strategy of Turkmenistan on climate change; indicator is not integrated<br><br>Information not available for other national policies |

All countries in the CA region prepared their first voluntary national review of SDGs by 2020. Kazakhstan developed the second review in 2022, and Turkmenistan plans to present its second review in 2023 (Sustainable Development Knowledge Platform 2022). This demonstrates a certain political will in the efforts to fulfil national obligations under the Paris Agreement. However, as Table 7.4 shows, sustainable land and water management is not always a priority in national policies, despite the increasing droughts in the region. Moreover, the progress of SDG nationalization in the five CA countries is not homogeneous. Kazakhstan and Uzbekistan seem to take the lead in integrating SDGs 2, 6, and 15 into the national statistics and monitoring systems.

Nevertheless, the SDG indicators are not always integrated into the objectives of the national development programs and strategies for agriculture and water management in both countries. Next comes Kyrgyzstan, whose nationalized SDG indicators 2, 6, and 15 are also monitored and tracked in country statistics. However, national programs seldom contain target indicators corresponding to the SDGs. Tajikistan has nationalized indicators for the three SDGs, but monitoring and trend reporting on indicators are not always publicly available. Accordingly, SDG indicators 2, 6, and 15 are not integrated into national policies. Finally, a fully-fledged Turkmenistan analysis is unfeasible owing to the lack of information on national indicators (except for 6.4.2 and 15.3.1). National monitoring and trend reporting on indicators are not publicly available in Turkmenistan. National development programs and strategies have also not been available by state agency statistics or government platforms (Gasanov and Gasanova 2020).

The comparative review shows that Kazakhstan, like Uzbekistan, holds a confident leading position in the CA region on implementing the SDGs in national statistics and monitoring. Still, progress must be made on the methodological development of sustainable development indicators and their respective consolidation in national

strategies and programs for developing agriculture and water sectors. Turkmenistan and Tajikistan should improve access to national data on the SDGs and monitor SDG adaptation and integration into relevant national strategic programs and plans on drought events (Xenarios et al. 2021). Monitoring and integrating targets for sustainable land and water resource usage in Kazakhstan is an example of Tajikistan, Kyrgyzstan, and Turkmenistan in developing drought and climate-resilient agriculture. Kazakhstan is one of the leading countries in the effort and commitment to incorporate the SDGs into national policies. However, better-customized plans should include sustainable agriculture implementation practices in climate-driven weather extremes.

### 7.4.2 State-driven initiatives on drought and agriculture in Kazakhstan

The main strategic document of Kazakhstan, 'Kazakhstan 2050,' emphasizes the exhaustibility of natural resources as a national challenge by stating that the country must follow the path of effective management of natural resources for sustainable economic growth. Strategic measures to combat desertification are outlined in the Concept for Kazakhstan's Transition to a Green Economy by 2050 through the introduction of sustainable land management practices (such as prevention of land degradation and restoration of degraded land; prevention of further overgrazing; efficient use of water; rational use of resources) (Government of Kazakhstan 2013).

In recent years, Kazakhstan agreed to abide by several global agreements. In 2016, Kazakhstan ratified the Paris Agreement and committed to reducing greenhouse gas emissions to 15 percent to 25 percent by 2030 as its nationally determined contribution. In 2020, President Tokayev stated at the UN Climate Ambition Summit that Kazakhstan would achieve carbon neutrality by 2060. Currently, Kazakhstan is elaborating the 2060 Long-Term Low-Carbon Development Strategy, aiming to accomplish sustainable agriculture

across 75 percent of arable land by 2045. Moreover, in 2017 Kazakhstan joined the Global Land Degradation Neutrality Target Setting Program. Under the program, the country pledges to achieve a neutral balance of land degradation by 2030 by scaling up irrigated land areas by 40 percent (2 million hectares) (LDN TSP 2018).

Furthermore, in 2021, the Government of Kazakhstan developed a new set of strategic documents to fulfil its international commitments. Nine national projects were developed to address strategic changes in all country sectors. Two of these projects outlined the sustainable approach to environmental and agricultural development against drought and land degradation crises as follows:

1) The National Project for the Development of the Agro-Industrial Complex of Kazakhstan for 2021-2025 and the associated Concept for the Development of the Agro-Industrial Complex for 2021-2030 were developed by the Ministry of Agriculture (MoA), pay considerable attention to land degradation and drought issues. The national project applies a customized version of the SDG 15.3 target to ensure the doubling of the land area using water-saving technologies (drip irrigation, sprinkling) (Government of Kazakhstan 2021b). The concept provides measures to combat pasture degradation, strengthen control over the agrochemical state of soils, and introduce modern methods for monitoring land-use processes using space monitoring and remote sensing (Government of Kazakhstan 2021a).

2) The national project Zhasyl Kazakhstan for 2021-2025, supervised by the Ministry of Ecology, Geology, and Natural Resources (MEGNR), determines four main directions for development. The project targets 'increasing productivity through economical use of water' and alleviating drought and water stress. The objective is to reduce water losses during irrigation which will be achieved by constructing additional irrigation sources — for example, nine new reservoirs in Akmola, West Kazakhstan, Zhambyl, Kyzylorda, and Turkestan regions until 2025, with a storage volume of 1.7km$^3$ (Government of Kazakhstan 2021c).

