Comprehensive analysis of the disaster risk reduction system for the agricultural sector in Kazakhstan
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<table>
<thead>
<tr>
<th>Abbreviation</th>
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<tr>
<td>AMIS</td>
<td>Agricultural Market Information System</td>
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<tr>
<td>CCC</td>
<td>Climate Change Coordination Center</td>
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<td>CES</td>
<td>Committee of Emergency Situations</td>
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<td>CESDRR</td>
<td>Center for Emergency Situations and Disaster Risk Reduction</td>
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<tr>
<td>CIS</td>
<td>Commonwealth of Independent States</td>
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<td>CMC</td>
<td>Crisis Management Centre</td>
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<td>DRR</td>
<td>Disaster risk reduction</td>
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<td>EWS</td>
<td>Early warning system</td>
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<td>FAO</td>
<td>Food and Agriculture Organization of the United Nations</td>
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<td>GDP</td>
<td>Gross domestic product</td>
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<td>GEF</td>
<td>Global Environment Facility</td>
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<td>GIZ</td>
<td>Deutsche Gesellschaft für Internationale Zusammenarbeit (German Agency for International Cooperation)</td>
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<tr>
<td>ICPC</td>
<td>Interagency Civil Protection Commission</td>
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<td>IPCC</td>
<td>Intergovernmental Panel on Climate Change</td>
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<td>IWG</td>
<td>Intersectoral Working Group</td>
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<tr>
<td>Kazhydromet</td>
<td>National Hydrometeorological Service of the Ministry of Ecology, Geology and Natural Resources</td>
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<td>MoE</td>
<td>Ministry of Energy</td>
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<tr>
<td>MEGNR</td>
<td>Ministry of Ecology, Geology and Natural Resources</td>
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<tr>
<td>MES</td>
<td>Ministry of Emergency Situations</td>
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<tr>
<td>MEWR</td>
<td>Ministry of Environment and Water Resources</td>
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<tr>
<td>MIA</td>
<td>Ministry of Internal Affairs</td>
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<tr>
<td>MNE</td>
<td>Ministry of National Economy</td>
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<td>MoA</td>
<td>Ministry of Agriculture</td>
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<tr>
<td>NGO</td>
<td>Non-governmental organizations</td>
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<td>RSE</td>
<td>Regional state enterprise</td>
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<td>SCPS</td>
<td>State Civil Protection System</td>
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<tr>
<td>UDDS 112</td>
<td>Unified Duty Dispatch Service “112”</td>
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<tr>
<td>UNDP</td>
<td>United Nations Development Programme</td>
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<tr>
<td>UNFCCC</td>
<td>United Nations Framework Convention on Climate Change</td>
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<tr>
<td>UNICEF</td>
<td>United Nations International Children’s Emergency Fund</td>
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<tr>
<td>USAID</td>
<td>United States Agency for International Development</td>
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<tr>
<td>USSM</td>
<td>Unified state system for monitoring the environment and natural resources</td>
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<td>WHO</td>
<td>World Health Organization</td>
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<td>WMO</td>
<td>World Meteorological Organization</td>
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Executive summary

Agricultural hazard profile. The agricultural hazard profile includes complex sectoral risks that are likely to damage agricultural production under the influence of natural and climatic factors, as well as those induced by agricultural economic activities. The territory of Kazakhstan is exposed to various natural hazards, including earthquakes, flooding, landslides, mud flows, avalanches, and extreme temperatures which undermine sustainable agriculture. Risks of drought, soil erosion, plant damage from diseases and pests, as well as hail, also have a high degree of impact. According to long-term forecasts (Kozhakhmetov and Nikiforova, 2016) in Kazakhstan, the frequency of heavy rain, storm winds and hail, as well as wind activity, may increase. The agricultural sector is most vulnerable to and dependent on external climatic factors. Rising temperatures and changes in the nature and frequency of precipitation have a negative impact on the sector – lower yield productivity, depletion of forage land, inferior quality of land resources, and the development of degradation processes.

Agriculture and food security profile. The share of agricultural land in the land fund is 40.1 percent of the land in use. The country's agro-industrial complex is characterised by a mature grain industry, animal breeding, the production of vegetables and fruit, and fisheries. Agroclimatic and soil conditions are the main barriers for agricultural production, particularly for crops. The largest area of arable land is located in the northern part of the country, which are grain-sowing regions. The largest area of pastures is located in central and western areas, while perennial plantations prevail in the mild climate zone of the south of the country. At the beginning of 2020, the share of the employed population living in rural areas was 41.5 percent, while the sector's contribution to gross domestic product (GDP) remains low, not exceeding 5.4 percent (Statistics Bureau, 2021a). The affordability of food in Kazakhstan is lower than that of developed countries and Eurasian Economic Union (EAEU) countries. The share of income spent on food is 52.3 percent among the poorest 10 percent of the population. Access to drinking water in rural areas also remains an issue.

Disaster risk reduction (DRR), climate change, and food security regulatory frameworks. Kazakhstan is a party to a number of international treaties, conventions and agreements addressing the issues of DRR, climate change, and food security, including the UN Framework Convention on Climate Change; Convention to Combat Desertification; Kyoto Protocol to the United Nations Framework Convention on Climate Change; Declaration of the World Summit on Food Security; Sendai Framework for Disaster Risk Reduction 2015–2030; and the 2030 Agenda for Sustainable Development. The country's State Civil Protection System (SCPS) has legal grounds from the Constitution of the Republic of Kazakhstan, consisting of the Law On Civil Protection and other regulatory legal acts. Food security is one of the main priorities of Kazakhstan, as specified in a number of regulatory documents. At the same time, the legal framework in the field of food security does not cover the role and impact of climate, and emergencies risks. Kazakhstan has a number of key strategies, concepts and related action plans that outline the strategic directions for climate change mitigation and adaptation in the country. The main strategic priorities of the country are concentrated in the long-term development programme, Kazakhstan–2050, and the Environmental Code of the Republic of Kazakhstan. Existing programmes are more focused on the country’s better economic development and food security. The main climate-change law, the Environmental Code of the Republic of Kazakhstan, regulates climate-change mitigation only through capping greenhouse gas (GHG) emissions (Government of Kazakhstan, 2020).

Institutional structure for the disaster risk management system. The country's SCPS is mandated to implement a set of protection measures against hazards stemming from emergencies and military conflicts. However, the existing system does not cover climate-change mitigation and adaptation. The coordinating and governing body is the Interagency Civil Protection Commission (ICPC). The Committee of Emergency Situations (CES) of the Ministry of Internal Affairs (MIA) is the competent authority that performs civil protection functions. The main DRR activities of the Ministry of Agriculture (MoA) focus on epizootic and phytosanitary safety of agricultural industries, monitoring of productivity, and degradation of farmland. Monitoring and prediction of hazardous processes and phenomena in terms their probability, impact and possible consequences
are competences of the National Hydrometeorological Service of the Ministry of Ecology, Geology and Natural Resources – Kazhydromet. On the initiative of Kazakhstan and upon the signing of an intergovernmental agreement between Kazakhstan and Kyrgyzstan, a regional Centre of Emergency Situations and Disaster Risk Reduction was established in 2016.

**Early warning systems (EWS).** Kazhydromet is the main actor that monitors and forecasts the natural hazards that threaten agricultural production and infrastructure in Kazakhstan. Information about the threat or occurrence of natural or man-made emergencies is transmitted to the Crisis Management Centre (CMC) of the CES. The information received by the CMC becomes the basis for further warning of the population and government agencies. The country operates a unified state system for monitoring the environment and natural resources (USSM) and undertakes efforts to strengthen the capacity of its monitoring network and improve the disaster prevention system, but the next stage – disaster risk management – is ineffective and needs further improvement. The epizootic situation is monitored and analysed by the Committee of Veterinary Control and Supervision of the MoA. Phytosanitary risks are monitored and analysed by the Republican Methodological Centre for Phytosanitary Diagnostics and Forecasts of the State Inspection Committee in the Agro-Industrial Complex. Farmland conditions are monitored and assessed by the Committee of Land Management. At the same time, as prescribed by current orders, farmers must themselves conduct phytosanitary monitoring, perform phytosanitary measures, and prevent the development and spread of harmful and especially dangerous organisms. There is no stand-alone organization to provide farmers with up-to-date information on prices for agricultural products in the country, although some state organizations are endowed with such functions.

**Agrometeorological infrastructure and services.** Kazakhstan has an integrated public policy in the field of agrometeorology provided by Kazhydromet. Agrometeorological monitoring in the country takes place at 206 agrometeorological points (weather stations and agrometeorological posts), including meteorological observations, monitoring of agricultural and pasture crop growth, and soil conditions. Agrometeorological products, including information on the current state of crops, and consultations, are provided according to the evidence-based data of the state observation network. The agrometeorological brief (issued every ten days) as well as agroclimatic maps, are regularly posted (with free access) on the website. In October 2020, Kazhydromet launched a new web app, AgroData ([https://agrodata.kz/](https://agrodata.kz/)). This app is designed to provide agrometeorology services to smallholders and farms, as well as other stakeholders. The evidence-based information obtained from the state observation network and public forecasts is available on the app free of charge and without special registration. However, the customised information or recommendations for specific farms are provided individually, on a contractual basis. Kazakhstan's system of measures on agrometeorology capacity development is underdeveloped, both among specialists of meteorological services and among farmers. A number of meteorological phenomena are not fully covered by the national observation network.

**Disaster risk reduction in agriculture.** A number of effective measures have been taken to reduce disaster risks in Kazakhstan; however, an integrated DRR system still needs to be created for the agricultural sector. At the moment, Kazakhstan does not have a DRR strategy aligned with the Sendai Framework. There are no strategic long-term plans for disaster preparedness and risk reduction to address natural and man-made disasters in the agricultural sector, due to their unpredictability, and a lack of disaster forecasting. The issues of emergency-related damage, losses and needs assessment in the agricultural sector have not been addressed. There are no common approaches to assess the damage in various agricultural industries, which leaves agricultural risks insurance unappreciated. Kazakhstan has practical experience in organizing rescue and recovery operations after natural and man-made disasters, a wide network of rescue and recovery subdivisions, emergency reserve forces, but this work lacks focus on DRR prevention and early action, in particular in agriculture.

**Programmes and projects.** In comparison with other countries in Central Asia, Kazakhstan's engagement in projects with international organizations is lower. To accelerate the process of modernization and improvement, it is necessary to draw on positive international experience by implementing international and joint projects. Such projects should support better implementation of state programmes, and capacity development for national structures, to promote the results of projects with international organizations.

**Conclusions and recommendations.** The concept of DRR in Kazakhstan, as a separate doctrine, is either not available or closed for access. Existing legislation does not cover climate-change implications, and it also lacks a link with the agricultural sector and food security. The country has a coordinating body for the State
Civil Protection System. A number of committees under the MoA supervise epizootic and phytosanitary safety as well as the state of farmland. However, the agricultural sector is not fully covered in terms of disaster risk prevention and reduction. The EWS for possible risks is concentrated in the state institution Kazhydromet. Along with that, the current monitoring network does not cover the entire territory, with meteorological posts causing forecasting challenges in terms of location accuracy, time of occurrence, and types of adverse weather events. The low level of farmer expertise makes the EWS in agriculture less effective. Kazakhstan is a member of the Agricultural Market Information System (AMIS). However, there is no stand-alone organization to provide farmers with up-to-date information on prices for agricultural products in the country, although such functions are vested in the state organizations KazAgro, Food Contract Corporation, and others. Until 2018, this function belonged to the Kazagromarketing company.

Evidence-based agrometeorological information and general use forecasts are provided to the public free of charge through the existing websites and apps of Kazhydromet. However, customised information or recommendations for specific farms are provided for a fee, on a contractual basis. The country’s system of measures on agrometeorological capacity development is underdeveloped, both among specialists of meteorological services and among recipients of information (farmers). The disaster risk management system is mainly about civil protection and does not provide details for the agricultural sector. The country lacks developed and approved strategic long-term disaster preparedness and risk reduction plans. At the moment, data on agricultural losses induced by disasters caused by natural hazards are not compiled through national statistics. Insurance in crop production has been voluntary since 2020.

Based on a review, the following recommendations are proposed for consideration, for the sake of capacity development and a better functioning disaster risk management system that takes into account climate change and food security:

**Recommendations to strengthen the regulatory framework for disaster risk reduction:**

- Develop a system of indicators for economic, technical and social effectiveness as part of an open, public assessment of governmental disaster risk reduction and management programmes. Create open resources to inform about these programmes’ implementation.
- Develop and approve the procedure for action and decision making in case of storm warnings for representatives of local executive agencies and agricultural producers, amend the relevant regulatory legal acts.
- Fix the conceptual framework (definitions) at the legislative level in the relevant documents (in terms of DRR, climate change, and food security).
- Improve and fix the existing methodological framework for disaster risk management in the legislation, develop sectoral programmes and plans for DRR in the agricultural sector.

**Recommendations to strengthen the institutional framework for disaster risk management:**

- Update disaster risk management in terms of distribution of powers and responsibilities, allocation of early warning functions. Develop mechanisms of interaction for prevention, response and information exchange on these matters.
- Improve the interaction of line ministries with local executive authorities.

**Recommendations to improve the early warning system:**

- Improve the quality of agrometeorological support available for the agricultural sector. Develop and approve regulations for actions and a list of measures for early warning and prompt response to storm warnings, taking climate change into account.
- Develop up-to-date methodological manuals for epizootics and epiphytotics prevention in terms of changes in their nature and severity, and create programmes to support institutions involved in disaster risk early warning.
- Improve the training system to teach farmers the basics of crop and livestock production with an emphasis on disaster risk management.
- Develop the AMIS in the country to facilitate marketing research and timely response of agricultural producers to market changes.
Recommendations to improve agrometeorology services:

- Broader use of geographic information systems (GIS) and high-quality satellite data, which also requires the training of specialists, development and adaptation of the methodological framework, and determination of risk threshold values.
- Develop and adapt software products for predicting adverse natural events for major crops.
- Organize educational events for meteorologists.
- Strengthen awareness-raising activities for residents of rural and remote areas about the existing threats, degree of their impact, and measures to mitigate the consequences of emergencies through educational and public institutions.

Recommendations for disaster risk reduction in agriculture:

- Develop a disaster risks profile for the agricultural sector containing information on the characteristics of natural hazards and anthropogenic impacts, likelihood of their occurrence, possible consequences and damage, and so on.
- Develop and approve, at government level, common approaches to the assessment of damage and losses from all types of agricultural emergencies.
- Establish an interagency and intersectoral working group to develop common approaches to the assessment of damage and losses.
- Develop an up-to-date system to assess agricultural risks, with the distribution of functions and responsibilities among state institutions.
- Develop common sectoral approaches to assess agricultural damage based on remote monitoring data.
- Develop the insurance market in the country, backed by a methodological framework for objective risks and damage assessment.
- Conduct research to identify opportunities for better quality and efficiency of agricultural insurance against natural and man-made risks that increases the interest of farmers.
- Conduct a sociological survey regarding compulsory insurance of civil and agricultural facilities; develop an action plan to strengthen information support for insurance against disasters.
- Develop a register of international programmes and projects in the field of agricultural disaster risk management. Hold regular thematic working meetings with specialists from international organizations and national institutions.
Climate change has become a global threat affecting everybody on the planet. The Europe and Central Asia (ECA) region is exposed to various natural hazards, including flooding, drought, hail, avalanches, landslides, storms, and heat waves. With climate change, these extreme weather events are likely to become more frequent and severe, reducing crops, livestock, fishery and forestry productivity and adversely affecting food security. According to the National Communication of the Republic of Kazakhstan to the United Nations Framework Convention on Climate Change (UNFCCC), Kazakhstan is largely exposed to climate-induced natural hazards such as earthquakes, mud flows, landslides, drought, and flooding (MEWR, UNDP and GEF, 2013).

This report is part of a series of country baseline studies on assessing climate change-related DRR, EWS, and agrometeorology services in the agricultural sector. These studies are being conducted by the FAO Regional Office for Europe and Central Asia (REU). Other countries included in the series are Armenia, Azerbaijan, Belarus, Georgia, Kyrgyzstan, Republic of Moldova, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan. Similar reports analysing disaster risk reduction and management systems in the agricultural sector in the Western Balkans (Albania, Bosnia and Herzegovina, Montenegro, North Macedonia, and Serbia) were completed in 2018.\(^1\)

The goal of this study was to analyse agricultural disaster risk management in Kazakhstan. The report draws on analysis of primary (semi-structured interviews with experts) and secondary (literature review) data sources. It includes an overview of existing legal, policy and institutional frameworks, as well as related strategic planning documents, reports and knowledge products to strengthen the system and mitigate the adverse impact of natural risks. A questionnaire prepared by FAO international experts was used during the interviews (formal survey method). The specialists were surveyed during 2020, from May to September. The list of organizations interviewed is presented in Annex 1. The situational analysis methodology developed by the Global Risks Identification Programme and the Bureau of Crisis Prevention and Recovery was applied for the report preparation. The questions were mainly based on the Capacity for Disaster Reduction Initiative’s (CADRI) questionnaire on disaster risk management in food security and agriculture and climate services.

The studies were part of the FAO regional initiative ‘Managing natural resources sustainably and preserving biodiversity in a changing climate’ and within the framework of the FAO–GEF project, Integrated Natural Resource Management in Drought Prone and Salt-Affected Agricultural Production Landscapes in Central Asia and Turkey (CACILM-2). The results of such country studies will be used as technical briefs for the design and implementation of capacity-development initiatives in the region.

\(^1\)The Western Balkan reports are available at the following link: [https://www.fao.org/europe/resources/disaster-risk-reduction-and-management/en/#c589778](https://www.fao.org/europe/resources/disaster-risk-reduction-and-management/en/#c589778)
Country background

Physical, geographical, and socioeconomic characteristics

Geography, and geophysical and climatic conditions, determine the unique risk profile in Kazakhstan. At the same time, the disaster risk concept encompasses any possible hazard which leads to negative consequences for environmental, economic, or social conditions, and with implications for the agricultural sector. Agricultural risks consist not only of natural and geophysical elements, but also economic and social factors. These factors are associated, first of all, with the country’s economic development, the government’s capacity for disaster risk management, economic and social infrastructure, and safety culture of the population, which together determine the country’s degree of vulnerability to disasters. One of the first steps in a comprehensive analysis and subsequent assessment of disaster risks is the collection and systematizations of data on the country’s physical, geographical and socioeconomic characteristics, with due attention to gender and age aspects (FAO, 2016).

Geographical location. Kazakhstan is located in the centre of Eurasia and covers an area of 2.725 million km$^2$ (Visit Kazakhstan, 2016). Its landscape stretches from the Caspian Sea in the west to the Altai Mountains in the east, and from the plains of Western Siberia in the north to the oases and deserts of Central Asia in the south.

Climate. Its distance from the ocean determines Kazakhstan’s strongly continental climate, its zoning, and precipitation deficit. Annual precipitation in the foothills and mountainous regions ranges from 500 mm to 1 600 mm, in the steppe regions from 200 mm to 500 mm, and in the desert from 100 mm to 200 mm. Average January temperatures range from -18 °C in the north to -3 °C in the south. Average daily temperatures in July range from 19 °C in the north to 29 °C in the south. The winter is long and cold in the north. In some years, the temperature can drop below -52 °C in northern regions, but there can be thaws with the temperature climbing to 5 °C. The highest surface air temperature in July does not exceed 41 °C in the north and 47 °C in the south (Kyzyl Kum desert). Daily temperature variations can reach 20 °C to 30 °C. Kazakhstan is divided into five natural climatic zones from north to south: forest-steppe, steppe, dry steppe, semi-desert, and desert, differentiated by a decrease in precipitation and an increase in temperature. The most humid zone is the forest-steppe, with up to 350 mm of precipitation; the annual precipitation in the desert zone does not exceed 150 mm (Institute of Geography and Water Security, 2017).

Temperature profile. In terms of hydrothermal resources available, the flat territory of Kazakhstan is divided into nine climatic zones from north to south (Figure 1) – from slightly humid, moderately warm (I) to very dry and very hot (IX). The temperature and humidity profile of Kazakhstan in the warm period is characterised by the hydrothermal coefficient (HTC), which varies from 0.2 in the south to 1.1 in the north – HTC 1.0–1.3 means a slightly humid zone (forest-steppe), 0.7–1.0 arid zone (steppe), 0.5–0.7 very arid (dry steppe), 03–0.5 dry (semi-desert), less than 0.3 very dry (desert) (Institute of Geography and Water Security, 2017).
Terrain. The terrain of Kazakhstan is complex and diverse: about 10 percent is high mountains; deserts cover about 44 percent of the territory; semi-deserts 14 percent, steppes 26 percent, and forests 5.5 percent. The southwestern, northern and central regions are characterised by flat terrain, at 200 metres to 300 metres above sea level. The mountainous area is located in the southeast of the country. The highest point in Kazakhstan is in the Tien Shan mountains, Khan Tengri peak (6,995 metres). The terrain of Kazakhstan is marked by the presence of inland basins (Caspian Sea, Aral Sea, Lake Balkhash), deep valleys, and dry basins (UNECE, 2019a).

Land resources. The total territory of Kazakhstan, according to the land inventory, is 272.5 million ha as of 1 November 2019. The total area of farmland is around 106.4 million ha, while reserve lands amount to 95.7 million ha (MoA, 2020). The structure of the land fund is shown in Figure 2. Kazakhstan is in the top ten of countries with the most total forested area designated for soil and water protection (as of 2020, it was 63 percent). In 2020, around 3.4 million ha of the country was covered by forest, which

\[\text{Reserve lands are all lands not in private ownership or land use, which fall under the jurisdiction of the district executive authorities.}\]
was a noticeable increase (1.15 percent per year) through the 2010–2020 period. At the same time, at lease since 2000, the area of artificial forest plantations has been decreasing (FAO, 2020a).

**Water resources.** There are 8 500 rivers in Kazakhstan. The northeastern waters of the Caspian Sea are part of the country’s territory. The Aral Sea is divided between Kazakhstan and Uzbekistan. The lake basin has 48 000 lakes, the largest of which are Balkhash, Zaisan, and Alakol (Tyumenev, 2008).

**Agro-industrial complex.** Kazakhstan has a mature grain industry, animal breeding, fruit and vegetables production, and fish farming. Agroclimatic and soil conditions are the main barriers for agricultural production, crops primarily. The risk of drought, soil erosion, plant damage by diseases, pests and hail, and other anomalous natural phenomena, have potentially big implications for agricultural production.

The national statistical office produced the following socioeconomic indicators in 2019:3

- total population of Kazakhstan was 18 395 600 people, of which 49.6 percent are men, and 50.4 percent are women (Statistics Bureau, 2021a);
- share of urban and rural population was 58.4 percent and 41.6 percent, respectively (Vlast, 2019);
- GDP was USD 80.7 billion, while GDP per capita was USD 9 731.1;
- agriculture as a proportion of GDP was 5.4 percent (in 2020);
- the administrative and territorial structure of Kazakhstan includes 14 regions and three cities of republican significance;
- representatives of 130 ethnic groups live in Kazakhstan, and a consultative and advisory body for the harmonisation of interethnic relations is operating successfully – the Assembly of the People of Kazakhstan;
- the official language is Kazakh; while Russian is officially used, along with Kazakh, in state organizations and local self-government bodies;
- education level: the gross enrolment ratio in secondary education (defined as the ratio of the number of students aged 11 to 17 to the total population) in 2018 was 108.45, and in higher education 54.29 (Statistics Bureau, 2021a).

3In October 2020, the Committee of Statistics of the Ministry of National Economy of the Republic of Kazakhstan was transformed into the Bureau of National Statistics under the Agency for Strategic Planning and Reforms.
Natural hazard profile in the agricultural sector of Kazakhstan

The territory of Kazakhstan is exposed to various types of natural hazards, which accounted for about 12 percent of all the emergencies in the country from 2002 to 2013 that are available for analysis (Raimbekov, Tleuova and Kusainov, 2015). According to the Kokshetau Technical Institute, the average annual rate of natural emergencies is about 4,000 cases, in which more than 5,000 people are affected and about 600 people die every year (Raimbekov, Tleuova and Kusainov, 2015). Agricultural natural hazards can be divided into meteorological and geological hazards – snowstorms, blizzards, heavy rain, flooding, avalanches, mud flows, landslides, stormy winds, drought; and natural fires, dangerous infectious diseases and poisoning of people, mass diseases of animals, mass outbreaks of plant pests, water accidents, and earthquakes of more than 3 on the Richter scale (Raimbekov, Tleuova and Kusainov, 2015). One third of the territory of Kazakhstan is earthquake-prone, with more than 6 million people living in those zones.

According to the Committee of Emergency Situations, in 2019 emergency services registered 15,821 natural and man-made emergencies, 2,759 people were affected, and 573 people died. The total damage amounted to KZT 3.46 billion (more than USD 8.23 million). The 112 emergency line received 6.47 million calls. The firefighting service, rescue and other emergency units had 78,515 responses, saved 12,135 lives, while 26,749 people were evacuated from emergency zones (CES, 2019a). The total number of emergencies is decreasing – in 2016, for example, 16,823 emergencies were registered, in which 3,691 people were affected, and 1,196 people died (Zakon.kz, 2017). The profile of the Kazakhstan’s exposure to natural hazards is presented in Figure 3.

The figure shows that the entire territory of Kazakhstan, regardless of the season, is exposed to various kinds of natural hazards. The risk profile differs depending on the natural and climatic zone. The highest concentration of dangerous natural phenomena is observed in the foothills and mountainous regions of the southern and eastern parts of the country.

In September 2020, the Committee of Emergency Situations of the Ministry of Internal Affairs of the Republic of Kazakhstan was reorganized into the Ministry of Emergency Situations.

Exchange rate USD 1 = KZT 420 (across the report).

Figure 3. Map of the country’s exposure to natural hazards

NOTE: The boundaries and names shown and the designations used on these map(s) do not imply the expression of any opinion whatsoever on the part of FAO concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers and boundaries.

The public availability of up-to-date statistics on natural hazards is limited. Therefore, the 2016–2020 trend for disasters caused by natural hazards is shown in Figure 4.

Figure 4. Disasters caused by natural hazards in Kazakhstan, 2016–2020

Endogenous and exogenous disasters

Earthquakes. Almaty, East Kazakhstan, Jambyl, Kyzylorda, Mangistau, and Turkestan regions are exposed to seismic hazards. Earthquakes with strengths of 7 to 9 on the Richter scale are possible in this area. Fifty-five percent of the territory of East Kazakhstan, with a population of more than 1 million people, is located in an earthquake-prone zone where shocks measuring up to 9 points may happen. In the Jambyl region, where more than 1 million people live in the risk zone, earthquakes of up to 8 points are possible. Large portions of the Kyzylorda and Turkestan regions are in the zone of seismic activity of less than 6 points. The city of Shymkent is located in a 7-point zone (CES, 2019b). According to the CES, in recent years the biggest event was an earthquake on 23 May 2003 in the Turar Ryskulov district of the Jambyl region, where more than 8 620 buildings were destroyed or damaged, of which 2 496 residential buildings could not be restored, 20 820 people lost homes, three people died, and total financial damage amounted to KZT 16.1 billion (more than USD 38 million).

Landslides. Landslides are common in the mountainous regions of Kazakhstan. The country recorded more than 376 landslide hazard sites which pose a threat to more than 2 800 essential facilities with a population of 2 500 people (MEGNR, 2019a). Over the past ten years, 29 landslides with a volume of 1 000 m$^3$ to 15 000 m$^3$ have occurred in the mountainous regions of the southeastern part of the country (MoE, 2017).

Mud flows. The mud flow threat is present in Almaty, Jambyl, East Kazakhstan, and Turkestan regions. Mud flows are extremely dangerous in the cities of Almaty, Esik, Taigal, Kaskelen, Sarkand, Zharkent, Tekeli, Merki, Shymkent. Of the total area of mud flow hazard zones (13 000 km$^2$), the Almaty region covers more than 11 000 km$^2$. Over 5 600 sources of mud flows have been identified in the country, of which 1 226 pose a threat to economic facilities, settlements, and farmland (CES, 2017a).

Flooding. A total of 852 potential flood-prone areas and 596 moraine lakes have been identified throughout the country. There are 807 settlements in the flood hazard zone. According to the CES, 54 hydrometeorological emergencies were recorded from 2010 to 2015. During this period, 8 858 residential buildings were flooded in 214 settlements. As a result, 50 people and 48 959 animals died, and 1 373 houses were destroyed (CES, 2019b). The largest flooding emergencies are presented in Table 1.
**Table 1. Major flooding emergencies in Kazakhstan, 2010–2015**

<table>
<thead>
<tr>
<th>Year</th>
<th>Location</th>
<th>Flooded facilities</th>
<th>Destroyed facilities</th>
<th>People evacuated</th>
<th>Livestock died</th>
<th>Cause of emergency</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>Almaty region</td>
<td>1 857</td>
<td>631</td>
<td>8 453</td>
<td>23 324</td>
<td>Dam break</td>
</tr>
<tr>
<td>2010</td>
<td>East Kazakhstan region</td>
<td>1 157</td>
<td>536</td>
<td>7 724</td>
<td>23 314</td>
<td>Melt water</td>
</tr>
<tr>
<td>2011</td>
<td>West Kazakhstan region</td>
<td>2 629</td>
<td>–</td>
<td>8 905</td>
<td>610</td>
<td>Melt water and rain</td>
</tr>
<tr>
<td>2012</td>
<td>Turkestan region</td>
<td>1 302</td>
<td>eight</td>
<td>–</td>
<td>–</td>
<td>Melt water and rain</td>
</tr>
<tr>
<td>2013</td>
<td>Kostanay region</td>
<td>94</td>
<td>–</td>
<td>326</td>
<td>–</td>
<td>Heavy rainfall</td>
</tr>
<tr>
<td>2013</td>
<td>Karaganda region</td>
<td>149</td>
<td>38</td>
<td>125</td>
<td>501</td>
<td>Dam break</td>
</tr>
<tr>
<td>2015</td>
<td>Karaganda region</td>
<td>2 121</td>
<td>170</td>
<td>13 279</td>
<td>17 111</td>
<td>Melt water</td>
</tr>
<tr>
<td>2014</td>
<td>Akmola region</td>
<td>429</td>
<td>–</td>
<td>304</td>
<td>–</td>
<td>Melt water</td>
</tr>
<tr>
<td>2015</td>
<td>Akmola region</td>
<td>346</td>
<td>28</td>
<td>2 164</td>
<td>–</td>
<td>Melt water</td>
</tr>
</tbody>
</table>

Source: CES, 2019b.

**Avalanches.** Avalanche is the second most frequent and destructive natural hazard in the mountainous regions of Kazakhstan. The most avalanche-prone areas are the Kazakhstani Altai, Ile, Zhetysu, Talas Alatau, and the Karatau ridge in the southern and southeastern part of the country. Out of 800 areas of avalanche formation, 498 pose a threat. There are more than 369 essential facilities in these zones, where 3 148 people live. The most dangerous zone is the basins of the Kishi and Ulken Almaty (Ile Alatau) rivers with 29 most hazardous avalanche-prone areas. The ski track of the Shymbulak sports complex as well as the Medeu-Shymbulak road section are exposed to a high level of risk due to frequent avalanches. There are 336 points of focus in the East Kazakhstan region which pose a threat to over 1 060 people (CES, 2019b).

**Erosion processes.** Erosion phenomena contribute to an expansion of degraded lands and pose a risk of desertification. Desertification caused by wind erosion covers steppe, dry-steppe, semi-desert, and desert zones in Kazakhstan. Thin soil particles and soils are blown out under the influence of wind erosion. The humus content and absorption capacity decrease, the carbonate content increases, and agrochemical and water-physical properties deteriorate in the plowing horizon of deflated soils (Government of Kazakhstan, 2005). According to a consolidated analytical report for 2019, there are more than 29.3 million ha of actually eroded lands in Kazakhstan. In general, more than 90 million ha are recognised as eroded and erosion-prone. Of the total area of eroded farmland, 1.8 million ha are arable land. The smallest share of eroded land (up to 5 percent) of total farmland is observed in the Akmola, Karaganda, Kostanay and North Kazakhstan regions (MoA, 2020). Areas of farmland exposed to erosion processes are presented in Table 2.

**Table 2. Areas of eroded farmland by region, 2019**

<table>
<thead>
<tr>
<th>Region</th>
<th>Total farmland, thousand hectares</th>
<th>Share of eroded land (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Akmola</td>
<td>13 123.8</td>
<td>4.4</td>
</tr>
<tr>
<td>Aktobe</td>
<td>26 970.2</td>
<td>9.6</td>
</tr>
<tr>
<td>Almaty</td>
<td>15 414.8</td>
<td>37.4</td>
</tr>
<tr>
<td>Atyrau</td>
<td>9 767.2</td>
<td>32.1</td>
</tr>
<tr>
<td>East Kazakhstan</td>
<td>22 618.0</td>
<td>5.7</td>
</tr>
<tr>
<td>Jambyl</td>
<td>9 236.1</td>
<td>28.5</td>
</tr>
<tr>
<td>West Kazakhstan</td>
<td>13 900.6</td>
<td>13.5</td>
</tr>
<tr>
<td>Karaganda</td>
<td>37 396.4</td>
<td>2.6</td>
</tr>
<tr>
<td>Kyzylorda</td>
<td>10 873.4</td>
<td>26.2</td>
</tr>
<tr>
<td>Kostanay</td>
<td>18 125.2</td>
<td>4.2</td>
</tr>
<tr>
<td>Mangistau</td>
<td>12 642.8</td>
<td>11.5</td>
</tr>
<tr>
<td>Pavlodar</td>
<td>11 172.5</td>
<td>11.6</td>
</tr>
<tr>
<td>South Kazakhstan</td>
<td>8 394.3</td>
<td>0.7</td>
</tr>
<tr>
<td>Turkestan</td>
<td>10 041.1</td>
<td>40.5</td>
</tr>
<tr>
<td>Shymkent city</td>
<td>83.0</td>
<td>28.0</td>
</tr>
<tr>
<td>Almaty city</td>
<td>27.6</td>
<td>0.4</td>
</tr>
<tr>
<td>Nursultan city</td>
<td>13.9</td>
<td>–</td>
</tr>
</tbody>
</table>


**Meteorological hazards**

Along with endogenous and exogenous disasters, meteorological hazards in Kazakhstan that are dangerous for agriculture include drought, intense heat, prolonged precipitation, heavy rain, heavy snowfall, hail, thunderstorms, strong winds (squalls, tornadoes) and snow storms, ground frost during the growing season, severe frost, and dust and sand storms, which are typical across the entire territory (CES, 2017b).
Information on the frequency of extreme weather events is presented in Table 3. The table presents the meteorological phenomena by region. Snow storms and strong winds are more typical for the northern regions. The eastern part of the country is prone to frequent snow, wind, and blizzards. The frequency of heavy precipitation is highest in the mountainous zone in the south, both in terms of rain and snow.

Extreme weather events have a negative impact on agricultural activities. Hail damages crops and fruit trees. Heavy rain is dangerous during the flowering period of plants and fruit crops, as they wash off pollen, knock down flowers and formed ovaries. Heavy rain in summer causes grain dumping and complicates the drying of cut grasses. Strong wind damages agricultural plants, threshing grain out of the wheat, interferes with harvesting operations, and impedes grazing in the mountains. Late spring and early autumn frost can damage or end the growing season. Dry winds lower yields in the northern parts of Kazakhstan. Drought reduces yields in rainfed agriculture, and in some years, prolonged drought can cause the complete destruction of crops (Ventskevich, 1952).

### Table 3. Frequency of extreme weather events by region in Kazakhstan (%)

<table>
<thead>
<tr>
<th>Region</th>
<th>Extreme weather events</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Heavy rain</td>
<td>Strong wind</td>
<td>Severe blizzard</td>
<td>Heavy snow</td>
<td></td>
</tr>
<tr>
<td>Kyzylorda</td>
<td>0.1</td>
<td>1.2</td>
<td>1.5</td>
<td>0.3</td>
<td></td>
</tr>
<tr>
<td>Turkestan</td>
<td>14.5</td>
<td>2.7</td>
<td>1.0</td>
<td>28.1</td>
<td></td>
</tr>
<tr>
<td>Jambyl</td>
<td>6.0</td>
<td>10.2</td>
<td>1.3</td>
<td>3.7</td>
<td></td>
</tr>
<tr>
<td>Almaty</td>
<td>59.2</td>
<td>43.6</td>
<td>0.5</td>
<td>43.8</td>
<td></td>
</tr>
<tr>
<td>East Kazakhstan</td>
<td>4.8</td>
<td>14.5</td>
<td>15.3</td>
<td>11.6</td>
<td></td>
</tr>
<tr>
<td>Karaganda</td>
<td>1.8</td>
<td>4.4</td>
<td>12.3</td>
<td>1.7</td>
<td></td>
</tr>
<tr>
<td>Pavlodar</td>
<td>1.8</td>
<td>1.2</td>
<td>4.3</td>
<td>0.9</td>
<td></td>
</tr>
<tr>
<td>Akмола</td>
<td>2.7</td>
<td>9.7</td>
<td>19.4</td>
<td>2.6</td>
<td></td>
</tr>
<tr>
<td>South Kazakhstan</td>
<td>2.8</td>
<td>5.0</td>
<td>6.1</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>Kostanay</td>
<td>2.9</td>
<td>3.6</td>
<td>18.4</td>
<td>4.3</td>
<td></td>
</tr>
<tr>
<td>Akтobe</td>
<td>0.8</td>
<td>0.8</td>
<td>14.8</td>
<td>1.7</td>
<td></td>
</tr>
<tr>
<td>Atyrai</td>
<td>0.7</td>
<td>0.4</td>
<td>3.1</td>
<td>0.3</td>
<td></td>
</tr>
<tr>
<td>West Kazakhstan</td>
<td>1.3</td>
<td>1.2</td>
<td>1.5</td>
<td>1.1</td>
<td></td>
</tr>
<tr>
<td>Mangystau</td>
<td>0.6</td>
<td>1.6</td>
<td>0.3</td>
<td>0.0</td>
<td></td>
</tr>
</tbody>
</table>

Source: Kozhakhmetov and Nikiforova, 2016.

### Main dangers from biological social hazards

Biological social hazards include mass diseases of people, animals and plants. In Kazakhstan, the most dangerous human diseases include plague, cholera, tularemia, brucellosis, anthrax, Crimean haemorrhagic fever, typhoid fever, and rabies. Diseases that can turn into epidemics in Kazakhstan are plague and cholera (ЧС-низ.кz, 2020b). The most widespread human disease in Kazakhstan is brucellosis, although in recent years, its prevalence has decreased.

The COVID-19 pandemic did not leave the agricultural sector unaffected. Although the country is one of the largest wheat producers in the region, in March 2020 the Kazakh government had to impose restrictions on the export of grain and flour (exports followed a monthly quota). This ban was lifted on 1 June. Another ban was introduced in April on the export of live cattle, sheep, and goats (until October 2020). Due to the export restrictions, Kazakhstan saw rapidly growing export prices for wheat in the first six months of 2020. The prices rose 17 percent in the first quarter of 2020, and 27 percent in the second quarter against the same period of the previous year. The largest change was recorded in May 2020 – the price was 32 percent higher than in 2019. According to a survey conducted by FAO, the majority of livestock farmer respondents reported moderate to serious financial problems caused by the COVID-19 pandemic. The pandemic had severe consequences for the availability of feed, as well as medicines and veterinary services in livestock production. However, respondents reported that the wage rate in June 2020 fluctuated within the normal range (FAO, 2020b).

In March (until October 2020), a package of measures was introduced to support agricultural producers, including exemption from land tax for all agricultural producers, VAT reduction for some agricultural products, as well as a three-month grace period for loans. In the same month, and until September 2020, customs duties were lifted and borders were opened for accelerated import of six products that are at risk in Kazakhstan (onions, potatoes, cabbage, buckwheat, poultry, and sugar). The Ministry of Trade and Integration of Kazakhstan also announced plans to establish a national wholesale distribution network for food (FAO, 2020b).

In accordance with the official list of especially dangerous animal diseases (Annex 5 to the Order of the Ministry of Agriculture of the Republic of Kazakhstan dated 30 October 2014 No. 7-1/559), the most widespread diseases in the country are: rabies, brucellosis, Aujeszky’s disease, leukaemia, leptospirosis, listeriosis, pasteurellosis, anthrax,
tuberculosis, foot-and-mouth disease, smallpox, echinococcosis, paratuberculosis, toxoplasmosis, trichophytosis, rickettsioses, tularemia, vesicular stomatitis (exotic disease), Schmallenberg disease; and in relation to cattle, viral diarrhoea, infectious rhinitis, parainfluenza-3, rinderpest, emphysematous carbuncle, campylobacteriosis, spongiform encephalopathy, and lumpy skin disease. Diseases of sheep and goats include anaerobic enterotoxaemia of sheep, braxy, infectious epididymitis of rams, contagious pustular dermatitis (ecthyma), chlamydial abortion of sheep, infectious agalactia of sheep and goats, scrapie, Visna maedi virus, adenomatosis, and bluetongue (exotic ruminants). In 2018, 347 foci of especially dangerous animal diseases were registered in Kazakhstan, compared with 360 foci in 2017. The 2018 figures involved 180 with brucellosis, versus 217 in 2017 (KazInform, 2019).

In accordance with the list of quarantine objects and alien species (Annex 1 to the Order of the Ministry of Agriculture of the Republic of Kazakhstan No. 11739, dated 30 March 2015), the following plant pests are considered harmful and must be subject to quarantine measures:

- locusts (Asian, Moroccan and Italian locust), *Eurygaster integriceps*, *Apamea anceps*, *Mayetiola destructor*, cereal chafer, *Helicoverpa zea*, Tetranychidae, gophers, mouse-like rodent, *Colorado beetle*, cereal diseases (rust, Septoria); and weeds such as *Ambrosia artemisiifolia*, *Ambrosia psilostachya*, *Acroptilon repens*, *Solanum rostratum*, *Cuscuta spp.* Global warming results in expansion of agricultural pest distribution areas and increase in the frequency of outbreaks. Locusts are particularly dangerous transboundary pests which also benefit from a changing climate. In Kazakhstan, locust infestations annually cover millions of hectares, requiring phytosanitary monitoring and control measures.

### Impact of climate change on agriculture and food security

The agricultural sector is vulnerable to and dependent on external climatic factors. Climate change has a negative impact on food security across all four food-security pillars – food availability, access to food, use, and stability of food supplies. According to climate-change scenarios, the temperature in Central Asia will rise by between 1 °C and 3 °C during 2030–2050, and by the end of the century it may rise to between 3 °C and 6 °C (IPCC, 2007). Climate change analysis performed by a Kazakhstan-UNDP-GEF project showed that the average annual temperature in Kazakhstan is moving upwards.

Rising temperatures can provoke and intensify the processes of arid-zone expansion to the northern part of the country, average annual precipitation growth of 0.8 percent to 15 percent in December–March and a drop from July to September, and a larger number of extreme events (heat, drought, flooding, landslides, mud flows). Depending on intensity, the average annual temperature may increase by 3.2 °C to 4.5 °C in the northern part of the country by the end of the century. Precipitation rates forecast in Kazakhstan are ambiguous, but the anticipated change does not exceed 15 percent (Orlovsky et al., 2019).

According to climate-change forecasts for the near and medium term (Kozhakhmetov and Nikiforova, 2016), a higher frequency of heavy precipitation (rain, snow), storm winds, and hail with stronger wind is possible. Climate change and stronger aridity will intensify the manifestation of dust storms. Higher precipitation rates in the desert zone, in the absence of catchment and drainage systems, can lead to flooding of settlements. In long-term forecasts, with the shallowing of the Lake Balkhash, the frequency of dust storms will increase in the southern part of the Balkhash region. A shallowing of Lake Balkhash may occur, replicating the scenario of the Aral Sea. Higher temperatures in mountainous areas will exacerbate the degradation of glaciers. In the flat part of the country, the timing of snow melting and flooding of rivers may shift and their subsequent shallowing is possible (Kozhakhmetov and Nikiforova, 2016).

Kazakhstan already has the highest variation in annual yields among all major wheat-producing countries globally (up to 27 percent difference between a good and a bad year). This happens because most of the wheat production is concentrated in the northern steppe zone, which is characterised by low rain and limited opportunities for irrigation. As a result, rainfed farming dominates in areas with a high risk of drought. Higher temperatures, as well as the wider spread of pests and diseases associated with climate change, are likely to further exacerbate yield variability. At the same time, farms in the south of the country depend on seasonal melting of snow cover. The expected warming will increase the productivity of spring pastures, but will reduce the productivity of summer and autumn ones, especially in the south (USAID, 2017).

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Project of the Government of Kazakhstan/UNDP/GEF, Assistance to the Republic of Kazakhstan in the preparation of the Seventh National Communication to the UN Framework Convention on Climate Change.
Agricultural resources

The area of agricultural land in the structure of the land fund is 106.4 million ha, or 40.5 percent of the land in use. The structure of agricultural lands by type is presented in Table 4. In recent years, the area under agricultural lands has been increasing in all regions due to the inclusion of reserve lands into production. The largest area of arable land is located in the grain-sowing regions – Kostanay (6 million ha), Akmola (5.9 million ha), and North Kazakhstan (4.9 million ha). The largest areas of pastures are concentrated in the regions located in the desert and semi-desert zones: Karaganda (13.1 million ha), Aktobe (9.4 million ha), East Kazakhstan (8.9 million ha), Almaty (6.6 million ha), and West Kazakhstan (5.5 million ha) (MoA, 2020).