In 2017, the Government adopted the Law on Pastures, which ensures the application of the sustainable use of pastures similar to the obligatory pasture rotation requirement. The law should mitigate the desertification impacts of overgrazing and facilitate the partial achievement of target SDG 15.3 on sustainable land use and drought combat strategy by 2030 (UNECE 2019). Also, in 2021, Kazakhstan adopted a new Environmental Code, which arranges a specific priority for mitigation and adaptation measures to protect lands from depletion, degradation, desertification and sustainable water resources management.

Attempts have also been made to improve agricultural water efficiency in the country. A state program for water resources management until 2030 has been initiated to 'improve the efficiency and rational use of water' through increasing the area of irrigated land up to 3 million hectares, the construction of 38 new reservoirs, and the introduction of water-saving incentivizing tariffs for the restoration and development of the water management irrigation infrastructure by 2030 (MEGNR 2020). In addition, Kazakhstan supports implementing foreign advanced water-saving technologies such as drip irrigation techniques developed in Israel to adopt best practices against drought.

### 7.4.3 Internationally driven initiatives on drought and agriculture in Kazakhstan

Kazakhstan is engaged with various international organizations on drought policy improvements in the country and, more broadly, in the CA region. According to the Ministry of Foreign Affairs of the Republic of Kazakhstan (2018), in 2018, Kazakhstan was a member of 160 international organizations and participated in executive bodies and international treaties, many related to environmental and climate aspects. More than 30 bilateral agreements on environmental protection and climate change were developed with the World Bank (WB), The Global Environment Facility (GEF), the Green Climate Fund (GCF), the United Nations Development Program (UNDP), the Asian Development Bank (ADB), the

UN Environment Program and its European and Asian Offices, the FAO, the United Nations Commission on Sustainable Development, UNESCO, the European Environment Agency, the International Union for Conservation of Nature, and the World Center for Monitoring and Conservation of Nature (Institute of Ecology and Sustainable Development 2020). Drought-related challenges have been of particular concern since the early 1990s when Kazakhstan joined the United Nations Convention to Combat Desertification (UNCCD) and adopted the Program on Combating Desertification for 2005-2015. A series of other initiatives were deployed later on — such as the Subregional Action Program for the Central Asian Countries on Combating Desertification within the UNCCD Context, the National Action Plan for Prevention and Mitigation of Consequences of Sand and Dust Storms (FSD) for 2021-2024, and the National Action Plan to Combat Desertification and Strategic Measures to Combat Desertification until 2025.

In partnership with international organizations, donors, and development banks, Kazakhstan is actively developing projects to address environmental problems and climate change in agriculture and water management. In 2012, the United Nations Development Program (UNDP), one of the first UN agencies in Kazakhstan, launched the 'improving the resilience of the wheat sector in Kazakhstan to climate change to ensure food security in CA' project, which produced climate-smart agricultural (CSA) tools such as 1) an integrated internet-accessible geographic information system (webGIS/geoportal) and 2) a drought early warning system. Also, the project built technical capacity for national monitoring and analysis of drought using remote sensing technologies in agriculture. Furthermore, UNDP developed 'strategic measures to combat desertification in Kazakhstan until 2025' (UNDP 2015) and proposed recommendations to improve the national action plan to combat desertification. Among the extensive portfolio of UNDP projects in Kazakhstan, it is worth noting the regular GEF Small Grants Program, which aims to provide grant support to address issues related to climate change (mitigation and adaptation) and land degradation (sustainable land and water management)

(UNDP 2020). Also, from 2012 to 2016, 15 loans worth 370 million euros were approved by the European Bank for Reconstruction and Development (EBRD) for Kazakhstan's municipal and environmental infrastructure and energy. About 30 percent of the loans were directed to the sustainable development of agriculture (South Kazakhstan Water Supply Project, Ust-Kamenogorsk Water, Semey Water).

Also, regional projects on the mitigation and adaptation of climate change, droughts, and sustainable water resources management were developed and implemented in Kazakhstan by the World Bank (Climate Adaptation and Mitigation Program for Aral Sea Basin, second irrigation and drainage improvement project, Modernization of the Kazhydromet network) (WB 2022); Asian Development Bank (Irrigation Rehabilitation Sector Project, Developing the Central Asia Regional Economic Cooperation Water Pillar, Supporting Environmental Safeguards in the Central and West Asia Region, Water Resources Management and Land Improvement Project) (ADB 2022); and GIZ (sustainable and climate-sensitive land use for economic development in Central Asia, Developing a National Policy Resilient to the Impact of Climate Change in Kazakhstan).

Drought management policies are also the priority area of FAO's work in Kazakhstan. FAO supports Kazakhstan in developing a national land degradation decision support system, which will integrate validated indicators through participatory processes to identify vulnerable areas affected or potentially affected by drought. The FAO's support aims at a more efficient land-use system through remote sensing, field data surveys (geobotanical, soil, water) and expert knowledge (FAO 2017). Moreover, land degradation and droughts are addressed in the 'investment in sustainable pasture management and increasing forage crop productivity' (2017-2019) project to develop pasture forage production and improve degraded pasture lands (FAO 2020). Also, the GEF-7 Sustainable Forest Management Impact Program on Dryland Sustainable Landscapes — whose two

components are: 1) 'FAO-GEF Partnership for Sustainable Agriculture and the Environment' program implemented by FAO and 2) Kazakhstan Resilient Landscapes Restoration Project implemented by the World Bank in Kazakhstan — aims to maximize the effectiveness, efficiency, and sustainability of investments in drylands and achieve LDN status in the country (GEF 2021).