More than 92 percent of all arable land is irrigated, and almost 47 percent of hayfields are covered by flood irrigation. However, in 2019, out of all irrigated land in the country (2.1 million ha), around 30.7 percent was not used. The main reason for this under-use is significant wear, and failure of irrigation and drainage systems, accompanied by a deterioration in land reclamation conditions. This is due to the fact that irrigation and drainage systems divided between many different farms were often left without organized maintenance and care. This is also the reason for the deterioration of the reclamation condition of irrigated lands. Regions with the most unused irrigated lands are Almaty (103,700 ha – 15.7 percent), East Kazakhstan (101,100 ha – 15.3 percent), and Jambyl (89,000 ha – 15.4 percent) (MoA, 2020).

Table 4. Breakdown of agricultural land as of 1 November 2019 (thousand hectares)

<table>
<thead>
<tr>
<th>Title</th>
<th>Total area</th>
<th>Of these, on land of agricultural designation</th>
<th>Share of land of agricultural designation, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricultural land</td>
<td>214,341.1</td>
<td>103,067.4</td>
<td>48.1</td>
</tr>
<tr>
<td>Of which:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arable land, total</td>
<td>26,011.2</td>
<td>25,510.3</td>
<td>98.1</td>
</tr>
<tr>
<td>Including: irrigated</td>
<td>1,665.0</td>
<td>1,536.5</td>
<td>92.3</td>
</tr>
<tr>
<td>Perennial plantings</td>
<td>1,470</td>
<td>772</td>
<td>52.5</td>
</tr>
<tr>
<td>Fallow land</td>
<td>3,978.2</td>
<td>1,847.8</td>
<td>46.4</td>
</tr>
<tr>
<td>Hayfields, total</td>
<td>4,913.0</td>
<td>2,178.8</td>
<td>44.3</td>
</tr>
<tr>
<td>Including: improved</td>
<td>41.3</td>
<td>14.5</td>
<td>35.1</td>
</tr>
<tr>
<td>inundation irrigation</td>
<td>725.2</td>
<td>339.6</td>
<td>46.8</td>
</tr>
<tr>
<td>Pastures, total</td>
<td>179,223.7</td>
<td>73,443.0</td>
<td>41.0</td>
</tr>
<tr>
<td>Including: improved</td>
<td>5,766.9</td>
<td>4,007.7</td>
<td>69.5</td>
</tr>
<tr>
<td>Watered</td>
<td>102,727.3</td>
<td>43,443.1</td>
<td>42.3</td>
</tr>
<tr>
<td>Vegetable gardens and service allotments</td>
<td>68.1</td>
<td>10.3</td>
<td>15.1</td>
</tr>
<tr>
<td>Non-agricultural land</td>
<td>48,519.5</td>
<td>3,365.2</td>
<td>6.9</td>
</tr>
<tr>
<td>Total</td>
<td>262,860.6</td>
<td>106,432.6</td>
<td>40.5</td>
</tr>
</tbody>
</table>


The agricultural sector’s contribution to the national economy is rather small these days. According to the Bureau of National Statistics, the share of agriculture as a portion of GDP has varied from 4.2 percent to 4.9 percent over the past (2010–2019) decade (Statistics Bureau, 2021a). It should be noted there has been a significant decline compared to the situation in the 1990s – in 1999, the figure was almost 10 percent (World Bank, 2021). The trend
of Kazakhstan’s GDP and contribution of the agricultural sector are shown in Figure 5. In 2020, the share of agriculture in the country’s GDP reached 5.4 percent (Statistics Bureau, 2021a).

There are three types of agricultural producers in Kazakhstan – first, agricultural enterprises that have a legal status, are large in size, and emerged from the breakup of former collective and state farms. As of 1 January 2021, there were more than 15 000 active enterprises registered in Kazakhstan (Table 5). Almost 60 percent of all cultivated land falls under this category (Statistics Bureau, 2021b). The second type of producer is individual (“peasant”) farms and individual entrepreneurs, mainly small and medium-scale privately owned farms. In 2021, there were more than 248 000 such entities registered in the country, covering almost 40 percent of cultivated land. The average size of these farms varies throughout the country – in the north it can be 5 000 ha or more, while small farms are concentrated on irrigated lands in the southern regions, with average sizes varying from 3 ha to 500 ha. The third type is household or family farms, which typically have micro or small-scale plots, most often used by rural families for subsistence-oriented farming. There are more than 1.6 million of these in total. While they amount to a quite insignificant area of cultivated land, such farms play a major role in livestock production, accounting for more than 65 percent, in monetary terms (Statistics Bureau, 2021b).

Table 5. Main parameters and contribution of different types of agricultural producers, as of 1 January 2021

<table>
<thead>
<tr>
<th></th>
<th>Agricultural enterprises</th>
<th>Peasant farms and individual entrepreneurs</th>
<th>Household farms</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cultivated land</td>
<td>Total number</td>
<td>15 050</td>
<td>248 199</td>
<td>1 636 249</td>
</tr>
<tr>
<td></td>
<td>thousand ha</td>
<td>13 377.6</td>
<td>9 005.1</td>
<td>199.6</td>
</tr>
<tr>
<td></td>
<td>%</td>
<td>59.2</td>
<td>39.9</td>
<td>0.9</td>
</tr>
<tr>
<td>Total agricultural production</td>
<td>billion KZT</td>
<td>1 699.61</td>
<td>2 033.58</td>
<td>2 630.78</td>
</tr>
<tr>
<td></td>
<td>%</td>
<td>26.7</td>
<td>32.0</td>
<td>41.3</td>
</tr>
<tr>
<td>Crop production</td>
<td>billion KZT</td>
<td>1 237.36</td>
<td>1 554.28</td>
<td>895.67</td>
</tr>
<tr>
<td></td>
<td>%</td>
<td>33.6</td>
<td>42.1</td>
<td>24.3</td>
</tr>
<tr>
<td>Livestock production</td>
<td>billion KZT</td>
<td>423.04</td>
<td>479.31</td>
<td>1 735.11</td>
</tr>
<tr>
<td></td>
<td>%</td>
<td>16.0</td>
<td>18.2</td>
<td>65.8</td>
</tr>
</tbody>
</table>

Source: Statistics Bureau, 2021b.

The law in Kazakhstan allows private ownership of land. However, the process of land privatization has been slow, and the government has instituted certain regulations which make it difficult for citizens to enjoy their tenure rights. The formal land market performs poorly, giving way to many informal transactions (USAID, 2007). As of 2019, only around 1.4 percent of all farmland was in private ownership (MoA, 2020).
The country’s farmland is used according to regional particularities. The largest area of arable land is located in the northern part of the country (grain-sowing regions), most pastures are located in the central and western parts of the country, while perennial plantations prevail in the mild climate zone in south of the country. A more detailed structure of farmland by region is presented in Table 6. The largest areas of fallow land are located in East Kazakhstan, West Kazakhstan, Karaganda, and Almaty regions. More than 50 percent of hayfields are concentrated in the East Kazakhstan, West Kazakhstan, Karaganda, and Almaty regions.

### Table 6. Composition of farmland by type and region, as of 1 November 2019 (thousand hectares)

<table>
<thead>
<tr>
<th>Region</th>
<th>Total area</th>
<th>Total farmland</th>
<th>Arable land</th>
<th>Perennial plantings</th>
<th>Fallow land</th>
<th>Hayfields</th>
<th>Pasture</th>
<th>Vegetable gardens and service allotments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Akmola</td>
<td>10 822.1</td>
<td>10 794.9</td>
<td>5 957.4</td>
<td>2.8</td>
<td>259.8</td>
<td>150.4</td>
<td>4 424.5</td>
<td>–</td>
</tr>
<tr>
<td>Aktobe</td>
<td>10 672.3</td>
<td>10 533.1</td>
<td>715.8</td>
<td>0.6</td>
<td>247.9</td>
<td>133.8</td>
<td>9 434.4</td>
<td>0.6</td>
</tr>
<tr>
<td>Almaty</td>
<td>8 007.4</td>
<td>7 885.9</td>
<td>1 013.7</td>
<td>21.4</td>
<td>69.6</td>
<td>189.5</td>
<td>6 591.4</td>
<td>0.3</td>
</tr>
<tr>
<td>Atyrau</td>
<td>2 982.6</td>
<td>2 790.3</td>
<td>66.6</td>
<td>0.5</td>
<td>7.5</td>
<td>50.6</td>
<td>2 725.1</td>
<td>–</td>
</tr>
<tr>
<td>East Kazakhstan</td>
<td>11 070.8</td>
<td>10 912.4</td>
<td>1 474.2</td>
<td>2.3</td>
<td>57.1</td>
<td>475.3</td>
<td>8 903.3</td>
<td>0.2</td>
</tr>
<tr>
<td>Jambyl</td>
<td>4 612.5</td>
<td>4 476.9</td>
<td>772.7</td>
<td>3.8</td>
<td>–</td>
<td>116.6</td>
<td>3 583.8</td>
<td>–</td>
</tr>
<tr>
<td>West Kazakhstan</td>
<td>7 039.9</td>
<td>6 984.9</td>
<td>541.8</td>
<td>2.0</td>
<td>462.4</td>
<td>450.0</td>
<td>5 527.2</td>
<td>1.5</td>
</tr>
<tr>
<td>Karaganda</td>
<td>15 169.6</td>
<td>14 750.6</td>
<td>1 244.2</td>
<td>1.9</td>
<td>216.2</td>
<td>225.1</td>
<td>13 063.2</td>
<td>–</td>
</tr>
<tr>
<td>Kyzylorda</td>
<td>2 701.6</td>
<td>2 175.5</td>
<td>169.5</td>
<td>0.6</td>
<td>38.3</td>
<td>36.3</td>
<td>1 924.0</td>
<td>6.8</td>
</tr>
<tr>
<td>Kostanay</td>
<td>10 551.0</td>
<td>10 405.3</td>
<td>6 053.5</td>
<td>9.2</td>
<td>112.4</td>
<td>119.9</td>
<td>4 110.2</td>
<td>0.1</td>
</tr>
<tr>
<td>Mangistau</td>
<td>5 198.8</td>
<td>4 179.4</td>
<td>0.4</td>
<td>–</td>
<td>0.1</td>
<td>–</td>
<td>4 178.7</td>
<td>0.2</td>
</tr>
<tr>
<td>Pavlodar</td>
<td>6 195.8</td>
<td>6 118.4</td>
<td>1 776.4</td>
<td>1.5</td>
<td>211.3</td>
<td>145.3</td>
<td>3 983.8</td>
<td>0.1</td>
</tr>
<tr>
<td>South Kazakhstan</td>
<td>7 198.6</td>
<td>6 967.3</td>
<td>4 926.9</td>
<td>2.6</td>
<td>57.4</td>
<td>16.7</td>
<td>1 963.2</td>
<td>0.5</td>
</tr>
<tr>
<td>Turkestan</td>
<td>4 209.6</td>
<td>4 092.5</td>
<td>857.2</td>
<td>28.0</td>
<td>107.8</td>
<td>69.3</td>
<td>3 030.2</td>
<td>–</td>
</tr>
<tr>
<td>Shymkent city</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Almaty city</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Nursultan city</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>106 432.6</td>
<td>103 067.4</td>
<td>25 510.3</td>
<td>77.2</td>
<td>1 847.8</td>
<td>2 178.8</td>
<td>73 443.0</td>
<td>10.3</td>
</tr>
</tbody>
</table>

*Source: MoA, 2020.*

In 2020, the total cultivated area of the country was 22.6 million ha, of which 15.9 million ha (or 70.3 percent) was for cereals, while grain storage capacity is 27 million tonnes. Oilseeds occupy an area of 2.9 million ha (12.9 percent), feed crops 3.2 million ha (14.2 percent), cotton and sugar beet 126 000 ha and 15 200 ha respectively, and potatoes, vegetables, and gourds together making up 459 900 ha (Statistics Bureau, 2021b).

As of 2020, 40.9 percent of the country’s population lived in rural areas – 1.17 million people (or 13.5 percent of the total working population) were employed in the agricultural sector, 42.4 percent of whom were women. Since 2011, when this figure was 48.5 percent, the share of women employed in agriculture has been decreasing slowly (Statistics Bureau, 2021a). In 2020, out of all working men, 15 percent were involved in agriculture (677 300 people); the share among women was lower, at 12.1 percent (or 497 800 people) (Statistics Bureau, 2021c). The average monthly salary in the agricultural sector is the lowest across the main types of economic activities. In 2020, it was KZT 130 178 (around USD 309), while the average salary across the country was KZT 213 178 (around USD 507) (Statistics Bureau, 2021a). In the agricultural sector, women earn only around 77 percent of what men earn. Many women feel that their weaker bargaining power, compared to men, had led to them receiving more remote or lower-quality land plots in terms of productivity, size, and location (ADB, 2018). Overall, in 2020, only 25.4 percent of all peasant farms were run by women (24.7 percent in rural areas); however, this share is steadily growing over recent years (Statistics Bureau, 2021a).

Of the total number of people employed in agriculture, more than 460 000 workers are hired employees, and 141 000 live in cities (Azattyq Ryhy, 2019). More than half of the people working in the agricultural sector (733 000) are self-employed. According to the internet edition kursiv.kz, almost 600 000 agricultural workers
only have only a school education (Shumekov, 2019). According to the statistics office, the migration outflow from rural areas for the period 2018–2019 was 61,691 people (Statistics Bureau, 2021a).

The proportion of people of working age is higher in urban areas than in rural areas – as of 2019, it was 60.2 percent and 57.6 percent, respectively. The proportion of elderly population (over working age) is also higher in cities (11.6 percent versus 10.3 percent among the rural population). On the contrary, the share of young people (less than 15 years of age) is higher in rural areas (32 percent), compared with urban (28.3 percent). The total fertility rate of the rural population is significantly higher than that of the urban population (in 2018, it was 3.09 and 2.68, respectively). However, in the early 2000s, the fertility rate in cities increased more steadily and significantly than in rural areas (MNE and UNFPA Kazakhstan, 2020).

Main types of agricultural products

In 2015, gross agricultural output amounted to KZT 3.3 trillion (USD 7.857 billion). In 2020, it reached KZT 6.36 trillion (USD 15.1 billion). The main subsectors of agriculture are crop production, which represents 58.2 percent of gross agricultural output, while livestock production is responsible for 41.6 percent (the remaining 0.2 percent is from agricultural services) (Statistics Bureau, 2021b). The trend of gross output of agricultural goods in Kazakhstan for 2010–2020 is shown in Figure 6.

![Figure 6. Trend of gross agricultural output (KZT millions)](image)

*Source: Statistics Bureau, 2021a.*

**Crop production.** The agricultural crop area in 2020 was about 22.6 million ha, showing steady growth since 1995, when it was only 15.3 million ha. At the same time, the structure of crop area changes annually. By 2017, the diversification of crop production resulted in a wheat area reduction from 13.8 million ha to 12 million ha (Government of Kazakhstan, 2018).

Between 2010 and 2020, the area under cereals and legumes slightly decreased (by 740,700 ha, or 4.5 percent). Cotton also decreased by 11,200 ha (8.2 percent), and tobacco by 1,200 ha (75 percent). Over the same period of time, there was an increase of 1,157,000 ha in the area under oil crops (66.2 percent), feed crops (by 641,900 ha or 25.1 percent), gourds (by 38,600 ha or 61 percent), vegetables (by 43,300 ha or 36 percent). In 2020, the production of fruit, grapes and their processed products amounted to 445,100 tonnes, an increase compared to 2016, when it was only 335,800 tonnes. Still, this volume was not enough to meet domestic needs, and around 818,700 tonnes were imported in 2020 (Statistics Bureau, 2021b).
Livestock production. The gross livestock output in 2020 exceeded KZT 2.6 trillion, which in real terms is more than twice the output of 2010 (Statistics Bureau, 2021b). The share of family farms in the structure of livestock production is 56.3 percent for meat, 74.6 percent for milk, and 24 percent for eggs. The livestock and poultry headcount rate, as the main indicator of the livestock industry, is presented in Table 7.

Table 7. Livestock and poultry headcount rate, 2017–2020

<table>
<thead>
<tr>
<th>Years</th>
<th>Cattle, thousand heads</th>
<th>Sheep and goats, thousand heads</th>
<th>Pigs, thousand heads</th>
<th>Horses, thousand heads</th>
<th>Camels, thousand heads</th>
<th>Poultry, million heads</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>6 247.2</td>
<td>17 947.1</td>
<td>831.1</td>
<td>2 113.2</td>
<td>172.5</td>
<td>378</td>
</tr>
<tr>
<td>2018</td>
<td>6 764.2</td>
<td>18 329.0</td>
<td>815.1</td>
<td>2 415.7</td>
<td>193.1</td>
<td>399</td>
</tr>
<tr>
<td>2019</td>
<td>7 150.9</td>
<td>18 699.1</td>
<td>798.7</td>
<td>2 646.5</td>
<td>207.6</td>
<td>44.3</td>
</tr>
<tr>
<td>2020</td>
<td>7 436.4</td>
<td>19 155.7</td>
<td>813.3</td>
<td>2 852.3</td>
<td>216.4</td>
<td>45</td>
</tr>
</tbody>
</table>


The main source of fish products in Kazakhstan is natural water bodies. Around 75 percent of all fish products consumed in Kazakhstan are imported. More than 120 fish farms are engaged in artificial fish breeding. The volume of fish farmed in 2017 was 40 700 tonnes (Government of Kazakhstan, 2018).

Processing. In 2019, gross food production output amounted to KZT 1.6 billion (around USD 3.8 million). The level of food processing in the country remains low – it was 6.7 percent of the total volume of industrial products in 2019 (Statistics Bureau, 2021b). The biggest share in the food production industry belongs to the grain processing (20 percent), dairy (16.2 percent), meat processing (14 percent), bakery (13.5 percent), fat and oil (8.7 percent) (Government of Kazakhstan, 2018).

Agrifood trade. In 2020, the import of food products reached USD 3.4 billion (8.8 percent of total imports), or in volume 6.9 million tonnes. Compared to 2015, imports in terms of volume didn’t grow much (only by 113 200 tonnes), but in monetary terms it increased more significantly, by USD 480 million (Statistics Bureau, 2021a). In 2012–2016, the largest share of imported consumed processed products came from dairy products (46 percent), sausages (41 percent), canned meat and vegetable products (42 percent). Among plant products, the largest share of imports came from sugar (42 percent), while the country’s own sugar factories work at 37.1 percent capacity. Despite the increase in poultry meat production, the degree of import dependence remains high (53.5 percent of all poultry meat consumed in 2017 was imported). Kazakhstan’s egg production almost completely covers the needs of the domestic market; the export of eggs in 2017 amounted to 6.8 percent of the total production (Government of Kazakhstan, 2018). In 2017, imported canned fruit and vegetables were 80.3 percent of domestic consumption, while the domestic processing enterprises were operating at 22.5 percent capacity. A similar problem is observed with fat and oil products (30 percent to 40 percent of total consumption is imports), with domestic processing enterprises working at no more than 50 percent of their capacity. Full self-sufficiency was noted only in the production of cereals and flour.

In 2020, exports of food products was USD 1.51 billion (3.2 percent of total exports), or 4.3 million tonnes in terms of volume. This was significant growth compared with 2015, when only 2.6 million tonnes was exported. In monetary value, over the 2015–2020 period, exports increased by USD 500 million (or by more than 50 percent). The main agricultural exports from Kazakhstan are wheat, flour, and vegetable oil (Statistics Bureau, 2021a). The export of dairy products, confectionery, chocolate, pasta, and poultry meat is also increasing (MoA, 2019).

Food security

In 2021, Kazakhstan ranked 41st among 113 countries in the Global Food Security Index, dropping from 32nd place in 2020 (The Economist, 2021). The country continues to pursue policies to improve food security, particularly agricultural productivity. Still, a number of problems related to food security remain. The low level of productivity, and issues with the quality and uneven supply of raw materials, are still common in Kazakhstan’s agricultural sector, and can affect the costs of food products. Problems around the availability and accessibility to food products are also present, particularly due to the lack of an efficient, open and transparent trade and logistics system, as well as a lack of sufficient retail infrastructure, and warehouse infrastructure.
State regulation of prices for essential food supplies is ineffective. The mechanism for enforcement of state policy on threshold and marginal values of retail prices has not been worked out. In market conditions, it is extremely difficult to curb the growth of prices for any type of food product, and physically reach outlets in Kazakhstan. The COVID-19 crisis is aggravating the issue of accessibility to food. To boost domestic availability and access to food, at the outset of the crisis the government introduced measures that included price ceilings for socially significant food products (including flour, bread, pasta, buckwheat, rice, beef, eggs, sunflower oil), and temporary export bans or export quotas (on commodities such as buckwheat, carrots, turnip, beet, onion, potatoes, white cabbage) (FAO, 2021).

Food affordability in Kazakhstan is lower than in developed countries and EAEU countries. The share of the population's income spent on food is significantly higher than that of developed countries. For the poorest 10 percent, this indicator is 52.3 percent, while in Belarus it is 49.1 percent, Russia 44.8 percent, 25 countries of the European Union from 25 percent to 30 percent, and the United States of America 22 percent (Government of Kazakhstan, 2018). In 2020, the proportion of the population with incomes below the subsistence minimum across the country was 5.3 percent. In urban areas it was 3.7 percent, while in rural areas it reached 7.6 percent (Statistics Bureau, 2021d). At the same time, Kazakhstan has the lowest poverty rate of all the countries in the Central Asia region.

Access to drinking water in rural areas remains an issue for Kazakhstan. As of 2019, around 84 percent of the rural population had a centralized water supply, while the remaining used local water sources. In urban areas, around 94.5 percent of the population were covered by the centralized water supply (Statistics Bureau, 2021a). There are plans to provide access to a centralized water supply for the whole population by 2023. One of the barriers for the access of the rural population to drinking water is the remoteness of quality water sources from settlements, as well as the fragmentation of functions among state bodies.

Consequences of restricted access to food

Kazakhstan belongs to the category of countries experiencing residual undernourishment, while the micronutrient deficiency remains high. At the same time, there is a growing number of obese and overweight people, due to the consumption of cheap food high in fat and carbohydrates. The number of undernourished people in Kazakhstan is very small (below 2.5 percent). Less than 2 percent of children under the age of five are underweight (the lowest rate in Central Asia), and much more children (about 12 percent) are overweight (FAO, 2017). According to the World Health Organization (WHO), almost 20 percent of children in Kazakhstan from six to nine years old are overweight or obese, with higher rates among the urban population. This is due to the high consumption of sugar-sweetened beverages, which are consumed regularly by 49.7 percent of school-age children (WHO, 2019). As of 2016, over 50 percent of adults were overweight, while over 18.9 percent of men and 22.7 percent of women were obese (Global Nutrition Report, 2020).

An analysis of the current situation shows that the nature of food insecurity has changed significantly over recent decades. Kazakhstan has made noticeable progress in reducing the number of hungry people. Consumption of fruit, seafood, and milk is increasing, and the proportion of polyunsaturated fats in the diet is increasing, but problems related to food security and nutrition remain urgent. Failure to comply with dietary recommendations in Kazakhstan (the daily salt intake in Kazakhstan per person is four times higher than the norm, 17 g, recommended by WHO) leads to the spread of arterial hypertension and cardiovascular diseases, overweight, type II diabetes, and cancer. According to the latest available data (2016), the probability of premature death in Kazakhstan from these diseases is 27 percent, and for men the risk is much higher (37 percent) than for women (19 percent) (WHO, 2019).

For the Sustainable Development Goals (SDGs) to be achieved in Kazakhstan, multisectoral and multi-level nutrition improvement measures are required. Given the wide range of factors affecting nutrition (agriculture, rural development, trade, education, social security, media), intersectoral coordination is essential. Collaboration with other sectors provides an opportunity to identify common interests and benefits which can transform into mutual cooperation.
Regulatory framework of Kazakhstan on disaster risk reduction, climate change, and food security

International conventions

Kazakhstan is a party to the following international treaties, conventions and agreements related to the problems of DRR, climate change, and food security:

- Convention on Biological Diversity (ratified by the Resolution of the Cabinet of Ministers of the Republic of Kazakhstan on approval dated 19 August 1994 No. 918), including the Cartagena Protocol (Law of the Republic of Kazakhstan dated 17 June 2008 No. 43-IV) and the Nagoya Protocol (Decree of the President of the Republic of Kazakhstan dated 17 March 2015 No. 1025);
- UN Framework Convention on Climate Change (ratified by the Decree of the President of the Republic of Kazakhstan dated 4 May 1995 No. 2260);
- Convention to Combat Desertification (ratified by the Law of the Republic of Kazakhstan dated 7 July 1997 No. 419-I);
- Vienna Convention for the Protection of the Ozone Layer (ratified by the Law of the Republic of Kazakhstan dated 30 October 1997 No. 177-I), including the Montreal Protocol on Substances that Deplete the Ozone Layer (ratified by the Law of the Republic of Kazakhstan dated 30 October 1997, No. 176-I);
- Convention on Environmental Impact Assessment in a Transboundary Context (ratified by the Law of the Republic of Kazakhstan dated 21 October 2000 No. 86-II);
- Convention on the Protection and Use of Transboundary Watercourses and International Lakes (ratified by the Law of the Republic of Kazakhstan dated 23 October 2000 N 94-II);
- Stockholm Convention on Persistent Organic Pollutants (ratified by the Law of the Republic of Kazakhstan dated 7 June 2007 No. 259);
- Kyoto Protocol to the UN Framework Convention on Climate Change (ratified by the Law of the Republic of Kazakhstan dated 26 March 2009 No. 144-IV);
- Declaration of the World Summit on Food Security (2009);
- Third UN World Conference on Disaster Risk Reduction – Sendai Framework for Disaster Risk Reduction 2015–2030 (2015);

The current legislation in Kazakhstan is the norms of the Constitution, related laws, other regulatory legal acts, international treaties, and other obligations of the country. At the same time, according to paragraph 3 of Article 4 of the Constitution of the Republic of Kazakhstan, international treaties ratified by the country have priority over its laws, and therefore national legislation is implemented in accordance with generally recognised principles and norms of international law. The legal enforcement of international treaties and agreements is governed by the law On international treaties of the Republic of Kazakhstan dated 30 May 2005 No. 54-III.
Legislation of the State Civil Protection System

The legal framework of the SCPS is based on the Constitution of the Republic of Kazakhstan, consists of the Law On Civil Protection, and other regulatory legal acts of Kazakhstan.

The Law On Civil Protection of 11 April 2014 No. 188-V governs the public relations arising in the course of civil protection actions and aims at prevention and liquidation of emergency situations of a natural and man-made nature and their effects, rendering emergency medical and psychological assistance to the population in the zone of emergency situations, ensuring fire and industrial safety; and also determines the main objectives, organizational principles of civil protection system creation and functioning in Kazakhstan; as well as forming, storage and use of the state material reserve, organization and activities of rescue services and formations. It defines the powers and tasks of the competent authorities at the central, territorial levels and the level of organizations in the course of daily activities, high preparedness and emergency modes.

Legal support in the field of the SCPS is also reflected in the following regulatory legal acts of Kazakhstan:

Law On the state of emergency dated 8 February 2003 No. 387-II establishes the grounds, terms, procedure for the introduction and operation of a state of emergency throughout the territory of Kazakhstan or in some of its localities, the legal regime of an emergency of a social nature. According to paragraph 2 of Article 4, natural and man-made emergencies caused by natural hazards, environmental crises, natural fires, epidemics and epizootics, damage to agricultural plants and forests by diseases and pests, industrial, transport and other accidents, fires, can serve as a basis for initiating a state of emergency.

Regulation On Republican Civil Protection Services – in accordance with the order of the Minister of emergency situations of the Republic of Kazakhstan dated 18 June 2014 No. 303, the regulation governs the tasks, powers and goals of the formation of the Republican Civil Protection Services.

Resolution of the Government of the Republic of Kazakhstan On the establishment of the classification of natural and man-made emergencies, dated 2 July 2014 No. 756, determines the organizational and legal frameworks for assessing emergency situations in terms of their severity and regulates relations arising in the course of activities of the civil protection management bodies.

Regulation on the Committee of Emergency Situations of the Ministry of Internal Affairs of the Republic of Kazakhstan (order of the Minister of Internal Affairs of the Republic of Kazakhstan dated 1 October 2014 No. 662) establishes the competence of the committee in the field of civil protection, in terms of preventing and eliminating emergencies of a natural and man-made nature, providing emergency medical and psychological assistance to the population, ensuring fire safety and organizing civil protection in Kazakhstan.

Resolution of the Government of the Republic of Kazakhstan On approval of the Fire Safety Rules dated 9 October 2014 No. 1077 establishes general fire safety requirements, including those for agricultural production facilities – the procedure for maintaining agricultural production facilities and processing of agricultural products; requirements for the operation of equipment for feed mills, flour and cereal plants, bakery enterprises, technological processes of agricultural production, during harvesting and stocking, preparation, transportation and storage of feed, other agricultural products.

Order On approval of the rules for organizing a civil protection warning system and alerting of population and state bodies in emergency situations in peacetime and wartime, dated 26 December 2014 No. 945, determines the procedure for organizing a civil protection warning system and alerting of the population and state bodies about the threat or emergencies of a natural, man-made and social nature in peacetime and wartime.
Order On approval of the rules for the organization and operation of the state civil protection system, dated 24 February 2015 No. 149 determines the procedure for the organization and functioning of the SCPS in Kazakhstan before, during and after an emergency.

Order On approval of the rules for informing, promoting knowledge, training the population and specialists in the field of civil protection dated 22 May 2015 No. 11134 defines the procedure for informing, promoting knowledge, training the population and specialists in the field of civil protection at the central and territorial levels, as well as organizations and individuals.

Order on approval of the technical regulation ‘General requirements for fire safety’ dated 23 June 2017 No. 439 establishes general fire safety requirements for products, protected facilities, including buildings and structures, production facilities, fire-technical products and general products.

In the process of legislative framework improvement, a number of laws and regulations of the SCPS lost their force, and their updated content was supplemented by the Law On Civil Protection No. 188-V of 11 April 2014. The legislative framework of Kazakhstan in the field of the SCPS does not take into account climate-change implications, and there is no link with the country’s agricultural sector and food security.
Hydrometeorological legislation

The main state documents in the field of hydrometeorology in Kazakhstan are:

Environmental Code of the Republic of Kazakhstan dated 9 January 2007 No. 212-III (with amendments and additions of 25 June 2020). Activities of the national hydrometeorological service Kazhydromet are governed by the Article 145-2 of this code to ensure monitoring of environmental conditions, and meteorological and hydrological monitoring using the state observation network. This activity is government controlled. The state observation network, including land plots and water areas allocated for it, as well as property, belongs exclusively to the government, is under state protection, and is not subject to privatization.

In the interpretation of the Resolution On approval of the Regulations on the Main Department for Hydrometeorology of the Republic of Kazakhstan, which became invalid in 1997, Kazhydromet is the main hydrometeorological agency in Kazakhstan. Kazhydromet manages the hydrometeorological monitoring and monitoring of the natural environment, provides executive authorities, organizations and the population with information on environmental conditions and climate, actual and expected changes in hydrometeorological conditions, and the state of the natural environment, reasons for these changes, and also bears responsibility for the further development of this sphere.

The Water Code of the Republic of Kazakhstan dated 9 July 2003 No. 481-II (with amendments and additions as of 26 November 2019) implements state policy in the field of use and protection of water resources, water supply, and sanitation. Article 60 of this code prescribes the state monitoring of water bodies which is an integral part of the system of state monitoring of the environment and natural resources. State monitoring of water bodies is a system of regular observation of hydrological, hydrogeological, hydrogeochemical, sanitary-chemical, microbiological, parasitological, radiological, and toxicological indicators of waterbodies’ condition, collection, processing and transmission of the information received, including using data from remote sensing of the Earth.

In addition, the following documents belong to the regulatory framework on hydrometeorology:

The Decree of the Government of the Republic of Kazakhstan On Approval of the Agreement on the Interstate Hydrometeorological Network of the Commonwealth of Independent States dated 23 August 2002 No. 944 regulates the actions for regular receipt, exchange and use of hydrometeorological information, to ensure the state's security and economic and environmental decision-making, ensures coordination of the activities of national, regional and global observation systems to assess hydrometeorological conditions, and other characteristics of the natural environment.

The Decision on the Concept of hydrometeorological security of the member states of the Commonwealth of Independent States dated 16 April 2004 regulates the provision of conditions for achieving the necessary level and quality of hydrometeorological equipment of Commonwealth of Independent States countries, allowing to reduce the negative impact of hazardous hydrometeorological or heliogeophysical phenomena on the safety of lives and property of people, as well as on the functioning of economies. The concept is based on the Model Law On Hydrometeorological Activities, adopted by the Interparliamentary Assembly of the CIS Member States, and the Geneva Declaration of the Thirteenth World Meteorological Congress.

Regulation On the Committee of Water Resources of the Ministry of Agriculture of the Republic of Kazakhstan. In accordance with the order of the minister of agriculture of Kazakhstan dated 10 October 2014 No. 19-5/ 519, the committee oversees the use and protection of the water fund. The committee includes eight basin inspectorates for the regulation of the use and protection of water resources and five subordinate organizations, whose activities cover the following tasks: ensuring coordinated implementation of the state policy in the field of water resources management; ensuring state control in the field of water resources management; fulfilling other tasks assigned to the committee, within the limits of its competence.

Order On approval of the rules for the operation of water facilities located directly on water bodies dated 31 March 2015 No. 19-4 / 294 determines the procedure for the operation of water facilities located directly on water bodies in accordance with the Article 37 of the Water Code of the Republic of Kazakhstan.
Regulatory legal acts concerning veterinary and phytosanitary safety

The regulatory framework for disaster risk management in the field of veterinary and phytosanitary safety is the following legislation:

The Law On Plant Quarantine of 11 February 1999 No. 344-I establishes the legal basis for regulation in the field of plant quarantine, determines the powers of state executive authorities, as well as the basic rights and obligations of individuals and legal entities in the field of plant quarantine.

The Law On Plant Protection dated 3 July 2002 No. 331-II defines the legal, economic and organizational basis for the activities in the field of plant protection from pests, weeds and plant diseases and seeks to protect the crops, their quality and prevent harmful effects for human health and environment in the course of implementation of phytosanitary measures in Kazakhstan.

The Law On Veterinary Medicine dated 10 July 2002 No. 339-II establishes the legal, social, organizational, financial and economic basis in the field of veterinary medicine and seeks to protect the population from diseases common to humans and animals, ensuring epizootic well-being and veterinary and sanitary safety in Kazakhstan.

The Law On the Protection, Reproduction and Use of Wildlife dated 9 July 2004 No. 593-II regulates public relations in the field of protection, reproduction and use of wildlife and seeks to provide conditions for the conservation of wildlife and its biological diversity, sustainable use of fauna in order to meet the ecological, economic, aesthetic and other human needs, taking into account the interests of present and future generations.

The Law On state regulation of the agro-industrial complex and the development of rural areas, dated 8 July 2005 № 66-III, defines the legal, organizational, economic and social basis for the state regulation of the agro-industrial complex and rural areas development in Kazakhstan. Paragraph 2 of Article 13 of the aforementioned law states that for the quality and safety of agricultural products to comply with international requirements, the state takes the following measures:

- veterinary and phytosanitary control in accordance with the legislation of Kazakhstan;
- prevention, diagnosis and eradication of contagious animal diseases according to the list approved by the Government of Kazakhstan, as proposed by the competent authority in the field of the agro-industrial complex;
- organization of state centres for livestock artificial insemination, procurement of livestock products and raw materials, livestock abattoirs, livestock burial grounds, special storage facilities (burial grounds) of pesticides, chemicals and their containers;
- veterinary measures seeking to protect the territory of Kazakhstan and prevent the spread of diseases common to animals and humans;
- phytosanitary measures seeking to prevent the spread of harmful and especially dangerous organisms, protect the territory of Kazakhstan from regulated pests, as well as identifying, localizing and eliminating them;
- compensation for damage incurred by the agro-industrial complex entities as a result of the seizure and destruction of animals, products and raw materials of animal origin that pose a threat to animal and human health.

Order On approval of lists of infectious animal diseases, for which restrictive or quarantine measures are established, dated 28 March 2012 No. 18-03/128, contains the categories of infectious animal diseases and regulates measures to prevent the development and spread of dangerous diseases in Kazakhstan.
Order On Approval of the Rules for the Identification of Farm Animals, dated 30 January 2015 No. 7-1/68, regulates relations related to the identification of animals, reliable registration and maintenance of state records on the movement of identified animals, defines the organizational, legal and financial basis for animal identification, and establishes the basic principles of organizing and doing this work in Kazakhstan.

Order On the approval of veterinary (veterinary and sanitary) requirements for production facilities engaged in animals breeding and selling, dated 29 May 2015 No. 7-1/498, establishes veterinary (veterinary and sanitary) requirements for production facilities that breed animals on specialised farms (complexes, poultry farms), feedlots, and sell them via domestic trade facilities.

Code of the Republic of Kazakhstan On people’s health and the health care system, dated 7 July 2020 No. 360-VI, regulates the state sanitary and epidemiological control and supervision aimed at preventing, detecting, suppressing violations of the legislation of Kazakhstan in the field of sanitary and epidemiological well-being of the population, as well as control over compliance with regulatory legal acts in the field of sanitary and epidemiological well-being of the population, in order to protect the health and environment of the population and the safety of products, processes, services. The code reflects the provisions of the Law On the Sanitary and Epidemiological Well-Being of the Population, which became invalid in 2009.

In order to implement the law On Veterinary Medicine at the government level, a number of decrees were adopted that specify specific procedures. In particular, the regulation On state veterinary and sanitary control and supervision, On approval of the standard regulations on subdivisions of local executive authorities carrying out activities in the field of veterinary medicine, On approval of the Rules for the identification of markets, organizations for the production, procurement (slaughter) of animals, storage, processing and sale of products and raw materials of animal origin, veterinary drugs, feed and feed additives.
Legislation of Kazakhstan on food safety

Food security is one of the main priorities of Kazakhstan. This is reflected in the following regulations governing relations in the field of food security:

The Law On Grain, dated 19 January 2001 No. 143-II, regulates the issues of grain market management and regulation, defines the relations arising in the process of production, storage and sale of grain, as one of the strategic products of food security in Kazakhstan.

The Law On Seed Production dated 8 February 2003 No. 385-II, defines the legal, economic and organizational basis for seed production activities and seeks to regulate the organization and functioning of the seed production system and state control in relation to production, harvesting, processing, storage, transportation, sale and use of seeds of agricultural plants.

The Law On the Regulation of Trading Activities dated 12 April 2004 No. 544-II regulates public relations in the field of trading activities, and establishes the principles and organizational foundations of its state regulation. One of the goals of the law is to promote sustainable economic development and ensure the country’s food security.

The Law On State Regulation of the Development of the Agro-Industrial Complex and Rural Areas, dated 8 July 2005 No. 66, defines the legal, organizational, economic and social basis for state regulation of the agro-industrial complex and rural areas development in the country. Chapter 3 of this law regulates the basic principles, monitoring and organization of food security in the country.

The Law On Food Safety, dated 21 July 2007 No. 301-III, establishes the legal basis for ensuring food safety to protect human life and health, the legitimate interests of consumers and environmental protection in Kazakhstan.

The Resolution On Approval of the Rules for Monitoring the State of Food Security, dated 12 April 2010 No. 296, determines the procedure for monitoring the state of food security in terms of food production amounts, their turnover and the availability of stocks, formation, availability and use of regional stabilization funds for food products, prices for socially significant food products.

The Law On National Security of the Republic of Kazakhstan, dated 6 January 2012 No. 527-IV, regulates the main directions in the field of national security, including food security. According to paragraph 2 of Article 22, food security provides for the state of protection of the economy in which the state shall be able to provide physical and economic accessibility to the population of high-quality and safe food products sufficient to meet the physiological norms of consumption and population growth.

Strategy Kazakhstan 2050 – this strategy changes the approaches to the management of natural resources, modernization of agriculture, enhanced food production and guarantees of national self-sufficiency. It also includes an increase in agro-industrial exports, satisfaction of regional and world demand, introduction of farmland into the market turnover for the purpose of their effective use (President of Kazakhstan, 2012).

The Law On Public Procurement, dated 4 December 2015 No. 434-V 3PK, has as one of its principles to provide support to domestic producers of goods, as well as domestic suppliers of works and services to the extent that this does not contradict the international treaties ratified by Kazakhstan. It approves the list of specialised organizations (agents) carrying out procurement operations and price interventions, as well as procurement of services for storage, processing, and transportation of agricultural and processed products. It prioritizes purchases of agricultural and processed products, and choice of supplier, subject to qualification requirements, in favour of domestic producers of food products.

a result of the programme implementation, labour productivity is expected to increase by 38 percent to the level of 2015; 30 percent higher production of agricultural products and services; an increase in food exports by USD 600 million and a decrease in food imports by USD 400 million; a reduction of irrigation water consumption per hectare from 9,180 m$^3$ in 2015 to 7,348 m$^3$ in 2021; an increase in additional surface water resources to 1.9 km$^3$ to the level of 2015 (Government of Kazakhstan, 2015b).

The Order On the approval of scientifically grounded physiological norms of food consumption, dated 9 December 2016 No. 503, in accordance with paragraph 2 of Article 18 of the Law of the Republic of Kazakhstan On minimum social standards and their guarantees, approves the average physiological norms of food consumption for basic age groups of the population.

The legislative framework of Kazakhstan in the field of food security does not take into account the role and impact of climate risks or risks of emergencies; there are no direct references or terminology used.
Kazakhstan has a number of key strategies, concepts and related action plans that outline the strategic directions for climate-change mitigation and adaptation in the country. The legislative basis of Kazakhstan in the field of climate-change adaptation includes the following regulatory documents:

The Law On the Accession of the Republic of Kazakhstan to the Vienna Convention on the Protection of the Ozone Layer, dated 30 October 1997 No. 177-1, determines the state policy of Kazakhstan in fulfilling international obligations in the field of environmental protection, and is aimed at protecting and preventing the destruction of the ozone layer, and its restoration, in order to protect human health and the environment from the adverse effects caused by its destruction.

The Land Code of the Republic of Kazakhstan, dated 20 June 2003 No. 442-II, governs state regulation of land relations in order to ensure the rational use and protection of agricultural lands, preservation and reproduction of soil fertility, preservation and improvement of the natural environment.

The Forest Code of the Republic of Kazakhstan, dated 8 July 2003 No. 477-II, establishes the legal basis for the rational use, protection, conservation and reproduction of forests as the main natural resource for climate-change adaptation. It regulates the norms of afforestation and forest seed production, increasing their ecological and resource potential.

The Law On Protection, Reproduction and Use of Wildlife, dated 9 July 2004 No. 593-II, regulates relations in the field of protection, reproduction and use of wildlife, is aimed at the conservation of wildlife and its biological diversity, sustainable use in order to meet environmental, economic, aesthetic and other human needs, taking into account the interests of present and future generations.

The Law On Specially Protected Natural Areas, dated 7 July 2006 No. 175-III, defines the legal basis for the creation and functioning of natural complexes, including land of specially protected natural areas, as well as the objects of the state nature reserve fund of Kazakhstan located on these lands.

The Environmental Code of the Republic of Kazakhstan, dated 9 January 2007 No. 212-III, defines state regulation of activities in the field of GHG and ozone-depleting substances emissions, and seeks to prevent and mitigate the irreversible consequences of climate change (including global) and degradation of the Earth’s ozone layer through monitoring the climate and the ozone layer, observations of climate change and the dynamics of the ozone layer, and a comprehensive assessment and forecast of its state.

The Strategy Kazakhstan 2050 seeks to develop the energy sector with a focus on the need to develop alternative energy sources, with the indicator to increase the share of alternative and renewable energy sources in the country’s consumption to 50 percent by 2050. Concerning agriculture, the programme addresses the problems of food security, depletion of natural resources, development of private entrepreneurship and education (President of Kazakhstan, 2012).

The Green Bridge Partnership Programme is an international environmental initiative of Kazakhstan for the transition of countries to a green economy based on multilateral partnerships with business, and public and international cooperation. The programme seeks to integrate environmental and economic policies for sustainable and effective development, as well as find common solutions to global environmental problems (Gubaidullina and Kadirisizova, 2012).
The III-VI National Communication of the Republic of Kazakhstan to the UN Framework Convention on Climate Change is one of the key documents describing the climate-change situation in Kazakhstan. The report studies the impact of climate change on the state of forests and human health, the development of desertification processes, the degradation of farmland and erosion phenomena, the spread of secondary salinisation and general loss of fertility, as well as mitigation mechanisms based on the use of the best available techniques (MoE, UNDP and GEF, 2013).

The Concept for the transition of the Republic of Kazakhstan to a green economy (President of Kazakhstan, 2013). In accordance with the decree of the President of Kazakhstan dated 30 May 2013 No. 577, a programme for the transition to a “green economy” and priority goals have been determined, including higher productivity of resources (such as water, land and biological resources). The focus is on the efficiency of resources management, including agricultural resources, modernization of existing and development of new infrastructure, improving people’s well-being and environmental quality by applying cost-effective measures to reduce the environmental impact, supported by strengthening of national security, including water supply.