Despite significant mitigation efforts, severe and medium-level droughts have been repeatedly recorded from 1966 until today (Ministry of Energy of the Republic of Kazakhstan 2017). The water shortages have a detrimental effect on national agriculture by impacting the most grain-producing regions of Kazakhstan. Joint work of the Ministry of Energy of the Republic of Kazakhstan, UNDP, and GEF revealed that severe droughts could reduce yields by at least 50 percent on average in most grain-producing lands of West Kazakhstan, Aktobe, Karaganda, and Kostanay regions. The frequency and intensity of severe drought can variably increase from 5 percent to 70 percent, depending on the geomorphological features of the area (Ministry of Energy of the Republic of Kazakhstan 2017).

More robust mitigation and adaptation measures against drought, land degradation, and water stress are needed for Kazakhstan's drought-prone and ecologically vulnerable areas and Central Asia. The FAO-GEF Central Asian Countries Initiative for Land Management (CACILM-2) (2017-2024) is one of the noteworthy initiatives to recover and protect agricultural land, combat land degradation, and improve the living standards of rural populations in Central Asia. The uniqueness of the ongoing project is the focus on integrated natural resources management (INRM) in drought-prone and salt-affected agricultural production landscapes in Central Asia and Turkey. The project contributes to UNCCD and UNFCC (United Nations Framework Convention on Climate Change) objectives. Currently, fieldwork is conducted in 18 zones in arid, saline, and soil-degraded regions

of Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan (Institute of Ecology and Sustainable Development 2020).

In Kazakhstan, CACILM-2 focuses on improving drought-prone and salt-affected areas, scaling up SLM practices, and developing land degradation assessment and monitoring (Institute of Ecology and Sustainable Development 2020). The project activities are concentrated in pilot sites in the northern (Kostanay, Akmola, and Pavlodar regions), southern (Almaty, Zhambyl, Kyzylorda, and Turkestan regions), and central Kazakhstan (Karaganda region). The measures for adopting CSA practices and monitoring their progress have been developed; the drought-mitigation tools and technologies, disaster risk management (DRM) and IWRM principles, and cultivation of drought-resistant crops have been introduced on more than 350,000 hectares — of which about 20,000 hectares have already benefited until 2021 from the improved employment opportunities and the provision of drought- and salt-resistant seeds.

The CACILM-2 project has produced four vulnerability maps which enhance the knowledge base and skills to avoid, reduce, and reverse land degradation neutrality (LDN) in Kazakhstan by 2021. These maps encompass a land degradation map (the whole Kazakhstani territory covered — 272.5 million hectares); a salinity map (Zhambyl and Kyzylorda region, the overall area covered — 40 million hectares); drought vulnerability map (Kostanay region — 19 million hectares); and soil carbon organic map (Zhambyl region — 14 million hectares). By 2021, several strategies for disaster risk management and innovative integrated natural resources management technologies were upscaled in several Kazakhstani areas (240 hectares). CACILM-2 findings demonstrated that resource-saving soil protection technologies are cost-effective and can also be beneficial in the longer term. More information is presented in Tables A3-1 and A3-2.

CACILM-2 is an example of a working project that (i) proved the cost-effectiveness of resource-saving soil protection technologies and (ii) produced vulnerability maps that contribute to disaster risk prevention management for drought-prone regions. International programs such as CACILM-2 and national development projects support sustainable land-use resource systems and present evidence-based improvements; however, these often remain on a local scale and are planned for a short-term period. Insufficient implementation mechanisms on a local level and institutional inadequacies hamper the development of sustainable agriculture in Kazakhstan. Upscaling and long-term program initiatives are required with the engagement of state agencies to incentivize sustainable agriculture in the drought-prone lands of Kazakhstan.

## 7.5 POLICY, GOVERNANCE, AND INSTITUTIONAL GAP ANALYSIS

Despite the measures taken within the framework of approved programs to improve the efficiency of land use and projects implemented with the support of international organizations, Kazakhstan has not yet been able to build an adequate, sustainable system of land management. The leading institutional barriers at a national level are a) uncertainty of responsibility and authority for SLM and insufficient coordination among implementing agencies; b) absence of a specialized working body for SLM, which collects and analyzes current information and performs the necessary management decisions; and c) lack of experienced and qualified personnel. As also outlined in the Strategic Measures to Combat Desertification in the Republic of Kazakhstan until 2025 (UNDP GEF 2015), the measures should correspond to the formulation of a comprehensive national policy, legislative and institutional frameworks, economic

incentives, knowledge, and capacity building, as well as monitoring and research programs on land administration.