The presented regulatory framework addresses the issues of climate change and adaptation to possible consequences. However, it should be noted that the use of direct terminology (climate change, adaptation to impacts, and so on) is extremely rare. Almost all legislative documents are directly or indirectly related to the agricultural sector; however, there is no clear wording, or specific provisions and regulations, in the majority of regulatory documents.
Agricultural disaster risk insurance legislation

Agricultural insurance in Kazakhstan against the adverse effects of natural hazards and disaster risks is currently at the stage of transition from mandatory to voluntary. The law On Mandatory Insurance in Crop Production, lost its force on 6 January 2020. The main provisions as amended are reflected in the law On State Regulation of the Development of the Agro-Industrial Complex and Rural Territories, which provides for insurance of all risks in the agro-industrial complex, and governs the rules for subsidising insurance premiums and the use of digital technologies. According to Article 10-1 of the law, the development of insurance in the agro-industrial complex is supported by subsidies for insurance premiums under insurance contracts concluded by insurance companies. Subsidies are provided within the framework of insurance products approved by the operator through the open information insurance system QOLDAU (QOLDAU, 2020).

According to the law On State Regulation of the Development of the Agro-Industrial Complex and Rural Areas, dated 8 July 2005 No. 66, the main functions of the operator in the field of insurance of the agro-industrial complex are: procurement of services to ensure access to the insurance information system and its maintenance; administration of the process of distribution of budgetary funds in the form of subsidies for insurance premiums; development, examination and approval of insurance products subject to subsidies; monitoring of the insurance industry in the agricultural sector; making proposals to the competent authority responsible for the development of insurance in the agricultural sector; organization of the activities of the expert council.

Additional regulations governing relations in the field of agricultural insurance are:

The Law of the Republic of Kazakhstan dated 18 December 2000 No. 126-II On Insurance Activities defines the legal, economic and organizational basis of insurance activities, and also regulates relations in the field of property insurance, including insurance for agricultural purposes and agricultural facilities.

The Order of the Minister of Agriculture of the Republic of Kazakhstan dated 19 May 2020 No. 172 On approval of the rules for subsidising insurance premiums, determines the procedure for subsidising insurance premiums for agro-industrial complex entities at the expense and within the funds provided in the state budget for the corresponding financial year.

In connection with the current changes in the field of agricultural insurance in Kazakhstan, the number of existing legislative acts is limited, which is compensated by their content, the possibility of additional editing, and publication of additional regulatory documents.
Concepts for disaster risk reduction, climate-change adaptation, and food security

The main strategic priorities of Kazakhstan related to DRR, climate-change adaptation, and food security are featured in the long-term development programme of the country, Kazakhstan 2050, and the Environmental Code of the Republic of Kazakhstan. The strategic programme identifies ten global challenges, with the following ones directly related to the issues in question:

- Global demographic imbalance – global trend of human aging. In 40 years, the number of people over the age of 60 will exceed the number of those under the age of 15. The growing demographic imbalance is shaping migration flows and exacerbating social tensions around the world.
- Threat to global food security – a high population growth rate exacerbates the food problem. Even today, there are tens of millions of people starving globally, with about a billion people experiencing food shortages.
- Severe water scarcity – the world’s water resources are under pressure. The consumption of drinking water on the planet has increased eight-fold over the past 60 years. Many countries will be forced to import water by the middle of the century.

The strategic programme sets goals for DRR and formation of a sustainable food security system in the context of the identified problems.

An integrated approach and implementation of climate-change adaptation programmes, in accordance with the law On Ratification of the Kyoto Protocol, dated 26 March 2009 No. 144-IV, is presented in the Second National Communication of the Republic of Kazakhstan to the Conference of the Parties to the UN Framework Convention on Climate Change (MEWR, 2009). In the agricultural sector, forest expansion and the conversion of unproductive arable land into pastures were identified as the main focus for reducing carbon dioxide and nitrous oxide emissions. Four sets of adaptation measures in agriculture are also outlined there:

- legislative measures aimed at creating market incentives to establish sustainable development systems in a market economy;
- measures to reduce soil erosion in desert and semi-desert areas;
- preventing outbreaks of pests and diseases through more detailed forecasts and use of pesticides;
- research into the possibility of growing more climate-resistant winter and spring wheat varieties.

The practical realisation of the identified priorities has a cost estimate of USD 957.4 million. Due to a lack of funding, the pace of implementation is slow. Efforts are being undertaken to implement the policy consistently, and while certain results have been achieved across all priorities, further implementation requires additional investment.

The concept of DRR in Kazakhstan, as a separate doctrine, is either not available or closed for access. The main provisions are reflected in the law On Civil Protection, which is aimed only at preventing and eliminating natural and man-made emergencies and their consequences. There is no specific terminology on DRR used in law.

As a practical action in the field of DRR, it is worth noting the ratification of the agreement between the Government of Kazakhstan and the Government of Kyrgyzstan on the establishment of the Centre of Emergency Situations and Disaster Risk Reduction (CESDRR), in accordance with the Law of the Republic of Kazakhstan dated 14 April 2014 No. 191-V 3PK. The centre’s work is focused on the following tasks (CESDRR, 2020):
• develop cooperation in DRR, prevention and elimination of emergency situations;
• mitigate factors of disaster risk, identify, assess, forecast and monitor emergency situation hazards;
• coordinate mutual efforts and strengthen preparedness for effective and timely response to emergencies;
• implement regional and international cooperation in DRR and emergency management;
• ensure the safety of the population during natural and man-made emergencies;
• involve international and non-profit organizational grants for DRR, development, and implementation of joint international projects;
• implement international and other programmes in the field of DRR, prevention and elimination of emergency situations.

Among the actions to address the issues related to the disaster risk prevention, climate-change adaptation, and food security in agriculture, it is necessary to note the State Programme for the Development of the Agro-Industrial Complex of the Republic of Kazakhstan for 2017–2021 (Government of Kazakhstan, 2018), which aims to address the following tasks:

• ensure food security;
• better availability of financing for agribusiness entities and optimal taxation regimes for agribusiness entities;
• better efficiency of land use;
• better efficiency of water resources use;
• ensure the accessibility of sales markets and development of exports;
• facilitate the development of the agrarian science, technology transfer and competences of agribusiness entities;
• enhance technological infrastructure and intensify production in the agro-industrial complex;
• improve the quality of public services and ensure the introduction of digital technologies in the agro-industrial complex;
• increase the level of rural citizens’ satisfaction with living conditions.

Programme funding amounted to KZT 2 947.1 billion (USD 7.02 million). It is also worth highlighting the programme Akbulak (President of Kazakhstan, 2010), providing the population with drinking water in the required quantity and guaranteed quality with funding of KZT 951.5 billion. The programme for the development of agriculture in Kazakhstan, Agrobusiness 2020 (Government of Kazakhstan, 2015b), has total funding of more than KZT 3.1 billion.

As an EWS in the field of food security and food safety, in accordance with the Decree of the Government of the Republic of Kazakhstan dated 12 April 2010 No. 296, food security monitoring is arranged in the country, to analyse the state of food security annually by comparing food security indicators in Kazakhstan with similar indicators of other countries, calculated by FAO.

The presented concept and programmes seek to enhance economic development and food security in the country. At the end of 2010, within the framework of a joint project of the United Nations Development Programme (UNDP) and the Ministry of Environment and Water Resources (MEWR), the draft National Concept on Climate Change Adaptation in Kazakhstan was developed (World Bank, 2013). However, there is no free access to information on the content and specific results of this concept.

Current state programmes in Kazakhstan do not have a clear focus on the problems of agriculture-related DRR and climate-change adaptation. Moreover, the analysis of the legislative framework showed that the current legislation of Kazakhstan does not contain special provisions and norms on climate-change adaptation. The main law on climate change (the Environmental Code of the Republic of Kazakhstan) regulates only issues related to climate-change mitigation by capping GHG emissions (Government of Kazakhstan, 2020).

The real proof of commitments fulfilled in the field of climate-change mitigation is the programme of gasification of the central and northern regions of Kazakhstan – the construction of the Saryarka gas pipeline. The programme covers 171 settlements, with the cost of the first phase of the programme KZT 267.3 billion. After construction of the pipeline, it is estimated that by 2030, about 60 000 to 70 000 tonnes per year of emissions and pollutants will have been avoided (Turan, 2018). It is also important to mention the Astana Green Belt
programme (Nur-Sultan Akimat, 2020). During the first and second phases of the programme, from 2012 to 2016, about 1.8 million seedlings with a closed root system were planted on an area of 1 323.5 ha, and perennial grasses (honey plants) were sown on 452.1 ha.

Despite the results achieved, experts believe that the development and implementation of programmes related to DRR and climate-change adaptation will be less urgent in the near future for a number of reasons. First, this is due to a lack of funding, since the area in question requires large investments. Second, it is due to the lack of profit and cost recovery, as adaptation measures have a high cost and in real climatic conditions, they should be profitable. Third, it is due to the low level of public concern about DRR and climate-change adaptation, because there is greater concern with regard to addressing economic problems.
Institutional framework for disaster risk management and climate-change adaptation

In accordance with the Law of the Republic of Kazakhstan dated 11 April 2014 No. 188-V On Civil Protection, the State Civil Protection System (SCPS) operates in the country, which represents a set of governing bodies, forces and means designed to implement a set of measures to protect the country’s population, facilities and territory from the dangers arising from emergencies and military conflicts or as a result of these conflicts, in peacetime and wartime. The SCPS management structure of Kazakhstan is shown in Figure 7.

The SCPS is organized according to the territorial/administrative and functional principle, taking into account economic, natural and other conditions, as well as demographic, gender, cultural characteristics of various population groups, climatic characteristics of the regions, the degree of danger and the nature of emergencies.
Organizational and methodological guidance for civil protection measures planning is provided by the Ministry of Emergency Situations (MES). Until September 2020, this function was performed by the Committee of Emergency Situations (CES) of the Ministry of Internal Affairs.

The SCPS consists of territorial and sectoral subsystems. Territorial subsystems are created at the regional, city and district levels for the prevention and elimination of emergencies and their consequences, for the implementation of civil protection measures within their territories, and consist of links corresponding to the administrative-territorial division of these territories. Sectoral subsystems are created by central executive authorities to organize the implementation of civil protection measures within their competence.

The current disaster risk management system has an extensive state structure focused only on the implementation of measures to protect the population from hazards arising from emergencies, which means a response to incidents. Climate-change mitigation and adaptation are not covered by the system. One of the main shortcomings of the current system is the low effectiveness of preventive measures at the stage of risk reduction – mitigation of disaster implications; lack of experience in practical response and regulations for DRR measures; insufficient level of training of the manager and coordinator of the disaster risk management system.
Interagency Civil Protection Commission of Kazakhstan

The Interagency Civil Protection Commission of the Republic of Kazakhstan (ICPC) is created by a decision of a competent authority at the central level – it exercises its powers in cooperation with central and local executive authorities, organizations, public associations and is the coordinating body to manage the SCPS. The main tasks of the ICPC are to develop proposals for:

- main directions of civil protection development and further improvement;
- formation of a system of legal, economic, organizational, technical and other measures in the field of civil protection;
- creation and development of forces and means of civil protection;
- coordination of the activities of central and local executive authorities on the prevention and elimination of emergency situations, socioeconomic and legal protection, medical rehabilitation of citizens affected by accidents, catastrophes, natural and other disasters, as well as persons who took part in the elimination of emergency situations and their consequences.

The ICPC has the right to make proposals regarding the coordination of actions of central and local executive authorities, scientific organizations and public associations in the field of civil protection; to hear the heads and officials of central and local executive authorities, organizations on issues related to civil protection activities; request from central and local executive authorities and organizations information about their relevant activities; to analyse the implementation of civil protection measures by central and local executive authorities; involve specialists of organizations (upon agreement with their management) to carry out analytical, expert and other work on civil protection issues; to make proposals to the prime minister of Kazakhstan on the allocation of funds from the reserve of the Government of Kazakhstan for sustaining the lives of people during the elimination of natural and man-made emergencies on the basis of approved standards. The composition of the ICPC is shown in Figure 8.

The ICPC is chaired by the minister of internal affairs, who is the head of the country’s civil protection and the chairperson of the commission. The vice minister of internal affairs is the deputy chairperson of the commission; while the head of the Disaster Risk Reduction and Civil Protection Office of the CES performs the functions of secretary of the commission. The ICPC includes representatives from the ministerial corps, national companies and public associations, and heads of executive authorities (MIA, 2017). The role and procedure for the Ministry of Agriculture’s activities as part of the ICPC is not specified.
Figure 8. Composition of the Interagency Civil Protection Commission of Kazakhstan

- Minister of Internal Affairs of the Republic of Kazakhstan, Chairperson of the ICPC
- Vice Minister of Internal Affairs of the Republic of Kazakhstan, Deputy Chairperson of the ICPC
- Head of Disaster Risk Reduction and Civil Protection Office of the Emergency Situations Committee, MIA RK, Secretary of the ICPC
- Deputy General Prosecutor of the Republic of Kazakhstan
- Deputy Chairperson of the National Security Committee of the Republic of Kazakhstan
- Vice Minister of Healthcare of the Republic of Kazakhstan
- Vice Minister of Information and Social Development of the Republic of Kazakhstan
- Vice Minister of Labour and Social Protection of the Population of the Republic of Kazakhstan
- Vice Minister of Industry and Infrastructural Development of the Republic of Kazakhstan
- Vice Minister of National Economy of the Republic of Kazakhstan
- Vice Minister of Digital Development, Defense and Aerospace Industry of the Republic of Kazakhstan
- Vice Minister of Education and Science of the Republic of Kazakhstan
- President of the Public Association "Red Crescent Society of the Republic of Kazakhstan"
- Vice Minister of Agriculture of the Republic of Kazakhstan
- Vice Minister of Finance of the Republic of Kazakhstan
- Vice Minister of Energy of the Republic of Kazakhstan
- First Deputy Chief of the General Staff of the Armed Forces of the Republic of Kazakhstan
- Chairperson of the Emergency Situations Committee, MIA RK
- Deputy Director of the Department of Logistics of the Ministry of Foreign Affairs of the Republic of Kazakhstan
- Managing Director of the Joint-Stock Company "National Company "Kazakhstan Temir Zholy"
- Managing Director for Production of the Joint-Stock Company "Kazakhstan Electricity Grid Operating Company “KEGOC”
- Member of the Board of the National Chamber of Entrepreneurs of the Republic of Kazakhstan "Atameken"
- Director of LLP “Institute of Seismology"

According to the regulation on the MES – Resolution of the Government of the Republic of Kazakhstan dated 23 October 2020 No. 701 – the Ministry is a competent authority performing civil protection functions, in terms of preventing and eliminating natural and man-made emergencies, providing emergency medical and psychological assistance to the population, ensuring fire safety, and organizing civil protection. The structure of the MES is shown in Figure 9. The tasks of the MES are to:

- design and implement state policy in the field of civil protection;
- ensure the functioning and further development of the SCPS;
- implement intersectoral coordination in the field of civil protection;
- implement state control in the field of fire safety and civil protection;
- organize fire prevention and control.

Figure 9. Structure of the Ministry of Emergency Situations of Kazakhstan

Ministry of Agriculture

The main DRR activities of the Ministry of Agriculture (MoA) are focused on the epizootic and phytosanitary safety of agricultural industries, and the state of fertility and degradation of farmland.

Agricultural land monitoring is controlled and supervised by the Land Management Committee. Regional representatives of the committee, together with local executive authorities, monitor activities and collect information on land quality – soil features, erosion processes, pollution and disturbance of the land, crops, technical condition of hayfields and pastures, soil grading. If the rules on land use (irrational use of agricultural lands) are violated, the committee initiates the seizure of land to prevent further degradation and deterioration of the quality of land resources (MoA, 2016).

The Committee of Veterinary Control and Supervision is responsible for DRR activities in the field of epizootic and food safety. The main functions of the committee in the field of DRR include (MoA, 2015):

- organize and deliver veterinary measures for the sake of prevention, diagnostics and eradication of especially dangerous animal diseases;
- testing, control of veterinary drugs, feed additives, devices, instruments, their registration tests;
- identify the causes and conditions for the occurrence and spread of animal diseases and food poisoning;
- state veterinary and sanitary control and supervision;
- arrange veterinary control posts at the border and customs points for the movement of articles across the state border;
- state veterinary and sanitary control and supervision over the fulfilment of the requirements established by technical regulations;
- state veterinary and sanitary control and supervision over the transportation, storage and destruction of strains of animal pathogens used in veterinary medicine;
- protection of the territory of Kazakhstan from the introduction and spread of infectious and exotic animal diseases from other states;
- reimburse, for the owners, the value of seized and destroyed sick animals, products and raw materials of animal origin that pose a danger to the health of animals and humans;
- introduce temporary veterinary and sanitary measures.

The committee, together with territorial divisions, develops plans for epizootic monitoring, regulations and technical conditions contributing to risk prevention and reduction, within its competence.

Disaster risk reduction in the field of phytosanitary safety is within the scope of the State Inspection Committee in the agro-industrial complex. The main functions of the committee related to DRR include (MoA, 2017):

- state quarantine and phytosanitary monitoring;
- ensure compliance with international norms and requirements in accordance with the concluded agreements in the field of plant quarantine;
- maintain a database on the presence and distribution of regulated articles in Kazakhstan and other states, measures and actions to combat them;
- control sample surveys of territories and premises of organizations, internal traders, peasant, household and dacha farms which are growing, harvesting, storing, processing and selling products of plant origin, farmland and land for other purposes;
- organize plant quarantine measures, control and supervision of their implementation;
- conduct secondary quarantine and phytosanitary control at phytosanitary control posts at the destination of regulated articles, conduct quarantine/phytosanitary or laboratory assessment, taking into account the phytosanitary characteristics of the area and origin of products, production sites, free or having limited prevalence of regulated articles.
• documentary quarantine and phytosanitary control of imported, exported and transit regulated articles at phytosanitary control posts;
• regular inspection and examination of regulated articles at domestic trade facilities and in organizations;
• organize and control the study of imported seed and planting materials in an authorised organization for the presence of latent infestation with regulated articles and alien species;
• make a decision on the establishment of a quarantine zone with the introduction of a quarantine regime or its cancellation;
• develop, together with research organizations, quarantine phytosanitary measures based on scientific principles of pest risk assessment, taking into account the requirements of international norms and recommendations;
• develop and approve methods, techniques, recommendations governing the procedure and methods for implementing plant quarantine measures.

One of the main functions of the committee in relation to DRR is state testing and registration of pesticides, and maintaining a register of pesticides permitted for use on the territory of Kazakhstan.

The MoA regularly allocates funding for applied scientific research to address strategically important government tasks. Priority specialised research areas related to DRR include the development of intensive livestock production; ensuring veterinary and phytosanitary safety; intensive farming and crop production; technical support for the modernization of the agro-industrial complex; sustainable development of rural areas; management of water, soil and biological resources. According to the National Centre for State Scientific and Technical Expertise, the amount of research funding allocated by the MoA for 2018–2020 amounted to KZT 10.17 billion (USD 24.2 million) (NASEC, 2018).
National hydrometeorological service

The probability, impact and possible consequences of hazardous processes and phenomena are monitored and forecasted by the National Hydrometeorological Service of the Ministry of Ecology, Geology and Natural Resources of the Republic of Kazakhstan, or Kazhydromet, using the state observation network. Monitoring data are concentrated in a unified state system for monitoring the environment and natural resources (Kazhydromet, 2020a). Kazhydromet is responsible for following types of monitoring:

- environmental monitoring;
- monitoring of the state of atmospheric air;
- monitoring of the state of atmospheric precipitation;
- monitoring of the quality of water resources;
- monitoring of soil conditions;
- meteorological monitoring;
- radiation monitoring;
- monitoring of transboundary pollution;
- background monitoring.

Besides environmental and meteorological monitoring, Kazhydromet performs the following activities: improves methods for hydrometeorological phenomena forecasting; research work related to environmental, meteorological, hydrological monitoring; prepares and organizes the publication of scientific/technical and applied research literature; provides data on background concentrations of environmental quality parameters and forecasts of adverse meteorological phenomena to individuals and legal entities on a contractual basis.

In the existing DRR system, Kazhydromet is defined as an alert body for geophysical and meteorological threats for the Public Meteorological Service of the World Meteorological Organization (WMO). Its scope does not include the responsibilities and functions of DRR; Kazhydromet’s activities are aimed at early identification of hydrometeorological disaster risks and refer to disaster early warning. Based on the monitoring results and forecasts, the Crisis Management Centre and the CES develops DRR action plans.
Centre of Emergency Situations and Disaster Risk Reduction

On the initiative of Kazakhstan, subject to the intergovernmental agreement between Kazakhstan and Kyrgyzstan, the Centre of Emergency Situations and Disaster Risk Reduction (CESDRR) was established in 2016. The centre’s work is focused on the following:

- cooperation with all stakeholders in the field of emergencies and DRR;
- implementation of joint international projects in the field of emergency situations and DRR;
- conducting special drills, workshops, training courses and other events;
- implementation of measures to harmonise legislation in the field of emergency situations and civil protection;
- participation in the preparation and delivery of international drills, rescue and humanitarian operations on the territory of the Parties and in other foreign countries, and assistance with the participation of Parties’ forces and means in such events;
- exchange of experience and implementation of best practices in the prevention and elimination of emergencies and DRR;
- other activities in the field of DRR, prevention and emergency response.

The main partners of the centre are the following international and regional organizations:

- Asian Disaster Reduction Center (Kobe, Japan);
- Asian Disaster Preparedness Center (Bangkok, Thailand);
- UNICEF Regional Office for Central and Eastern Europe and CIS;
- Regional office of European Civil Protection and Humanitarian Aid Operations;
- United Nations Regional Office for Disaster Risk Reduction;
- United Nations Environment Programme in Central Asia;
- European Civil Protection and Humanitarian Aid Operations;
- UNDP Regional Office for Europe and Central Asia;
- Subregional Office for North and Central Asia of the Economic and Social Commission for Asia and the Pacific;
- Coordination Office for Central Asia of the International Organization for Migration.

The strategic programme of the centre, that seeks to enhance security for the population and territories of the states in the region by strengthening the organizational and legal framework, institutional framework, mechanisms, policy and practice of disaster and emergency risk management for the future until 2030, provides for:

- promotion of harmonisation of national legislation in the field of DRR and emergency situations, in line with the principles of human rights and gender, taking into account the interests of the most vulnerable groups of the population, including women, children and the elderly;
- strengthening emergency management capacity at the regional level, by studying and implementing the advanced achievements of international organizations and government bodies of foreign countries and improving the exchange of best practices;
- assistance in creating and developing modern national information and communication systems for collecting and processing data and analysing information, taking into account international best practices;
- assistance in developing, improving and implementing methodological and guidance materials, uniform terminology, standardized forms and systems for receiving, collecting, processing, storing, protecting, analysing and exchanging information;
• creation of a data bank of the centre, assistance in integrating the information and communication systems and databases of crisis centres of competent authorities and states of the region;
• assistance in introducing the international monitoring systems and networks in the country on natural, man-made, ecological, climatic and other types of threats and potential emergencies;
• assistance in raising public awareness of the relationship between disaster risk and climate change, environmental degradation, and migration, to ensure further intersectoral focus in DRR programmes at the local, national, and regional levels.

Table 8 shows the projects implemented with partners of the CESDRR in 2016–2020.

<table>
<thead>
<tr>
<th>Name of project</th>
<th>Partners</th>
<th>Year of implementation</th>
<th>Project result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analysis of existing humanitarian/ emergency reserves</td>
<td>United Nations Children’s Emergency Fund (UNICEF)</td>
<td>2018</td>
<td>Final report on mapping and analysis of existing emergency stocks/reserves in Central Asia and South Caucasus</td>
</tr>
<tr>
<td>Strengthening Community Resilience to Negative External Impacts and Improving the Effectiveness of Flood Risk Management in Almaty Region</td>
<td>UNDP in Kazakhstan</td>
<td>2017</td>
<td>Educational and methodological materials developed, a gender survey conducted, and recommendations for gender mainstreaming in preparedness plans developed</td>
</tr>
<tr>
<td>Humanitarian Implementation Plan – 2017</td>
<td>United Nations Office for Disaster Risk Reduction, United Nations Office for the Coordination of Humanitarian Affairs</td>
<td>2017</td>
<td>Training modules developed by the Global Institute for Education and Training (GETI) under the United Nations Office for Disaster Risk Reduction on the Sendai monitoring system adapted in the context of Central Asia</td>
</tr>
<tr>
<td>Geoinformation systems, mapping and work with data</td>
<td>MapAction (UK)</td>
<td>2018–2019</td>
<td>Improving the qualifications of specialists in GIS management, mapping and working with data for the further emergency response work of headquarters</td>
</tr>
<tr>
<td>Development of unmanned aviation in order to ensure the safety of territories and population, including vulnerable groups from emergencies and disasters</td>
<td>United Nations Children’s Emergency Fund (UNICEF)</td>
<td>2020</td>
<td>New approaches to ensuring the safety and survival of children and vulnerable groups of the population identified, the exchange and use of international experience in the use of unmanned aviation for humanitarian purposes on the basis of Kazakhstani corridors</td>
</tr>
<tr>
<td>Research on Assessment of Drought Problems and Drought Monitoring Models in Central Asia</td>
<td>United Nations Economic and Social Commission for Asia and the Pacific</td>
<td>2019–2020</td>
<td>Assessment of drought problems and various existing drought monitoring models used in Central Asia</td>
</tr>
</tbody>
</table>

Activities of actors in the institutional structure of the DRR system

The structure of the CESDRR, together with the involved partners, enables the analytical work, theoretical training and dissemination of knowledge in the field of disaster and emergency risk reduction. For better efficiency, it is necessary to enhance the powers of the centre and endow it with functions aimed at uniting and coordinating the efforts of all actors in disaster risk management in the country – government agencies, research institutions, public organizations, the media, non-governmental organizations (NGOs), and businesses. A list of organizations involved in disaster risk management is presented in Table 9.

<table>
<thead>
<tr>
<th>Organization</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Hydrometeorological Service, Kazhydromet</td>
<td>Monitoring of the state of the environment, meteorological and hydrological monitoring using the state observation network (Kazhydromet, 2020a).</td>
</tr>
<tr>
<td>Committee of Water Resources of the Ministry of Ecology, Geology and Natural Resources</td>
<td>Coordinates the implementation of state policy, the implementation of strategic, regulatory, implementation and control and supervisory functions in the field of water resources management, including the maintenance of the state water cadastre and state monitoring of water bodies (MEGNR, 2019b).</td>
</tr>
<tr>
<td>Veterinary Control and Supervision Committee of the Ministry of Agriculture</td>
<td>Performs the implementation, control and supervisory functions in the field of veterinary medicine, including protecting public health from diseases common to animals and humans, ensuring veterinary and sanitary safety, protecting the territory of Kazakhstan from the introduction and spread of infectious and exotic animal diseases from other states, prevention and elimination of environmental pollution when individuals and legal entities carry out activities in the field of veterinary medicine (MoA, 2015).</td>
</tr>
<tr>
<td>State Inspection Committee in the Agro-Industrial Complex of the Ministry of Agriculture</td>
<td>Performs implementation, control and supervisory functions in the field of phytosanitary safety, protection and quarantine of plants, including monitoring, prevention of the import and spread of regulated articles in the country (MoA, 2017).</td>
</tr>
<tr>
<td>Committee of Forestry and Wildlife of the Ministry of Ecology, Geology and Natural Resources</td>
<td>Carries out implementation, control and supervisory functions in the field of forestry, protection, reproduction and use of wildlife and specially protected natural areas (MEGNR, 2019c).</td>
</tr>
<tr>
<td>State Institution Kazselezashchita of the Committee of Emergency Situations</td>
<td>Provides protection of the population, economic facilities and lands of Kazakhstan from the impact of hazardous natural phenomena (mud flows, avalanches, landslides), including by organizing a service to monitor hazardous natural phenomena and warn about the threat and occurrence of hazardous natural phenomena, and participation in mitigating their consequences.</td>
</tr>
<tr>
<td>JSC National Centre for Space Research and Technology</td>
<td>Implementation of research, development and production and economic activities in the field of space research, including the use of space monitoring and remote sensing technologies for solving problems in the field of ecology, agriculture, geology, cartography, land use, water management and other territorial objects and processes (NCSRT, 2020).</td>
</tr>
</tbody>
</table>

The Climate Change Coordination Center (CCCC) is an NGO in Kazakhstan facilitating the implementation of the UNFCCC, the Kyoto Protocol to the UNFCCC, and the Vienna Convention for the Protection of the Ozone Layer. The CCCC performs training, logistics, legislative, analytical and project activities, as well as interagency coordination within the scope of ratification of the Kyoto Protocol by Kazakhstan (CCCC, 2020).

In 2012, within the framework of the GIZ project, Adaptation to climate change through sustainable management of natural resources and transboundary cooperation to prevent disasters caused by natural hazards in Central Asia, an intersectoral working group (IWG) on DRR and climate change was established in Kazakhstan (Shivareva, 2016). The main objectives of the IWG were:
• expertise in the field of geo-risk prevention in Kazakhstan and Central Asia;
• analysis of existing water-related natural hazards, development of approaches to risk reduction and their communication to decision makers;
• consideration of the transboundary context, regular international coordination of the developed approaches;
• creation of IWGs in other countries.

The IWG included representatives of 11 organizations:

- KazNU named after Al-Farabi (https://www.kaznu.kz);
- Institute of Geography (https://ingeo.kz);
- Kazhydromet (https://www.kazhydromet.kz);
- Executive Directorate of International Fund for Saving the Aral Sea in Almaty (https://kazaral.org);
- Water Resources Committee (https://www.gov.kz/memleket/entities/water?lang=ru);
- GI Kazselezashchita under CES (http://qsq.emer.gov.kz/ru);
- National Centre of Space Research and Technology JSC (https://spaceres.kz);
- Regional Centre of Hydrology of Central Asia (http://ru-ec-ifas.waterunites-ca.org/ifas-division/branch-in-kazakhstan/index.html);
- Regional Environmental Centre for Central Asia (https://carececo.org/main);
- Kazgiprovodkhoz (http://kazgiprovodkhoz.kz);
- Public organizations.

This format of IWG activities has proven its effectiveness in analysing and preventing certain categories of disaster risks. For instance, in the period from 2012 to 2016, the working group provided the competent authorities with recommendations on the water resources management programme – the safety of the Shardara dam – which led to the construction of two spillways to be used in case of extreme flooding. In 2015, the working group concluded that the research on monitoring of mud flows has been significantly reduced, providing mostly background forecasts; the mountain slopes in southeast Kazakhstan had not been sufficiently studied in terms of their landslide hazard under the influence of strong earthquakes; the mud flow development patterns in the glacial zone were not clear in the context of the ongoing degradation of mountain glaciers; capacities of the existing engineering structures for mud flow protection had not been assessed, and there were no recommendations for their maintenance and development. In terms of hydrological DRR, the following shortcomings were identified: Kazakhstan has not officially approved the Classification of Natural Hazards, including hydrological hazards; there is no unified interagency database on hydrological hazards; the risks of hydrological hazards are practically not taken into account when planning the protection and development of territories; and there are no strategic plans to reduce the risks of hydrological hazards both for individual territories and the country as a whole. To address these, a request was sent to the government to look into the issue and instruct a number of scientific and industrial institutions to address the issues raised in connection with global warming.

The collaboration of specialists from diverse profile organizations is most effective for designing solutions to reduce the risks of various disasters. The results of the IWG’s work have proven that the creation of such groups with international participation and wider membership in a transboundary context can be an effective tool in preventing and reducing individual disaster risks in the country in the context of climate change.

According to Ede Jorge Ijjas-Vasquez (Akhmetov, 2019), former Senior Director for the Social, Urban, Rural and Resilience Global Practice at the World Bank Group, the impact of disasters will continue to grow globally due to urban population growth and economies that are increasingly exposed to natural hazards. The frequency and intensity of natural hazards will also increase due to climate change. Given the geographical features and exposure to various kinds of risks, including agricultural ones, it is especially important to ensure financial preparedness in the face of natural hazards. Given the objectivity of this assumption, it is necessary for Kazakhstan to create a special fund for the financial support of studies on disaster risk management and reduction and climate change, as well as for the humanitarian and financial support of measures to eliminate consequences of disasters caused by natural hazards.
Early warning systems for agricultural disasters

The agricultural sector is most exposed to various kinds of risks and adverse natural phenomena. One of the priority areas for disaster risk management is to improve the effectiveness of early warning systems (EWS) for highly exposed areas.

The main institute for disaster risk management, whose activities include monitoring and forecasting natural hazards that threaten agricultural production and agricultural infrastructure, is Kazhydromet. In accordance with the Order of the Minister of Internal Affairs of the Republic of Kazakhstan dated 26 December 2014 No. 945 On approval of the rules for organizing a civil protection warning system and alerting the population, state bodies in emergency situations in peacetime and wartime, the information about the threat or occurrence of natural or man-made emergencies is transmitted to the Crisis Management Centre (CMC) of the CES of the Ministry of Internal Affairs. The information received by the CMC becomes a basis for further warning of the population and government agencies. The EWS is designed to inform and alert the population about the threat or occurrence of an accident, its possible development and a forecast; inform the population about the rules of behaviour, the procedure for action and the measures that must be taken to preserve the life and health of people, the environment and economic facilities, and mitigate the consequences of accidents. It operates as shown in Figure 10.

![Figure 10: Stages of the early warning system]

In order to create a comprehensive notification and EWS in Kazakhstan, a Unified State System for Monitoring the Environment and Natural Resources (USSM) has been created. The USSM’s structure is shown in Figure 11. The USSM covers:

- collection, storage, processing of initial data on environmental conditions and natural resources use according to a set of parameters provided for by state and industrial monitoring programmes, maintaining cadastres and information banks for monitoring environmental components and nature management;
- compilation of data on environmental conditions and the use of natural and man-made processes and phenomena;
- preparation and transfer of regulated initial data and the results of their processing, including forecasts, certificates, reports and other forms of submissions to state authorities and administrations, central and regional state bodies for monitoring the environment and natural resources;
• development of recommendations for the implementation of measures to eliminate or reduce the negative consequences for the environment, protection and rational use of natural resources;
• information support for the compilation of state statistics, environmental expertise, environmental audit, control in the field of the environment and use of natural resources.

Guided by the “rules for the coordination of the activities of the dispatching services and the powers of the unified duty dispatch service 112” in the territory of Kazakhstan, according to the order of the minister of internal affairs of Kazakhstan dated 23 February 2015 No. 138, possible risks and adverse natural phenomena which are dangerous for the agricultural sector are communicated by the unified duty dispatch service 112 (UDDS 112) of the CES, a service that receives and processes the information from individuals and legal entities about the conditions preceding an emergency, fire, threat to life and harm to human health and on other cases requiring the adoption of emergency measures with the subsequent coordination of the response by the emergency services.

![Figure 11. Structure and interaction of unified duty dispatch service elements](image)

Prompt communication within the UDDS 112 is done via telephone and SMS notification of local executive authorities, via SMS-notification on road closures or storm warnings through cellular operators, and automatic launching of street sirens; and by informing the population by intercepting television and radio broadcasting, and through mobile warning and information points equipped with loudspeakers. At the end of 2019, a mobile application, Darmen, was launched in Kazakhstan, developed by the CES for prompt emergency communication with the population. The application operates in a number of regions, with the prospect of upscaling to cover all of Kazakhstan.

Apart from these communication tools, Kazakhstan has another mobile app for air quality monitoring (AirKZ), launched by the Ministry of Ecology, Geology and Natural Resources (MEGNR) (informBURO, 2018a). With its help, the user can monitor the quality of atmospheric air throughout the territory of Kazakhstan. The AirKZ app provides data on 46 settlements and 84 ecological posts. A user can manually select the posts, or the app can automatically determine the nearest post based on geolocation data. The app displays the main indicators of the pollutant concentration in the air at the selected post.

The epizootic situation is monitored and analysed by the Veterinary Control and Supervision Committee of the Ministry of Agriculture of the Republic of Kazakhstan with the involvement of local executive authorities of the relevant administrative-territorial units, animal health researchers, representatives of research organizations, and international animal health experts. According to the order of the minister of agriculture of Kazakhstan dated 28 March 2012 No. 18-03/128, the country approved a list of infectious animal diseases, in which restrictive measures are established for 52 diseases, and quarantine for 40 diseases. In accordance with the monitoring rules (Order of the Minister of Agriculture of the Republic of Kazakhstan dated 27 November 2014 No. 7-1/618), epizootic monitoring is arranged at the central regional and local levels; however, neither the order approving the list of diseases nor the rules indicate the specific diseases which are subject to epizootic monitoring. At the same time, the Order of the Minister of Agriculture of Kazakhstan dated 29 June 2015 No. 7-1/587 On the approval of veterinary (veterinary and sanitary) rules is in force, which regulates the procedure for implementing veterinary measures to implement and eradicate diseases specified in the list of infectious diseases of animals. These orders from one department may need to be combined into one regulatory document to simplify their use.
Phytosanitary risks in Kazakhstan are monitored and analysed by the Republican Methodological Centre for Phytosanitary Diagnostics and Forecasts of the State Inspection Committee in the agricultural sector. Organizations carry out phytosanitary and quarantine inspections of agricultural and other land, monitor the development and spread of harmful, especially dangerous plant organisms, identify outbreaks of quarantine objects, and determine the boundaries of their spread.

A survey of specialists and employees of the Republican Methodological Centre for Phytosanitary Diagnostics and Forecasts showed that the phytosanitary situation is monitored in accordance with the monitoring plan, expressed in hectares according to the list of especially dangerous and harmful organisms (Order of the minister of agriculture of the Republic of Kazakhstan dated 30 March 2015 No. 4-4/282 On approval of the list of quarantine objects and alien species, subject to establishment and implementation of plant quarantine measures, and the list of especially dangerous organisms), which does not cover the entire area of crops. According to the Order of the minister of agriculture of the Republic of Kazakhstan dated 30 March 2020 No. 107 On approval of the rules for subsidising an increase in crop yields and quality of crop production, farmers must themselves conduct phytosanitary monitoring and phytosanitary measures and prevent the development and spread of harmful and especially dangerous organisms whose number is higher than economic-injury level, with the exception of grasshoppers and herd and non-herd locusts, as well as some quarantine objects, in relation to which activities are carried out by the government and financed from budget funds.

There are a number of problems in the EWS for epiphytotics and epizootics in Kazakhstan:

- In the structure of the MoA, several divisions have similar functions – for example the Committee of Veterinary Control and Supervision, and the Department of Veterinary, Phytosanitary and Food Safety, which creates duplication of actions and makes epizootics prevention less effective. Therefore, early warning powers and responsibilities have to be distributed and functions defined. Since there is no clear focus on disaster risks early warning in the legislative framework and activities of the designated structural units, mechanisms of interaction for prevention, response, and information exchange in the field of disaster risk management in this area should also be developed.

- Interaction of local executive authorities and farmers with specialised institutions for disasters early warning in agriculture is weak. It is necessary to develop modern methodological manuals for epizootics and epiphytotics prevention, which are mandatory for local executive authorities and agricultural producers, and design programmes to support institutions engaged in disaster risks early warning.

- The low level of knowledge of agricultural producers on measures to prevent epizootics and epiphytotics – and therefore imposition of responsibilities of monitoring, reporting and measures to combat harmful and dangerous objects on farmers – reduces the effectiveness of the EWS. Illiteracy eradication among farmers is done chaotically, through the implementation of fragmented, inconsistent measures, without monitoring and assessment of their performance. It is necessary to improve the system of training for farmers in terms of the basics of agricultural and livestock production, with a focus on disaster risk management and with the involvement of research institutions, media representatives, and the agro-industrial sector.

The state of farmland is monitored and assessed by the Land Management Committee of the MoA (MoA, 2016). Survey work is based on monitoring plans and government orders, whose scope of work has been limited in recent years. Therefore, the identification of negative changes and early warning about risks has a low efficiency. Until 1990, an extensive monitoring network of the USSR operated, co-financed by allies, therefore scheduled surveys covered a large area of the country (21.1 million ha were surveyed annually). After Kazakhstan gained independence and self-financed soil surveys, the volume of work was reduced to a minimum. The gradual restoration of the system and the increase in the scope of the survey made it possible in 2019 to update the survey results of a total of 7.3 million ha of land. The committee also performs the functions of granting and withdrawing land, transferring land from one category to another, maintaining the state land cadastre, and compiling a land balance sheet.

The Kazakhstan forest fund is monitored and assessed by the Committee of Forestry and Wildlife of the MEGNR (MEGNR, 2019c). The early warning functions of the committee include monitoring of measures implemented to protect forests from pests and diseases, the timeliness of measures taken to prevent the emergence, spread,

\[7\text{The lowest population density of a pest that will cause economic damage; or the amount of pest injury which will justify the cost of control.}\]
accuracy of accounting and forecasting of outbreaks of forest pests and diseases, and weakening and death of plantations from the adverse effects of events of a natural and anthropogenic nature.

A priority for the improvement of the national system of disaster risks early warning is the creation of tools for integrated monitoring and forecasting of natural hazards using geographic information systems (GIS) and remote sensing data. Kazakhstan has a National Centre for Space Research and Technology, which is part of the Aerospace Committee of the Ministry of Digital Development, Innovation and Aerospace Industry. This centre carries out research, development and production and economic activities in the field of space research and technology, and supports the development of space activities in Kazakhstan. Among the main activities, it is worth mentioning the use of space monitoring and remote sensing technologies for solving applied problems in the field of ecology (including biohazards, dust storms from the dry bottom of the Aral Sea, the state of forests, the rate and extent of desertification), agriculture (moisture reserves in the soil, area and condition of crops, forecast of gross grain harvest, monitoring of crops affected by diseases and pests), as well as monitoring of emergencies (flooding, fires, accidents at oil fields and pipelines). The National Centre for Space Research and Technology is also a member of the Sentinel Asia regional initiative to support disaster management in Asia and the Pacific through the use of space and web GIS technologies.

Satellite data-based domestic software products can be developed if supported by various methodologies that take into account natural and climatic conditions of individual regions. The agricultural sector needs approaches for predicting drought, frost, hail, and flooding, as well as methodology for damage assessment. Such products can be developed and integrated if supported by international institutions and NGOs, if oriented towards international experience in the field of remote monitoring and EWS, and if facilitated by experienced international specialists. This approach helps to overcome the shortcomings in EWS, but it also generates momentum for insurance system development, which is an integral element of disaster prevention throughout the country.

Currently, there are the following organizations, among others, engaged in DRR in agriculture, who use the capabilities of GIS and mapping, and have databases to be used for disaster risks early warning:

- JSC Information and Accounting Centre (http://www.iuc.kz/);
- JSC National Centre for Seismological Observations and Research (Institute of Seismology, 2020);
- National Hydrometeorological Service Kazhydromet (Kazhydromet, 2020a);
- JSC National Centre for Space Research and Technology (NCSRT, 2020);
- Institute of Geography and Water Security JSC (https://ingeo.kz/?page_id=6096);
- State Fund for Environmental Information of the Ministry of Ecology, Geology and Natural Resources (MEGNR, 2020).

At this stage the main information sources in the field of DRR in agriculture are the websites of the relevant ministries, Kazhydromet, and the MES. Up-to-date information about suppliers, buyers and prices for agricultural products for farmers is posted on open marketplaces such as Satu (https://satu.kz/Pshenitsa; wholesale.html), Agro-Kazakhstan (https://agro-kazakhstan.com/ru/trade/r-33/p-1/), and the grain exchange of Kazakhstan (http://www.corn.kz/). Such platforms are not popular, so their content is rarely updated. For example, the website of the Grain Union of Kazakhstan (http://grainunion.kz/ru/info-system/17) provides market information that is six months old. There is no stand-alone organization providing farmers with up-to-date information on prices for agricultural products, although KazAgro (https://kazagro.kz/), Food Contract Corporation (https://www.fcc.kz/), and other state organizations are endowed with this function. The national platform Qoldau (QOLDAU, 2020) provides farmers with access to information on services for lending, field monitoring, insurance, weather data, and so on, if registered on the portal as an agricultural organization.

At the same time, Kazakhstan is also a member of the Agricultural Market Information System (AMIS), as one of the seven invited large agricultural exporters. In June 2016, with the support of FAO and the European Bank for Reconstruction and Development, three presentations of AMIS functions took place in Nur-Sultan, Kostanay, and Almaty. These events were designed to raise the awareness of producers, suppliers, processors and exporters about the possibilities of AMIS, as well as about the prospects and forecasts for grain production. Representatives of government agencies were also invited to the events – the MoA, agriculture departments, KazAgro, and Food Contract Corporation (FAO, 2016). According to a presentation by Natalia Merkusheva (2016), the monthly AMIS Market Monitor report was previously published on the KazAgro website, but at the time of drafting this report, there was no information about the system on their website.
Agrometeorology services

Kazakhstan’s unified state policy in the field of agro-hydrometeorology is implemented by Kazhydromet, the national hydrometeorological agency existing since 1922. Currently, it is a large research and production enterprise under the Ministry of Ecology, Geology and Natural Resources (MEGNR) with the status of a regional state enterprise (RSE). Kazhydromet has 15 branches in each region, with an overall staffing of more than 3,000 people. Kazhydromet RSE’s organizational structure is shown in Figure 12. The enterprise is focused on environmental, meteorological, agrometeorological, and hydrological monitoring using the state observation network.