At a local level, a severe obstacle to SLM is the challenging access to relevant knowledge and technologies, credit resources, limited availability of information resources, and shortage of reliable scientific research. Moreover, programs are dominated by top-down approaches and technical solutions, while the active role of the land user is rarely considered. The land tax system is based on land classifications and soil quality but without considering the land market values and incentives for adopting SLM initiatives. There are currently limited ways to encourage farmers to use land resources carefully: indicatively, the guarantees of the long-term rights of resource users; simplified access to resources; updated equipment; access to financial resources; and state support programs. Currently, the Kazakh government proposes a mechanism of mutual farmer obligations, as well as the principle of accountability for the insurance of crops when receiving state subsidies. These measures aim to improve the effectiveness of subsidies and the efficient use of land resources.

Also, one of the FAO proposals was to better implement the National Project on the Development of Agro-Industrial Complexes until 2030 through the 'responsible land user' scheme. The idea is that farmers adopt voluntary obligations to create a standard of best agricultural practices, use resource-saving technologies, fulfil social obligations, and increase all production indicators. Responsible land users can be the flagships of farming reform, motivating other agribusiness participants to sustainable agricultural production and replicating their experience. This initiative could contribute to Kazakhstan's better endorsement of SDG indicator 2.4.1.

As for SDG indicators 6.4.1 and 6.4.2, which review the efficiency of water use and the level of pressure on water resources, the assessments are not feasible without sufficient and reliable data sources. In Kazakhstan, indicators 6.4.1 and 6.4.2 are not included in strategic documents as targets (as shown in the analysis in Table 7.4); however, water stress is steadily increasing in cultivated land, especially in the southern regions.

Existing national water accounting and monitoring systems do not meet the requirements of rational and integrated water resources management. By 2020, the state hydrometeorological network will lag behind the standards of developed countries regarding hydrometeorological data coverage. Only 352 hydrological posts operate in Kazakhstan; the number of hydrological posts for the country's vast territory should be 511 to increase the reliability of hydrological assessments (MEGNR 2020). There is also an inconsistency in water law enforcement, which generally leads to the deterioration of the situation at all levels of water sector development. Therefore, improvement of the current water legislation is required; the existing water code was adopted in 2003, and over the 16 years of its application, it has been amended 62 times — about three times per year.

The existing monitoring of land resources in Kazakhstan also needs to be improved to create a better quality of land management, as demonstrated in Table 7.4. The monitoring should be enhanced through the clarifying indicators used in land degradation, actualization and timely updating of the cartographic component, increasing stationary observation points for soil quality, improvement of remote sensing data, and public data access. Notably, the recently approved Concept for the Development of the Agro-industrial Complex of Kazakhstan until 2030 (Government of Kazakhstan 2021b) stresses the following gaps in the land management system in Kazakhstan:

**Gaps in the land management system in Kazakhstan**

· Lack of coordination and limited monitoring over the use and protection of agricultural land;
· Deterioration of land quality, absence of a unified service and platform for qualitative (soil, geobotanical, agrochemical) land registration, failure to meet the requirements for survey frequency because of lack of funding;
· Shortage of single-source information about vacant land plots in electronic format;
· Low rates of involvement of unused agricultural lands that could be cultivated;
· Weak mechanisms of dividend payments and prohibition of exit while being pledged in second-tier banks of conditional land shares;
· Inconsistency of the methodological approach in assessing the state of land resources with the requirements of the LDN classification (SDG indicator 15.3.1) inhibits comparative analysis and assessment with other countries.

Some measures have been adopted to expand organic production in Kazakhstan and increase sustainable resource use by achieving neutrality in land degradation. Technologies of organic farming significantly mitigate the harmful effects on the soil by reducing the intensification of the use of chemical fertilizers and pesticides. Kazakhstan has recently acquired some experience producing organic wheat, flax, and vegetable products. However, the weak legislation, tax regimes, and lack of certification systems hinder the country's potential.

The earlier targets are closely related to SDG 15 to achieve an LDN world by 2030 and SDG indicator 15.3.1, which measures the area of degraded land as a percentage of land area. In fact, in the action plan for implementing the concept for the development

of the agro-industrial complex of the Republic of Kazakhstan for 2021-2030, indicator 15.3.1 is presented; however, it is not aligned with the global methodology and is not well integrated, as noted in Table 7.5.

It is also emphasized that the national SDG indicators 2.4.1, 6.4.1, 6.4.2, and 15.3.1 should be aligned with international methodology and integrated into national policies. There is a need to bring the national methods in line with global standards, develop target values for achievement by 2030, and develop an action plan with a quality monitoring process. Moreover, it is necessary to strengthen the indicators and principles of sustainable management of natural resources through legislative and strategic initiatives. Table 7.5 gives a brief overview of the institutional, governance, and policy gaps and recommendations for the better integration of SDG-related indicators.