Monitoring of the network performance is ensured by four departments in the areas of ecology, meteorology, agrometeorology, and hydrology. All information monitored is communicated to the department directorates. Environmental monitoring in Kazakhstan includes the following (Kazhydromet, 2020a):

- air quality monitoring (carried out in 45 settlements, at 140 observation sites and 15 mobile laboratories);
- surface water quality monitoring (carried out at 424 stations located at 143 water bodies);
- monitoring of atmospheric precipitation quality (carried out at 46 weather stations with snow cover monitored at 39 weather stations);
- determination of gamma-radiation background (conducted at 89 weather stations and 23 automatic stations, as well as determination of beta activity at 43 weather stations);
- determination of the qualitative condition of soil (at 102 observation sites);
- analysis at 20 chemical and analytical labs.

Meteorological monitoring in Kazakhstan is carried out at:
- 330 meteorological stations in total;
- 43 meteorological stations carry out actinometric observations;
- 9 aerological stations carry out upper air observations;
- 5 meteorological stations carry out ozonometric observations.

Observations cover the following meteorological characteristics: air temperature and humidity, soil temperature (on the surface and at depths), atmospheric pressure, wind speed and direction, atmospheric phenomena, glaze-ice and rime phenomena, precipitation amount and intensity, snow cover (height, density, water reserve), cloudiness (quantity, shape, height). Data from all meteorological stations, as well as automated meteorological stations, are transmitted to the central server via cellular communication channels in Nur-Sultan, to the WMO regional centre in Tashkent and to the WMO global centre information system in Moscow, as well as to the backup centre in Offenbach (Kazhydromet, 2020a).

Hydrological monitoring is carried out at 352 hydrological posts:
- 306 river posts;
- 36 lake posts;
- 10 marine stations and posts.

Water level, water temperature, and air-temperature observations are systematic. Measurements of water discharge are made every ten days (and more often during flooding). In autumn, winter and spring, observations of ice are carried out; in winter, observations are made of the thickness of ice, and of the height of snow on the ice.

Agrometeorological monitoring in Kazakhstan is carried out at 206 agrometeorological sites (115 meteorological stations and 91 agrometeorological posts), 173 of which carry out observations in grain-sowing regions, and 26 in the pastures. Observations are also carried out on rice, cotton and gardening land. Meteorological observations are carried out across all agrometeorological sites of the state observation network (air temperature, precipitation, atmospheric phenomena, as well as wind, total solar radiation, soil temperature on the soil surface and at depths), as well as observations of the growth of agricultural and pasture crops and soil condition (including soil temperature and moisture). The results of agrometeorological monitoring inform the following forecasts (Kazhydromet, 2020a):
- forecast of moisture reserves in the soil before the start of spring field work;
- forecast of optimal sowing dates;
- maturation forecasts;
- crop yield forecast;
- probabilistic drought forecast;
- forecast of agrometeorological conditions for harvesting.

According to Kazhydromet, agrometeorological products, including information on the current state of crops, and consultations, are provided according to the evidence-based data of the state observation network. In addition, Earth remote sensing data is also used to analyse the state of crops (Kazhydromet, 2020a). Agrometeorological information is equally accessible to all farmers, mainly through the internet. However, only Kazhydromet, as a monopoly, provides official information on a fee-paying basis. The means of communication available for the rapid monitoring of land conditions and weather forecasts fully meet farmer needs. In most cases, farmers do not take advantage of the available opportunities. The agrometeorological brief is regularly (every ten days) published on a public domain site. The site also publishes agroclimatic maps.
for different regions of the country, characterising the climatic conditions contributing to the growth of the main agricultural crops in Kazakhstan, which can be used in planning and agriculture practices. The map series includes the following maps:

- vegetation period duration;
- aridity of the growing season;
- heat supply during the growing season;
- moisture provision during the growing season;
- amount of precipitation during a warm period.

As of October 2020, a new web application, AgroData, has been made available via Kazhydromet resources (https://agrodata.kz/). This application was developed to provide agrometeorology services to peasants and farmers, and to other stakeholders. The web application includes important information for making decisions in crop production: weather forecasts, agrometeorological forecasts (farmer’s calendar, recommended sowing dates, rate of productive moisture in soil, forecast of drought and yield), actual data for ten days and NDVI (normalized difference vegetation index) values (Kazhydromet, 2020b). According to the developers of this application, the use of such predictive and accurate information about the weather will allow farmers to:

- make precise plans around the dates of field treatment;
- prevent the death of plants resulting from exposure to rain on treated fields;
- efficiently plan for the entry of agricultural machinery to the field, and fuel consumption; and ensure timely harvesting without loss of grain quality;
- plan for the sale of products and scheduling of processing plants based on the projected yield of agricultural crops.

Accurate information obtained from the state observation network and public forecasts is available on the application page, without any charges or special registration needed. However, specialised information or advice on specific farms (points) is provided separately, on a contractual basis. According to the outcomes of the interviews, even the local executive authorities do not receive regular information on the hydrometeorological state. Registered users have the opportunity to conclude a contract online, using the AgroData app. After execution of the contract, registered users have the opportunity to access detailed agrometeorological information via a special section, “for farmer”, on the Kazhydromet website. Prices for works and services produced by Kazhydromet are approved by the Order No.171 of the acting minister of energy of Kazakhstan dated 14 May 2018 On amendments to the Order No.143 of the minister of energy of Kazakhstan dated 25 November 2014, On approving prices for works, services, produced and (or) executed by the state monopoly entity in the field of meteorological and hydrological and environmental condition monitoring. Services related to agrometeorological projections, route research, as well as agrometeorological forecast information, are provided on a fee basis (Kazhydromet, 2020a). Pursuant to the AgroData app website, the following types of services are provided (Kazhydromet, 2020b):

- weather forecast by site for one, three, seven days and storm warnings;
- actual weather conditions (air temperature and humidity, amount of precipitation, depth of snow cover, depth of soil freezing, and so on);
- determination of viability of winter crops in the fields of farm households;
- determination of productive moisture reserves in the fields during the growing season;
- forecast of productive moisture reserves in spring before the start of sowing;
- forecasts of ripening date and yields of wheat, barley, sunflower, sugar beet and corn;
- crop simulation under various conditions of irrigation and fertilization;
- probabilistic forecast of drought and forecast of agrometeorological conditions for harvesting, recommendations on the timing of sowing and treatment of fields;
- identification of damaged areas (from diseases, pests, hail) in the fields using remote sensing of the Earth.

After a year of successful operation of the AgroData web application, Kazhydromet started developing a mobile version of the service. While the web application requires stable access to the internet, the mobile version should be able to work without internet connection and be more easily accessible to farmers (Kazhydromet, 2020a).
After the initial validation, analytical deliverables of Kazhydromet are forwarded to the forecasting departments and the central dispatching division of hydrometeorological centre. The above departments are to prepare the release of forecast materials for a wide range of consumers. Up-to-date information on the most important meteorological phenomena, forecasts and reviews of actual weather, as well as advisory seasonal forecasts, warning maps and the state of the environment, are publicly available on the Kazhydromet website. Information on weather changes, anomalous phenomena, and storm warnings, is regularly posted in news feeds. In addition, a monthly information bulletin is issued on the state of the environment in Kazakhstan, which is also available for public access. Forecasting and timely issuance of storm warnings on dangerous hydrometeorological phenomena is carried out 24 hours a day, in a prompt processing mode.

Kazhydromet does not provide farmers with information on specific recommendations or climate-resilient practices, because these services are not part of its mandate. It is mainly the MoA, research institutes, and international organizations, that do this. The CACILM-2 project, in particular, introduces climate-resilient approaches and practices in drought-prone and salt-affected areas.

The Kazhydromet organizational structure also includes a research centre, which has the following objectives:

- Forecast of fluctuations and future climate changes in Kazakhstan based on regional and global climate models.
- Adaptation of numerical hydrological models for forecasting the runoff of lowland and mountain rivers in Kazakhstan during flooding and snow melts.
- Development of methods for forecasting the runoff of lowland and mountain rivers, water inflow into reservoirs and inland water bodies.
- Assessment of surface water resources of water basins.
- Development of a methodological approach for the optimization of the hydrometeorological network of Kazakhstan.
- Adaptation of numerical hydrodynamic models for the Caspian Sea and the development of marine forecasting methodology.
- Issuance of operational marine forecasts and forecasts of fluctuations in the surface level of the Kazakh part of the Caspian Sea, and reviews of the ice situation in the Caspian Sea.

In Kazakhstan, the system of measures aimed at strengthening the capacity and qualifications in the field of agrometeorological activities, both in terms of meteorological staff and information users (farmers), is underdeveloped. Training of meteorological specialists in the country is carried out by the Department of Meteorology in Kazakh National University named after Al-Farabi majoring in meteorology and hydrometeorology. There is no other alternative to obtain meteorological education in Kazakhstan. There is no local capacity development and qualifications for graduated specialists. As the most feasible resource for capacity development, one can attend training courses for specialists facilitated by the Institute for Advanced Training of Executives and Specialists in the field of meteorology and climatology.

There are currently no specific activities in the country focused on raising the meteorological awareness of the population and of farmers, in particular. In most cases, farmers are guided by meteorological information and short-term forecasts of international internet resources such as RP5 (https://rp5.kz/), Gismeteo (https://www.gismeteo.kz/weather-nur-sultan-5164/), and msn weather (https://www.msn.com/ru-ru/weather).

Currently, Kazakhstan has a sustainable capacity and infrastructure for hydrometeorological and agrometeorological monitoring. At the same time, a review of thematic articles and interviews with relevant specialists have revealed a number of problems that hinder effective performance in this area. Taking into account the geographical and soil-climatic features of the country, and in order to provide high-quality services to the agricultural and water sectors and improve the accuracy of forecasts, it is necessary to expand the existing network of meteorological stations customized to the specialisation of the regions, which will also increase the efficiency of EWS and reduce the proportion of possible damage. The current meteorological monitoring network does not provide full coverage of the territory, and therefore, some weather phenomena are missed and not taken into account, which is reflected in the accuracy of the reported data and forecasts (Kruglova, 2017).

Since Kazhydromet is the only legal body that has the right to provide official information services to any organization (storm warnings about impending hazardous and natural phenomena), the industry needs
to establish a weather radar coverage network in the country to enable more accurate forecasting and early warning of a number of meteorological phenomena (precipitation, their type, nature and quantity) in relation to the agricultural sector. Facilitation of this exercise in the field of meteorology requires significant costs, therefore the support of international financial institutions and other donor organizations is especially relevant in terms of the development of an early warning system for disaster risks.

Considering the fact that organizations of various forms and departments are involved in monitoring hydrometeorology, seismology and mud flow hazards, it is necessary to improve the mechanism of interaction between Kazhydromet and the National Centre for Seismological Observations and Research JSC, and Kazselezashchita State Institution, to reduce agriculture and environmental disaster risks.

Thus, several meteorological phenomena remain not fully covered by the national observation network. Therefore, in order to reduce the risks of disasters in agriculture, it is necessary to ensure adaptation and implementation of modern methods of agrometeorological monitoring of drought, dry wind, hail showers and other phenomena, through, for example, radar and thermal imaging.
Disaster risk reduction in agriculture

Several efficient measures have been taken to reduce disaster risks in Kazakhstan; however, the issue of establishing an integrated system aimed at reducing disaster risks in the agricultural sector remains open.

In the previous sections, it was considered that Kazakhstan is exposed to various natural hazards, including earthquakes, flooding, landslides, mud flows, avalanches and extreme temperatures, as well as man-made threats such as traffic accidents, industrial accidents and incidents. The analysis indicated that the highest frequency of disasters (0.25 cases per year) comes under incidents, and then in descending order: earthquakes and floods (0.20 cases per year), industrial and traffic accidents (0.10 cases per year), landslides and extreme temperatures (0.05 cases per year) (UNDP, 2011). However, there is no emphasis on DRR in agriculture.

Kazakhstan also lacks a DRR strategy to be developed in line with the Sendai Framework Kazakhstan has joined. Given the frequency of extreme weather events and climate change, it is critical to have a DRR strategy and to ensure that risk reduction is addressed at all levels of government (UNECE, 2019b).

Detailed analysis of risk vulnerability is presented in Section 2.2 of this report. Information on the degree of exposure to hazards in the context of regions is summarised in the form of GIS maps under a “collection of natural and man-made hazards and risks of emergencies of the Republic of Kazakhstan”, developed by the Institute of Geography and Water Security. The atlas includes the following sections: organization of emergency prevention and response – 7 maps; natural hazards and risks – 108 maps; biological and social hazards and risks – 26 maps; and technological hazards and risks – 32 maps. This information is not available in the public domain, although some part of the atlas is presented on the website of the CESDRR.

Among the activities carried out to assess the risks of disasters in agriculture, special attention should be paid to the efforts of the Land Management Committee under the Ministry of Agriculture, which, jointly with the non-profit joint-stock company Government for Citizens state corporation, carries out land monitoring, soil and geo-botanical surveys, soil appraisal, in accordance with the Order No.159 of the minister of national economy of 23 December 2014, On approval of the rules for monitoring land and using its data in the Republic of Kazakhstan. Soil surveys are carried out mainly on intensively used farmland and in areas where there are no materials of reliable quality. The monitoring content includes systemic observations at permanent and semi-permanent sites, records of soil and geo-botanical surveys that identify changes, formulate appropriate forecasts and develop recommendations for the prevention and elimination of negative consequences. In the process of monitoring, anthropogenic and natural factors are investigated that contribute to the development of deflation processes, water erosion, soil salinisation, soil pollution with toxic substances, as well as the content of humus, nitrogen, phosphorus, potassium and trace elements in soils. Observation frequency at permanent ecological sites is one to three years, and at semi-permanent sites five years. There are 1,180 observation sites located within the territory of Kazakhstan. Surveys are carried out in accordance with monitoring rules.

Based on the results of soil, soil-melioration, erosion and geochemical studies, the Committee for Geodesy and Cartography prepares a series of thematic soil maps, with a description and classification of soils, and recommendations for their rational use and protection. Major scope soil surveys (111.55 million ha or 60.2 percent) were carried out before 1990. Information from survey data is currently out of date, and the pace of updating prevents these records being used as a tool for early warning of disaster risks. The territorial coverage and availability of survey materials by year are presented in Figure 13.
Topographic and geodetic mapping of agricultural lands is carried out within the framework of the Strategic Plan of the Ministry of Digital Development, Innovation and Aerospace Industry of the Republic of Kazakhstan for 2017–2021, as pursued by Order No.352-HK of the minister of digital development, innovation and aerospace industry of 20 December 2019. The main content of agricultural maps is the differentiation of land by actual use, classification, characteristics, and structure. The maps are the basis for assessing the intensity of negative processes, including for early warning of disaster risks, land reclamation and soil protection measures, soil and geo-botanical surveys, placement of cultivated areas, and forage resources.

As of 1 January 2020, 68.4 million ha of the territory of Kazakhstan was covered by agricultural maps (or 25.1 percent of the total area of the country), including maps of intensive farming areas (5.2 million ha) and developed farming (63.2 million ha). Updating of mapping material involving an area of 204 million ha is now needed. The chart of renewal and provision of agricultural maps on the territory of Kazakhstan is shown in Figure 14.

In Kazakhstan, there are no developed and approved strategic long-term plans for disaster preparedness and risk reduction of natural and man-made disasters, due to the unpredictability of their occurrence, and lack of forecasting of disasters. This situation also applies to the agricultural sector. Among the current action plans and rules, one can note fire safety action plans developed at local and facility level, and flood control plans, which are developed annually for individual administrative territorial units (cities, districts, villages – for the short-term perspective, depending on the conditions of winter-spring period). As a long-term plan, it is necessary to indicate the action plan for the elimination of emergencies of a global and regional nature (Resolution No.486 of the Government of the Republic of Kazakhstan dated 16 August 2017), which summarises the sequence of actions, deadlines and responsible organizations for coordination, emergency rescue and response emergency events. There are also no plans for preventive early action in relation to emergencies in agriculture.

The problems of assessing damage and loss, as well as needs, after occurrence of a disaster, as related to the agricultural sector in Kazakhstan, also remain open. There are no uniform methods for assessing damage in various sectors of agriculture, and therefore, in addition to the background of an imperfect insurance system for agricultural risks, the likelihood of losses in the event of an emergency increases many times over.
In 2019, regional FAO training was held in Almaty on a methodology for assessing direct losses associated with natural-hazard induced disasters in agriculture, fisheries and forestry. In his presentation, the representative of the National Committee on Statistics confirmed that data on losses in agriculture caused by disasters are not currently being generated within the framework of national statistics. At the same time, the collection of data on agricultural production is carried out on a regular basis – these data are published in the form of summarised information, bulletins and compilations on the website of the National Statistics Bureau. The Committee for Forestry and Wildlife under the MEGNR collects data on forest fires, including footprint and scope of damage (Sadvakasova, 2019). The following have been suggested as shortcomings and limitations of the existing system:

- lack of a unified methodology that meets international standards;
- lack of a unified integrated information system (including a system for processing, aggregating and storing data on damage and losses);
- lack of integrated methods for determining damage from all types of disasters in agriculture;
- decisions of the Interagency State Commission for Prevention and Elimination of Emergency Situations, which is the coordinating body for DRR, are presented in the form of recommendations;
- during the meetings of this commission, issues related to unified assessment of the consequences of disasters caused by natural hazards are not considered.

At the present stage, state support for agriculture, including that aimed at reducing disaster risks, includes subsidies for agricultural production, as well as production-related, technical and supply chain support of the industry in order to create conditions for enhanced reproduction, address social and environmental problems, and increase the level and quality of life in the countryside. At the same time, it should be noted that properly worded legislative and regulatory tools for DRR in agriculture remain insufficiently developed. Indirectly, the following issues are being resolved through the current legislative framework, as well as state and sectoral programmes in relation to DRR:

- Issues of pricing policy and support for agriculture are actively resolved with the sale of manufactured products in domestic and foreign markets.
- The priority of the rational use of land resources with an emphasis on preserving and increasing soil fertility is stressed.
• Phased increase in irrigated land to 3 million ha is planned to overcome constraints in crop production in arid regions (President of Kazakhstan, 2019).
• Compulsory soil surveys of agricultural lands are included as a tool for monitoring soil fertility.
• Diversification of agricultural production is supported, in particular integrated production (crop farming and livestock), cultivation of oilseeds, grain legumes, and feed crops.
• Subsidies are provided for livestock development in all directions, as well as the development of a forage base.
• The practice of subsidising the use of mineral fertilizers, as well as carrying out phytosanitary and quarantine measures in crop production, to reduce exposure to adverse natural factors.
• Promotion of resource-saving techniques and technologies is being conducted, as well as cultivation of drought-resistant and stress-resistant crops.
• Use of water-saving irrigation systems in intensive and vegetable crop-farming is supported.

Analysis of the risk management system in agriculture in Kazakhstan shows that early, preventive measures and actions in relation to natural-hazard induced disasters are not widespread. The main activity is focused on the efforts in the recovery period after the actual occurrence of disasters.
Agricultural insurance

Financial protection is one of the factors of an effective DRR system in agriculture – it is the advance preparation of financial mechanisms that allows for a rapid response to disasters and for effective recovery (Sputnik Kazakhstan, 2019). The main instrument for redistribution of disaster risks in agriculture is the development of an insurance system, and the establishment of insurance funds and reinsurance. The state insurance system of Kazakhstan does not provide for compulsory insurance against natural and man-made emergencies. At the same time, the services offered by private insurance organizations are practically inaccessible to people. With an insurance rate of 0.2 percent to 0.4 percent of the cost of a premises, the price of an insurance policy is not affordable for a large part of the community (Informburo, 2018b). In such an environment, when an emergency occurs, the burden on the state budget increases, since funds are used from the reserves of the government and local executive authorities, as pursued by the Order No.486 of the Government of the Republic of Kazakhstan dated 16 August 2017 On approval of action plans for elimination of emergency situations of global and regional scale.

Since 2020, insurance in crop production has been transferred to a voluntary category. At the same time, in the system of insurance and control of the occurrence of insured events, remote space monitoring data, various calculated indices that have a stable relationship with yield, biomass accumulation, and available moisture, are widely used. However, due to the lack of long-term databases and calibration of satellite information, the registration of insured events by this system may have insufficient accuracy. Given that the previous compulsory agricultural insurance system was ineffective and unattractive for farmers, there is still a high degree of probability that with voluntary insurance, the interest of farmers in crop insurance will be even lower.

Nevertheless, the insurance market, as well as the field of remote monitoring in agriculture, are developing. In the near future, the developers of the Qoldau information platform are planning to launch new insurance products that will cover livestock and forage. Currently, a system of voluntary insurance of livestock against diseases, in particular breeding cattle, has been introduced in the livestock sector. The occurrence of an insured event is considered when an outbreak of a dangerous disease gets registered in the territory of insurance. The insurance product covers the risks of infectious, invasive and non-communicable diseases, accidents, natural hazards and malicious actions of third parties (AgroInfo, 2019).

The existing Law No.126 of the Republic of Kazakhstan dated 18 December 2000, On Insurance Activities, does not contain direct references to agriculture, agricultural production, agricultural facilities, and DRR in agriculture. All this creates an unfavourable environment for insurance institutions in the agricultural sector and in terms of investment attraction.

An analysis of the insurance market and the existing tools for DRR in agriculture suggests the need for fundamental changes in the field of financial protection of agriculture from disaster risks, both from the regulatory perspective and in terms of developing effective insurance products acceptable to farmers and insurance agents.

It needs to be clearly understood that government support for DRR is not limited to subsidies and sectoral programmes. Analysis of the foreign practice of regulation in the agricultural sector shows that the share of subsidies for agricultural products is 30 percent in the United States of America, 50 percent in Germany, and 75 percent in Japan. The level of state support for the agricultural sector in Kazakhstan is much lower than in developed countries. State support for agricultural producers in Kazakhstan is 6.2 times lower than the threshold level determined for a WTO (World Trade Organization) country. Kazakhstan is 15 times lower in terms of subsidies per hectare of arable land than the United States of America, and more than 70 times lower than the European Union (Sakhanova, 2015).

According to the results of interviewing representatives of the insurance business, it was noted that a functioning disaster risk management system in agriculture requires the development of the following regulatory documents:

- development of a legal framework for compulsory insurance against the risks of natural and man-made disasters;
- development of regional and sectoral plans for DRR, including for agriculture, taking into account the analysis of risk characteristics and specifics of the economy;
- development of general methodological approaches in assessing damage from emergencies of various types.
Disaster risk reduction, early warning, and agrometeorology services programmes and projects

A wide range of international institutions and organizations provide comprehensive support to Kazakhstan in strengthening the country’s capacity in disaster risk management and early warning in agriculture. This support is carried out through joint projects with a focus on DRR, early warning, and agrometeorology in cooperation with partners such as FAO, UNDP, World Bank, GEF, and GIZ, with the active participation of local advanced institutions based on multi-stakeholder partnerships.