Table 7.5. Policy, governance, and institutional gaps on SDGs in Kazakhstan and recommendations

| Policy, governance, and institutional gaps | Recommendations | Beneficiary SDGs |
|---|---|---|
| -Top-down approach to sustainable land management<br>-Overlooked role of farmers and users in sustainable land management and decision-making processes | Introduction of the responsible land user institution to contribute to the Concept of Agro-Industrial Complex Development | 2.4.1. 'Proportion of agricultural area under productive and sustainable agriculture |
| Lack of institutional and legal enforcement and consistency | Improvement of the current strategic water policy and water legislation | 6.4.1 'Change in water use efficiency over time and 6.4.2 'Level of water stress: freshwater withdrawal as a proportion of available freshwater resources' |

| | | |
|---|---|---|
| Methodological inconsistency in the assessment of the state of land resources and the requirements for the LDN classification | Improving the methodology and adopting monitoring for LDN indicator | 15.3.1. 'Percentage of land degraded over a total land area' |

## 7.6 CONCLUSION

Sustainable land and water resources are supported in Kazakhstan to mitigate the consequences of drought and land degradation. Sustainability is sought to be achieved in the country through strategic and national documents such as 'Kazakhstan 2050,' Concept for Kazakhstan's Transition to a Green Economy by 2050, State Program for Water Resources Management, Environmental Code, Law on Pastures, National Project for the Development of the Agro-Industrial Complex of Kazakhstan for 2021-2025, the Concept for the Development of the Agro-Industrial Complex for 2021-2030, and the Zhasyl Kazakhstan project. Also, internationally driven projects contribute to LDN and enhance agricultural resilience to drought. As mentioned, the interregional CACILM-2, GEF Small Grants program, and FAO's Resilient Agroforestry and Rangeland Management project effectively implement integrated natural resources management in drought-prone regions and improve ecological conditions and local livelihoods.

Moreover, to mitigate and adapt measures against drought, the Government of Kazakhstan designs and implements national strategies and action plans. Also, SDG-customized indicators are introduced to confront significant agri-environmental

challenges. The Concept for the Development of the Agro-Industrial Complex for 2021-2030 is the main guideline in Kazakhstan to mainstream SDGs toward sustainable agricultural and food systems in the country. However, it still does not comprehensively address the needs on a local level since essential methodological and monitoring inconsistencies are presented in land-use planning. Overall, it is acknowledged that Kazakhstan is known internationally as a country with an active position towards committing its national obligations for achieving neutrality in carbon and land degradation; however, current state programs and international support to combat drought and land degradation in the country are still insufficient. More institutional changes are required to improve the effectiveness of the national anti-drought strategies.

According to prevalent climate change scenarios, in fewer than 60 years, global warming will provoke a massive degradation of pastures in Kazakhstan, leading to a decline in the export performance of dominant crops. The country should strive to transform energy-intensive agriculture into a balanced farming regime, the main feature of which is the optimal balance between energy consumption, yields, and environmentally sustainable agricultural production. By following the best practices of neighboring states like Uzbekistan and Tajikistan, Kazakhstan must develop an agricultural adaptation strategy based on climate change monitoring for the agroecological suitability of lands. The implementation of the strategy should be guided by mid- and long-term indicators related to a local context, gender aspect, and age disaggregation ('leaving no one behind' principle). The strategy's targets must also foresee a regional context and contribute to the common goal of building a resilient and sustainable future for the broader CA region. More substantial incentives must be realized to stimulate climate-smart organic agriculture and drought-resistant crops.

Moreover, LDN targets, although accepted on a national level, must be implemented in the national short- and long-term development programs, the corresponding target of which should be elaborated in the agricultural adaptation strategy. The critical focus of the program should be strengthening sustainable land management, where a land-farmer-government interaction is followed. Responsible use of land and water resources and trustworthy farmer-government activities should be prioritized by integrating transparent and efficient legislation, tax, and monitoring systems. The national strategy should focus on the capacity development of methodological and monitoring platforms and hydrometeorological services, as these are key for building preventive and early warning systems. Efficient and timely monitoring is essential for achieving sustainable targets and goals. As Table 7.4 shows, Kazakhstan has considerably endorsed sustainable land use and management practices via the trustworthy monitoring of SDG indicators. However, improved monitoring of the water resources management and environmental protection — learned from Uzbekistan's experience — should be studied and upscaled for Kazakhstan and other drought-prone CA areas.

Current practices of agricultural intensification have proven to be unsustainable. High-intensity land and water use are depleting the productive capacity of land and water systems, causing severe land degradation and deteriorating the quality of ecological services. Incorrect planning for intensive livestock production can lead to adverse environmental consequences, including soil and vegetation erosion, water and marine pollution, and the unsustainable use and conversion of vast rangelands. Hence, upscaling environmentally responsible and climate-smart production and implementing the concept of LDN can be a powerful tool in combating desertification and the degradation of farmland.

The strategy for creating sustainable agrifood systems should be based on the climate-smart use of land resources such as agroecology; soil-protective and resource-conserving agriculture; organic agriculture; agroforestry; the organization of mixed crop-livestock farms; the introduction of capacity-building institutions; and the implementation of sustainable livestock management practices in line with the Global Agenda for Sustainable Livestock and Sustainable Use.

Also, emphasis is needed on the development and conservation of livestock genetic resources based on the Global Plan of Action for Animal Genetic Resources; improvement of rangeland management measures that will contribute to the development of forage production and improvement of pasture productivity; the restoration of grasslands and other rangelands to enhance soil carbon sequestration; the prevention of the infiltration of invasive species; control of the expansion of rangelands and forage crops at the expense of forested lands; and building food systems based on a principle of a circular economy.

Land use management in the drought-prone regions of Kazakhstan presented in this study could be a helpful example for CA countries to follow, thereby developing national planning and policies for agricultural land management and droughts. National and regional efforts should be oriented toward implementing an integrated approach to sustainable resource use, addressing the main threats associated with land degradation, water scarcity, poverty, and gender inequality, and developing comprehensive monitoring of SDG indicators.

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# Annex 1. Farming allocation, land use, and degradation challenges in Kazakhstan

Table A1-1. Land cultivated by individual farmers or farm enterprises (as of 1 July 2020)

| | No. of farms or farm enterprises | Numbers of farmers or farm enterprises (no.) and hectares (ha) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | up to 50 ha | | 51-200 ha | | 201-500 ha | | 501-1,000 ha | | 1,001-10,000 ha | | 10,001-20,000 ha | | over 20,000 ha | |
| | | Farmers (no.) | Area (ha) | Farmers (no.) | Area (ha) | Farmers (no.) | Area (ha) | Farmers (no.) | Area (ha) | Farmers (no.) | Area (ha) | Farmers (no.) | Area (ha) | Farmers (no.) | Area (ha) |
| **Republic of Kazakhstan** | 133,965 | 80,458 | 981,190 | 20,841 | 2,499,256 | 13,227 | 4,909,828 | 8,265 | 6,762,480 | 10,902 | 29,389,999 | 215 | 3,139,278 | 57 | 3,603,519 |
| **Akmola** | 3,356 | 263 | 8,298 | 1,158 | 141,005 | 922 | 316,347 | 480 | 357,056 | 528 | 1,198,294 | 5 | 62,710 | - | - |
| **Zhambyl** | 11,937 | 7,431 | 126,577 | 2,438 | 276,165 | 1,104 | 371,204 | 491 | 361,702 | 462 | 1,133,427 | 9 | 114,397 | 2 | 53,492 |
| **Kostanay** | 3,560 | 260 | 9,724 | 1,170 | 165,732 | 860 | 372,954 | 535 | 491,531 | 715 | 2,131,236 | 13 | 225,125 | 7 | 389,845 |
| **Kyzylorda** | 2,972 | 878 | 22,120 | 1,021 | 121,033 | 577 | 199,069 | 266 | 196,150 | 223 | 531,349 | 4 | 53,648 | 3 | 72,894 |
| **North Kazakhstan** | 2,431 | 239 | 9,035 | 980 | 117,196 | 541 | 201,705 | 315 | 258,722 | 351 | 927,840 | 4 | 93,002 | 1 | 21,973 |
| **Turkestan** | 48,292 | 43,340 | 408,476 | 3,571 | 391,383 | 961 | 326,784 | 286 | 213,806 | 131 | 287,976 | 3 | 41,596 | - | - |

Source: Adapted from 'Statistical Compilation 2016-2020,' by Bureau of National Statistics (2021)

Table A1-2. Agricultural land use in Kazakhstan (thousands of hectares as of November 2020)

| | Total area of agricultural land | Agricultural land uses | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Arable land | Perennial plantations | Deposits | Hayfields | Pastures | Forest area | Swamps | Underwater | Other |
| **Republic of Kazakhstan** | 108,563 | 25,807 | 62 | 1,853 | 2,225 | 75,599 | 1.3 | 131 | 200 | 2,684 |
| **Akmola** | 10,848 | 5,958 | 1,6 | 292 | 152 | 4,419 | 0 | 2.5 | 6.5 | 17 |
| **Zhambyl** | 4,705 | 782 | 3.7 | 0 | 120 | 3,665 | 0.1 | 2.7 | 7.2 | 125 |
| **Kostanay** | 10,441 | 6,177 | 1,4 | 85 | 130 | 3,907 | 0 | 31 | 23.7 | 86 |
| **Kyzylorda** | 2,788 | 177 | 0.6 | 40 | 37 | 1,998 | 0 | 2.1 | 3.6 | 531 |
| **North Kazakhstan** | 7,342 | 4944 | 0.8 | 57 | 17 | 2,084 | 0.2 | 44 | 66.2 | 129 |
| **Turkestan** | 4,308 | 865 | 28 | 102 | 69 | 3,127 | 0.2 | 0.1 | 7.4 | 109 |

Source: Adapted from 'Statistical Compilation 2016-2020,' by Bureau of National Statistics (2021)

Table A1-3. Impacts on agricultural areas in the Kazakhstan's regions (thousands of hectares, as of November 2020)

| | Agricultural land uses | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Crushed | Saline | Salty | Eroded | Deflated | Waterlogged | Marshy | Other |
| **Republic of Kazakhstan** | 3,848 | 4,898 | 179,132 | 15,341 | 1,137 | 7,655 | 24,436 | 262,918 |
| **Akmola** | 410 | 242 | 6,422 | 478 | 68 | 382 | 561 | 14,612 |
| **Zhambyl** | 0 | 252 | 7,003 | 2,242 | 30 | 352 | 1,217 | 11,938 |
| **Kostanay** | 237 | 344 | 11,294 | 302 | 137 | 443 | 599 | 19,600 |
| **Kyzylorda** | 62 | 109 | 11,856 | 5,155 | 13 | 2,366 | 4,349 | 24,099 |
| **North Kazakhstan** | 107 | 34 | 3,271 | 597 | 91 | 363 | 352 | 9,804 |
| **Turkestan** | 125 | 95 | 8,866 | 590 | 1.7 | 158 | 820 | 11,609 |

Source: Adapted from 'Statistical Compilation 2016-2020,' by Bureau of National Statistics (2021)

## Annex 2. Seeded and harvested area and land productivity for Kazakhstani crops for 2021

Table A2-1. Spring and winter wheat, cereals (including rice) and legumes, and oilseeds across the Kazakhstan regions

| Region | Spring and winter wheat | | | Cereals (including rice) and legumes | | | Oilseeds | | |
|---|---|---|---|---|---|---|---|---|---|
| | Seeded area (hectares) | Harvested area (hectares) | Productivity (kg/hectare) | Seeded area (hectares) | Harvested area (hectares) | Productivity (kg/hectare) | Seeded area (hectares) | Harvested area (hectares) | Productivity (kg/hectare) |
| **Akmola** | 3,977,882 | 3,872,252 | 870 | 4,585,629 | 4,463,168 | 870 | 270,545 | 258,563 | 550 |
| **Aktobe** | 327,028 | 323,270 | 560 | 444,486 | 435,634 | 580 | 68,818 | 65,667 | 610 |
| **Almaty** | 137,438 | 136,404 | 1,570 | 486,101 | 479,012 | 2,840 | 133,829 | 133,429 | 1,960 |
| **Atyrau** | | | | | | | | | |
| **West Kazakhstan** | 175,144 | 163,664 | 750 | 248,734 | 232,323 | 710 | 121,916 | 113,694 | 590 |
| **Zhambyl** | 169,002 | 165,681 | 1,150 | 402,791 | 392,623 | 1,400 | 59,186 | 58,430 | 800 |
| **Karagandy** | 769,961 | 760,635 | 920 | 949,722 | 936,453 | 920 | 25,859 | 25,759 | 630 |
| **Qostanay** | 3,643,252 | 3,590,833 | 720 | 4,088,835 | 4,007,146 | 710 | 607,098 | 529,306 | 450 |
| **Kyzylorda** | 11,531 | 11,230 | 920 | 97,136 | 96,782 | 4,770 | 6,727 | 6,624 | 940 |
| **Mangystau** | | 637,780 | | | 865 675 | | | | |
| **Pavlodar** | 638,223 | 2,428,433 | 1,110 | 871,851 | 2,991,515 | 1,990 | 271,059 | 268,159 | 810 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **North Kazakhstan** | 2,440,384 | 196,321 | 1,180 | 3,015,426 | 294,611 | 1,160 | 959,946 | 895,859 | 800 |
| **Turkestan** | 206,071 | 421,370 | 1,150 | 305,172 | 593,348 | 1,150 | 85,657 | 85,076 | 730 |
| **East Kazakhstan** | 425,094 | 1,720 | 1,590 | 599,614 | 1,720 | 1,650 | 487,655 | 484,004 | 1,380 |
| **Nur-Sultan city** | 1,720 | | | 1,720 | | | | | |
| **Almaty city** | | 9,772 | 400 | | 10,702 | 390 | | | 530 |
| **Shymkent city** | 9,845 | 3,872,252 | 750 | 10,825 | 4,463,168 | 830 | 4,083 | 3,413 | 550 |

Note: In the case of blank cells, no data is provided
Source: Adapted from 'Statistics on Agriculture, Forestry, Hunting and Fishing' by Bureau of National Statistics (2022b)

## Table A2-2. Potato, open ground vegetables, gourd, sugar beet, cotton, and tobacco crops across the Kazakhstan regions

| Region | Potato | | | Open ground vegetables | | Gourd | Sugar beet | | Cotton (CT) and tobacco (TB) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Seeded area (hectares) | Harvested area (hectares) | Productivity (kg/hectare) | Seeded area (hectares) | Harvested area (hectares) | Harvested area (hectares) | Harvested area (hectares) | Productivity (kg/hectare) | Seeded area (hectares) | Harvested area (hectares) | Productivity (kg/hectare) |
| **Akmola** | 15,223 | 15,050 | | 2,355 | 2,333 | 2 | | | | | |
| **Aktobe** | 6,384 | 6,378 | 16,570 | 4,595 | 4,573 | 1,109 | | | | | |
| **Almaty** | 40,608 | 40,518 | 19,490 | 33,319 | 33,316 | 4,465 | 6,902 | 24,900 | | | |
| **Atyrau** | 1,974 | 1,972 | | 2,801 | 2,797 | 1,252 | | | | | |
| **West Kazakhstan** | 3,924 | 3,922 | 14,800 | 3,510 | 3,510 | 1,719 | | | | | |
| **Zhambyl** | 11,446 | 11,445 | 23,390 | 43,226 | 43,218 | 14,627 | 5,156 | 31,090 | | | |
| **Karagandy** | 16,446 | 16,338 | 24,030 | 3,335 | 3,223 | 26 | | | | | |
| **Qostanay** | 9,050 | 8,790 | 18,920 | 2,307 | 2,305 | 256 | | | | | |
| **Kyzylorda** | 3,809 | 3,808 | 14,450 | 6,045 | 6,045 | 8,453 | | | | | |
| **Mangystau** | 1.1 | | | 353 | 347 | 468 | | | | | |
| **Pavlodar** | 15,329 | 15,329 | 28,900 | 6,890 | 6,829 | 2,042 | | | | | |
| **North Kazakhstan** | 19,748 | 19,526 | 17,980 | 5,630 | 5,612 | | | | | | |
| **South Kazakhstan** | 20,129 | 20,127 | N/A | | | | | | | | |
| **Turkestan** | 31,195 | 30,675 | 20,430 | 42,868 | 42,868 | 70,790 | | | 109,971 (CT)<br>334 (TB) | 109,971 (CT)<br>334 (TB) | 2,640 (CT)<br>3,410 (TB) |
| **East Kazakhstan** | 74 | 66 | 22,820 | 9,116 | 9,096 | 4,679 | 0.1 | | | | |
| **Nur-Sultan city** | 108 | 108 | 9,620 | 217 | 17 | | | | | | |
| **Almaty city** | 346 | 346 | 13,420 | 202 | 202 | | | | | | |
| **Shymkent city** | | | | 2,059 | 2,058 | 91 | | | | | |

Note: In the case of blank cells, no data was available

Source: Adapted from 'Statistics on Agriculture, Forestry, Hunting and Fishing' by Bureau of National Statistics (2022b)

# Annex 3. Activities and interim results of the CACILM-2 project in Kazakhstan

Table A3-1. Project components of CACILM-2

| Project component | Region | Year | Indicator | Land area, hectares | Interim improvement | Outcome |
|---|---|---|---|---|---|---|
| **Introduction, cultivation, and distribution of drought- and salt-tolerant crops:**<br>**Supporting drought- and salt-tolerant pasture crops and propagation of improved native species** | Almaty | 2020<br>2021 | Pasture crops:<br>1) wheatgrass (agropyron desertorum)<br>2) hair (psathyrostachys [elymus] juncea)<br>3) izen (kochia prostrata [L.])<br>4) sainfoin (onobrychis arenaria) | 5<br>30 | All varieties of perennial pasture crop tested in 2020-2021 in the semi-desert zone, where the average annual rainfall is 200-250mm, showed a good result | Field trials and demonstration of drought- and salt-tolerant pasture crops of 4 genotypes in the Almaty region (South-Eastern Kazakhstan) on a total area of 35 hectares (5 hectares—2020, 30 hectares—2021) |
| **Implementation of soil protection technologies** | Almaty | 2020<br>2021 | Oats, barley, Sudan grass, millet, sorghum, and African millet<br>Sudan grass, sorghum | 7.5<br>2 | Satisfactory results are shown from oats, barley, Sudanese grass, millet<br>No data available | No data available |
| **Combat salinization and rehabilitation of degraded irrigated lands in the Kyzylorda region:**<br>**Effects of introducing sugar sorghum into rice crop rotation** | Kyzylorda | 2021 | Before the introduction of sugar sorghum:<br>degree of salinity<br>pH<br>humus<br>amount of salts (%) | 47 (demo sites of four peasant farms) | After the introduction of sugar sorghum:<br>degree of salinity improved<br>pH decreased<br>humus increased<br>amount of salts (%)—no consistent result | Sugar sorghum improves the physical and chemical composition of soil in saline lands |
| **Rehabilitation of degraded lands through strip-sowing of perennial in the Almaty region** | Almaty | 2021 | Harvesting of grain barley, oats, millet, Sudanese grass, Mohar, Alfalfa, sainfoin, wheatgrass | 18 | 10-hectare demo site: 3 tons of hay harvested from Sudanese grass and 3 hectares under mohar<br>8-hectare demo site: 6 tons of hay harvested from Sudanese grass; the oats did not give a crop | The regrowth of perennial grasses in the first year of life, such as alfalfa, sainfoin, and wheatgrass, was satisfactory |

* Soil analysis results are demonstrated for depths 0-20cm

Table A3-2. Project cost savings through convention and resource-saving interventions

| Conventional practices | Resource-saving interventions | | | | |
|---|---|---|---|---|---|
| | 1st year of implementation | | Future implementation | | |
| OPERATIONS | US$/ hectares | Activities | US$/ hectares | Activities | US$/ hectares |
| PLOUGHING | 16 | | 0 | - | - |
| | - | | 19 | Herbicide treatment | 20 |
| CULTIVATION | 12 | | 12 | - | - |
| DISKING | 10 | | - | - | - |
| SEED THINNING | 6 | | - | - | - |
| SOWING (SEEDS, FERTILIZER) | 163 | | 163 | Direct sowing | 163 |
| HERBICIDE TREATMENT | 21 | | 21 | Herbicide treatment | 10 |
| INTER-ROW CULTIVATION | 11 | | - | - | - |
| FERTILIZATION | 76 | | 76 | Fertilization | 76 |
| 2-ROW CULTIVATION | 11 | | - | - | - |
| HARVESTING | 9 | | 9 | Cleaning | 9 |
| TOTAL | 337 | | 322 | | 278 |

Note: The US$ is estimated on the exchange rate of 1US$ = 477 KZT equivalence as of 23 August 2022

Source: Adapted from Regional FAO/GEF project 'Integrated natural resource management in drought-prone and saline agricultural production landscapes in Central Asia and Turkey,' by Iskandarova K.A., Meldebekova, Ainebekova B.A. (2021). World Soil Day Conference FAO, Astana.