Annex 2 contains the main projects related to DRR, EWS, and agrometeorology services in agriculture, with consideration of climate change.

FAO efforts in Kazakhstan are undertaken in five priority areas: food safety and organic food production; veterinary medicine and livestock production, pasture management and phytosanitary control measures; rational use of natural resources to strengthen national capacities and promote political dialogue and regional cooperation; development of fisheries and aquaculture, with an emphasis on responsible management and conservation of fish resources; development of information technologies in the field of agricultural statistics, data collection and analysis. The FAO programme to improve regional and national locust management in Caucasus and Central Asia aims in particular at supporting prevention through early systems and the use of modern tools.

Currently, Kazakhstan, compared with other Central Asia countries, has a significantly smaller number of projects implemented with the participation of international organizations. In relation to the areas of DRR, early warning and agrometeorology, Kazakh government agencies need to carry out joint research to analyse and evaluate the projects of international organizations in the agricultural sector. It is necessary to attract positive international experience in problem areas through the implementation of international and joint projects. The outcomes of such projects should be aimed at increasing the efficiency of state programmes and strengthening the capacity of national structures to promote the results of projects of international organizations.
Conclusions and recommendations

An overview of the current state of disasters early warning, climate change, food security and meteorology, as well as an analysis of the current legislative framework in Kazakhstan, carried out on the basis of available literary, internet sources and direct interviews with specialists, representatives of insurance organizations, and scientific institutions engaged in disaster risk management, has allowed the drafting of several conclusions and recommendations. The recommendations drafted are institutional in nature and generally do not require large financial costs, which determines their implementation at the domestic level. At the same time, most of the proposals require technical assistance from international organizations with advanced experience and knowledge in promoting and adapting similar efforts in other countries. The issues of forecasting adverse natural events, insurance against disaster risks, disaster risk analysis and damage assessment, expansion of the agrometeorological monitoring network, implementation and training to use software products on agrometeorology, have not been sufficiently addressed. These problems of disaster risk management in agriculture can be successfully resolved given there is an interaction and joint control by international and national institutions.

Regulatory framework for disaster risk reduction

The concept of DRR in Kazakhstan, as a separate doctrine, either does not exist or is not publicly available. Its main provisions are reflected in the law On Civil Protection, which is aimed only at prevention and elimination of emergencies and their consequences. The existing legislation in this area does not take into account climate-change aspects, it also lacks linkages with the agricultural sector and food security. At the same time, food security is one of the main priorities of Kazakhstan, approved in a number of laws, which, however, does not take the role and impact of climate risks or risks of emergencies into account. The country has a number of key strategies and plans aimed at climate-change mitigation and adaptation; however, specific terminology (climate change, adaptation to impacts, and so on) is extremely rare. The main law regulates only issues related to capping GHG emissions. While these documents often apply to the agricultural sector, clear language and specific provisions are often missing. Government programmes implemented in the agricultural sector are focused on the development of the sector’s economy, infrastructure, food security and do not take into account the aspects of DRR and climate change. The development and implementation of programmes related to disaster risk reduction and climate-change adaptation is likely to be less urgent in the near term due to funding constraints, lack of physical profit, and a low level of concern among the population about these issues.

Recommendations:

- To assess investment needs and enable high-quality implementation of state DRR programmes, it is necessary to develop a system of indicators of economic, technical and social effectiveness. It is also necessary to create open resources for informing about programme implementation – regular reports containing specific indicators of spending and results achieved.
- To develop and approve the procedure for action and decision-making in case of storm warnings for representatives of local executive authorities and agricultural producers, to amend the relevant regulatory legal acts.
- At the legislative level, it is necessary to consolidate the conceptual framework (in terms of DRR, climate change and food security) in the relevant documents detailing the order of actions and regulations in the field of agriculture.
- Improve and fix the existing methodological framework for disaster risk management in the legislation, develop sectoral programmes and plans for DRR in the agricultural sector.
Institutional framework for disaster risk management

The country has a coordinating body for SCPS management, an interagency commission headed by the minister of internal affairs of Kazakhstan. The commission also includes the vice minister of agriculture, but his/her role and regulations are not specified. Another state body, the Ministry of Emergency Situations, carries out executive functions in this area. Kazakhstan has a National Platform for Disaster Risk Reduction, but the existing system in the country is focused only on the implementation of measures to protect the population from hazards arising from emergencies, which means a response to incidents. Climate-change mitigation and adaptation are not covered by the system. One of the main shortcomings of the current system is low effectiveness of preventive and response measures aimed to reduce the consequences of disasters, a lack of experience in response activities, and an insufficient level of executive training. The country has a Unified State System for Monitoring the Environment and Natural Resources (USSM), work is underway to strengthen the capacity of the monitoring network and improve the disaster prevention system, but the next stage – disaster risk management – has low efficiency and needs further modernization. A number of committees under the MoA oversee epizootic and phytosanitary safety and controls the state of farmland. However, the agricultural sector is not fully covered in terms of disaster risk prevention and reduction.

Recommendations:

• There is a need to update the EWS in terms of the distribution of powers and responsibilities and definition of functions, since there is no clear emphasis on disaster risks early warning in the legislative framework and the activities of the designated structural units; interaction mechanisms should also be developed for prevention, response, and information exchange in the field of disaster risk management.

• It is necessary to improve the interaction of line ministries with local executive authorities; and in particular, to introduce a more vertical system between the subordinate organizations, and build intersectoral collaboration.

Early warning systems

The early warning system for possible risks is hosted by the Kazhydromet State Enterprise, which officially has a monopoly on the formulation of forecasts, drafting conclusions about the occurrence of weather events and storm warnings. The country has a unified state system for monitoring the environment and natural resources, which was established with an aim of creating a comprehensive notification and EWS. At the same time, the current monitoring network does not allow covering the entire territory of the country with meteorological posts, both in terms of quantity and quality of equipment. Therefore, there are forecasting challenges in terms of location accuracy, time of occurrence and types of adverse weather events. The epizootic and phytosanitary situation is monitored by the relevant committees under the MoA. At the same time, pursuant to the existing rules, farmers must themselves conduct phytosanitary monitoring and phytosanitary measures, as well as prevent the development and spread of harmful and especially dangerous organisms (with the exception of grasshoppers and locusts). The low level of farmers’ expertise makes the EWS in agriculture less effective. Another problem is the confusion in the distribution of powers, as well as weak interaction of local executive authorities and farmers with specialised institutions. There is no stand-alone organization providing farmers with up-to-date information on prices for agricultural products in the country, although a number of state organizations are endowed with such functions.

Recommendations:

• It is necessary to improve the quality of available agrometeorological support for the agricultural sector, including through expansion of the existing monitoring network. It is also necessary to develop and approve regulations of actions and lists of measures for government bodies and local executive authorities for early warning and prompt response to storm warnings in the field with due consideration to climate change.

• It is necessary to develop up-to-date methodological manuals for epizootics and epihepatitis prevention, which are mandatory for observance by local executive authorities and agricultural producers in terms of changes in their nature and severity, and create programmes to support institutions involved in disaster risks early warning.
• It is necessary to improve the training system to teach farmers the basics of crops and livestock production with an emphasis on disaster risk management with the involvement of research institutions, media representatives, and the agro-industrial sector.

• It is also necessary to promote the development of the agricultural markets information system in the country to facilitate marketing research and timely response of agricultural producers to market changes. Upgrading the efficiency of the information support system, as an element of EWS, is possible through the establishment of mobile applications that consolidate up-to-date information on the state of the markets and the pricing policy of specific agricultural products, or on the basis of state network platforms such as Qoldau, KazAgro, and Food Contract Corporation, which partially fulfil this function.

Agrometeorological infrastructure and services

The unified state policy in the field of agrometeorology is implemented by Kazhydromet. Actual information and general use forecasts are provided to the public free of charge through the existing websites and apps of Kazhydromet. However, customized information and recommendations for specific farms are provided separately, on a contractual basis. While the country has a sustainable capacity and infrastructure for agrometeorological monitoring, a number of challenges remain: the need for more accurate forecasting and more efficient EWS facilitated via expansion of the existing network of stations; number of meteorological phenomena are not fully covered (for example, drought, dry wind, hail). The system of measures aimed at strengthening the capacity and qualifications in the field of agrometeorological activities, both in terms of meteorological staff and information users (farmers), is underdeveloped across the country. The creation of task forces and multidisciplinary working groups is key for building enhanced agrometeorology services.

Recommendations:

• Use of GIS and high-quality satellite data needs to be enhanced to cover agricultural risk monitoring processes. Training of appropriate specialists is required, as well as development and adaptation of the methodological framework for verification of satellite monitoring data, determination of threshold values for certain risks based on various vegetation indices and meteorological indicators. This issue is most relevant when it comes to the monitoring and forecasting of agrometeorological hazards, primarily atmospheric and soil drought, hail, and temperature anomalies. To do this work more effectively, an intersectoral working group can be created with the participation of institutions engaged in disaster risk management and international expertise as an essential element.

• To develop and adapt software products for forecasting adverse natural phenomena for major crops based on the use of Kazhydromet’s output products. To develop software for processing information from satellite images, with the ability to extract information about condition and dynamics of vegetation cover, moisture and soil temperature. Based on received information, to develop models for registering soil and atmospheric drought, forecasting hydrothermal indicators, productivity of major crops.

• Organization of training events (lectures, workshops, training programmes) for meteorologists within the country, with a wide coverage of specialists at regional and district levels.

• It is necessary to strengthen the work on awareness of the residents of rural and remote areas about the existing threats, degree of their impact, measures to mitigate the consequences of emergencies as the main element of EWS through educational and public institutions.

Disaster risk reduction in agriculture

The disaster risk management system is mainly about civil protection and does not have a thorough coverage of the agricultural sector. The lack of a risk assessment system with clear distribution of functions and responsibilities among state institutions does not permit a reliable assessment of possible damage in agriculture, resulting in an inadequate development of decision-making practices based on risk analysis. There are no developed and approved strategic long-term plans for disaster preparedness and risk reduction in the country due to the unpredictability of their manifestation and lack of disasters forecasting. This situation also applies to the agricultural sector. There are no methods for assessing the damage in various sectors of agriculture, and therefore, in addition to the background of an imperfect insurance system for agricultural risks, the likelihood of losses in the event of an emergency increases many times over. Data on losses in agriculture caused by natural-
hazard induced disasters are not currently compiled within the framework of national statistics. The state insurance system does not provide for compulsory insurance against emergencies. At the same time, the services offered by private insurance organizations are practically inaccessible to people. Since 2020, insurance in crop production has also been transferred to a voluntary category and it is highly likely that the interest of farmers will not be high, since the previous system was ineffective and unattractive. The existing system of animal health insurance is also voluntary, which result in a high degree of risks associated with compensation for damage in the event of epizootics.

Recommendations:

- To implement DRR policies in agriculture, it is necessary to develop a disaster risk profile register. Such a document should contain characteristics of natural hazards and anthropogenic impacts, indicating the sources and conditions of their occurrence, as well as statistically substantiated information on the likelihood of occurrence, exposure of certain areas of business, areas of probable distribution, possible consequences and damage. Such sectoral registers can represent the basis for activities planning and developing plans for DRR in agriculture.
- It is necessary to develop and approve, at the government level, common approaches to assessment of damage and losses from all types of agricultural emergencies.
- The creation of an interagency and intersectoral working group, with the participation of agricultural producers and forestry institutions, to develop common approaches to assessing damage and losses.
- It is necessary to develop an up-to-date system to assess the agricultural risks with the distribution of functions and responsibilities among state institutions.
- Develop common sectoral approaches to assess agricultural damage based on remote monitoring data. They should be developed taking into account statistical data and existing methods for evaluating insurance companies.
- It is also required to enable further development of the insurance market in Kazakhstan. The voluntary basis and imperfection of insurance products, as well as the unreasonableness of insurance rates in the agricultural sector, make this direction unattractive both for insurance companies/potential investors and farmers. Therefore, it is necessary to develop a methodological framework for reliable assessment of risks and damage caused, drafted on the basis of detailed analysis of statistical data of a maximum retrospective, taking into account soil and climatic characteristics and specialisation of the regions.
- Carry out research to identify opportunities to improve the quality and efficiency of insurance in agriculture against natural and man-made risks so as to increase the interest of farmers. Leverage research outcomes to develop differentiated insurance products adapted to individual soil and climatic conditions, as well as methodological frameworks for assessing damage for each disaster risk.
- Conduct a sociological study on the need for compulsory insurance of civil and agricultural facilities, develop an action plan to strengthen the information support for disaster insurance by insurance and outreach companies in the areas potentially exposed to various kinds of risks.
- To facilitate coordination of efforts and capabilities of international organizations, it is necessary to develop a register of international programmes and projects in the field of disaster risk management in agriculture with a description of goals and objectives, achieved outcomes, challenges, measures for further development and dissemination of best practices, in order to avoid possible duplication and increase project efficiency. As a positive initiative, thematic working meetings of specialists from international organizations and national institutions in the field of disaster risk management can be regularly held to discuss the problems of monitoring, forecasting, early warning, analysis and assessment, and development of joint projects.
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List of references
Comprehensive analysis of the disaster risk reduction system for the agricultural sector in Kazakhstan


# Annexes

## Annex I.

### List of interviews

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<th>Organization</th>
<th>Agency (Ministry)</th>
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<td><strong>Ministries</strong></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Representative of the Land Management Committee (LMC)</td>
</tr>
<tr>
<td>2</td>
<td>Head of the District Division of Agriculture Department, State Institution under LMC</td>
</tr>
<tr>
<td>3</td>
<td>Specialist of the District Division Veterinary Department, State Institution</td>
</tr>
<tr>
<td>4</td>
<td>Representative of the State Inspection Committee in Agro-Industrial Complex (SICAIC)</td>
</tr>
<tr>
<td>5</td>
<td>Specialist of the Scientific and Methodological Centre of Agrochemical Service under SICAIC</td>
</tr>
<tr>
<td>6</td>
<td>Head of the Branch of Republican Methodological Centre for Phytosanitary Diagnostics and Forecasts under SICAIC</td>
</tr>
<tr>
<td>7</td>
<td>Specialist for introduction and quarantine nursery of grain crops of Republican Plant Quarantine Centre, State Institution under SICAIC</td>
</tr>
<tr>
<td>8</td>
<td>Representative of the Committee of Forestry and Wildlife</td>
</tr>
<tr>
<td>9</td>
<td>Representative of Kazhydromet RSE</td>
</tr>
<tr>
<td>10</td>
<td>Specialist of the permanent meteorological site of Kazhydromet RSE</td>
</tr>
<tr>
<td>11</td>
<td>Specialist of Climate Policy and Green Technologies Department</td>
</tr>
<tr>
<td>12</td>
<td>Specialist of the Branch of Kazvodkhoz RSE under the Committee of Water Resources</td>
</tr>
<tr>
<td>13</td>
<td>Representative of the training centre of Kokshetau Technical Institute under the Committee of Emergency Situations</td>
</tr>
<tr>
<td><strong>NGOs</strong></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Representative of Kazakhstan Association of Insurers</td>
</tr>
<tr>
<td>15</td>
<td>Representative of the National Agrarian Scientific and Education Centre</td>
</tr>
<tr>
<td>16</td>
<td>Representative of the state corporation, Government for Citizens</td>
</tr>
<tr>
<td>17</td>
<td>Specialist of the Centre for Geographic Research under the Institute of Geography and Water Security</td>
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<tr>
<td>18</td>
<td>Specialist of Information Accounting Centre JSC</td>
</tr>
<tr>
<td>19</td>
<td>Specialist of the National Centre for Space Research and Technology JSC</td>
</tr>
</tbody>
</table>
Annex II.
Projects related to disaster risk reduction, early warning systems, and agrometeorology services in Kazakhstan

<table>
<thead>
<tr>
<th>Project name</th>
<th>Region, country of implementation</th>
<th>Financing organization</th>
<th>Implementing agency</th>
<th>Project budget (USD million)</th>
<th>Implementation timeline</th>
<th>Project objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integrated natural resources management in drought-prone and salt-affected agricultural production landscapes in Central Asia and Turkey (CACILM-2)</td>
<td>Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan, Turkey</td>
<td>Global Environment Facility (GEF)</td>
<td>Ministry of Agriculture, Ministry of Energy, Kazakhstan</td>
<td>49.48</td>
<td>2017–2022</td>
<td>The objective of the project is to disseminate the practices of integrated natural resource management in agriculture in countries whose landscapes are prone to drought and salinity. (<a href="http://www.fao.org/in-action/cacilm-2/ru/">http://www.fao.org/in-action/cacilm-2/ru/</a>)</td>
</tr>
<tr>
<td>Locust management improvement project (phase 2)</td>
<td>Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan, Afghanistan</td>
<td>Japan International Cooperation Agency (JICA)</td>
<td>State Inspection Committee in Agro-Industrial Complex (SICAIC) and State Agency Republican Methodological Center for Phytosanitary Diagnostics and Forecasts, Ministry of Agriculture</td>
<td>7.23</td>
<td>2020–2025</td>
<td>The main objective of the project is to preserve food security and livelihoods of rural populations of Central Asia by preventing and reducing threats from locust outbreaks and damage to crops and pastures, as well as potential impacts on human health and the environment. The expected outcome of the project is the improvement of national and regional locust management through the development of national capacities and more effective regional cooperation. (<a href="http://www.fao.org/3/cb1302ru/cb1302ru.pdf">http://www.fao.org/3/cb1302ru/cb1302ru.pdf</a>)</td>
</tr>
<tr>
<td>Towards better national and regional locust management in Caucasus and Central Asia</td>
<td>Central Asia (including Kazakhstan) and Azerbaijan</td>
<td>Government of Turkey</td>
<td>Ministry of Agriculture, Kazakhstan</td>
<td>0.6</td>
<td>2014–2019</td>
<td>The objective of the project was to contribute to safeguard food security and livelihoods of rural populations in Caucasus and Central Asia by preventing, controlling and limiting the threats posed by locusts to crops and rangelands. (<a href="http://www.fao.org/3/BU325en/BU325en.pdf">http://www.fao.org/3/BU325en/BU325en.pdf</a>)</td>
</tr>
<tr>
<td>Enhancing locust management and prevention</td>
<td>Central Asia (including Kazakhstan), Caucasus, Russian Federation, Afghanistan</td>
<td>USAID</td>
<td>Ministry of Agriculture and National Locust Control Unit, Kazakhstan</td>
<td>1.66</td>
<td>2011–2017</td>
<td>The project aimed to improve national and regional locust management, to reduce the occurrence and intensity of locust outbreaks, as well as to protect human health and biodiversity through the reduction of risks associated with obsolete and useable pesticides. (<a href="http://www.fao.org/3/bu326e/bu326e.pdf">http://www.fao.org/3/bu326e/bu326e.pdf</a>)</td>
</tr>
<tr>
<td>Project name</td>
<td>Region, country of implementation</td>
<td>Financing organization</td>
<td>Implementing agency</td>
<td>Project budget (USD million)</td>
<td>Implementation timeline</td>
<td>Project objectives</td>
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<tr>
<td>Sustainable forest ecosystems management</td>
<td>Kazakhstan</td>
<td>Global Environment Facility (GEF)</td>
<td>Government of Kazakhstan</td>
<td>102.93</td>
<td>2018–2023</td>
<td>The objective of the project is to prevent loss and degradation of high conservation value forests, to integrate economic and environmental assessment of ecosystem services, as well as criteria and indicators of sustainable forest management into decision-making processes for natural resource management using innovative analytical planning tools, and to increase Kazakhstan’s capacity in monitoring wildlife, fight against poaching and information management. (<a href="https://www.kz.undp.org/content/kazakhstan/ru/home/projects/sdu/Sustainable_Forest_Management.html">https://www.kz.undp.org/content/kazakhstan/ru/home/projects/sdu/Sustainable_Forest_Management.html</a>)</td>
</tr>
<tr>
<td>Assistance in updating Nationally Determined Contributions in line with Kazakhstan’s climate commitments</td>
<td>Kazakhstan</td>
<td>United Nations Development Programme (UNDP)</td>
<td>Ministry of Ecology, Geology and Natural Resources, Kazakhstan</td>
<td>0.54</td>
<td>2020–2022</td>
<td>The project objective is to support the development of updated Kazakhstan contributions with the inclusion of a climate change adaptation component, introduction of a modern system for measuring, reporting and verification of greenhouse gases, and definition of policies and measures for climate change adaptation. (<a href="https://www.kz.undp.org/content/kazakhstan/ru/home/projects/sdu/ndc.html">https://www.kz.undp.org/content/kazakhstan/ru/home/projects/sdu/ndc.html</a>)</td>
</tr>
<tr>
<td>Institutional capacity strengthening and awareness raising on irrigation water supply and drainage networks in Almaty and Turkestan regions</td>
<td>Kazakhstan</td>
<td>United Nations Development Programme (UNDP)</td>
<td>Ministry of Agriculture, Kazakhstan</td>
<td>1.85</td>
<td>2018–2021</td>
<td>The objective of the project is to strengthen the capacity of Kazvodkhoz enterprise and its branches in Almaty and Turkestan regions, through institutional changes, management improvement and regulation of irrigation systems, with subsequent scaling for the rest of Kazakhstan. (<a href="https://www.kz.undp.org/content/kazakhstan/ru/home/projects/sdu/irrigation_and_drainage_in_kazakhstan.html">https://www.kz.undp.org/content/kazakhstan/ru/home/projects/sdu/irrigation_and_drainage_in_kazakhstan.html</a>)</td>
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<tr>
<td>Assist the Republic of Kazakhstan in meeting international commitments to reduce greenhouse gas emissions by reducing the carbon footprint of electricity suppliers</td>
<td>Kazakhstan</td>
<td>United Nations Development Programme (UNDP)</td>
<td>Ministry of Ecology, Geology and Natural Resources, Kazakhstan</td>
<td>1.50</td>
<td>2019–2021</td>
<td>The objective of the project is to support Kazakhstan's national initiative to create offset mechanisms to neutralize greenhouse gas emissions, contributing to the achievement of UN Sustainable Development Goal, which implies reclamation of 350 million hectares of forests around the world by 2030 as part of the fight against climate change. (<a href="https://www.kz.undp.org/content/kazakhstan/ru/home/projects/sdu/assistance-to-the-republic-of-kazakhstan-in-fulfilling-internati.html">https://www.kz.undp.org/content/kazakhstan/ru/home/projects/sdu/assistance-to-the-republic-of-kazakhstan-in-fulfilling-internati.html</a>)</td>
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<tr>
<td>Project name</td>
<td>Region, country of implementation</td>
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<tr>
<td>Assist in sustainable land management in arid (steppe) and semi-arid zones through integrated spatial planning and agroecological incentives</td>
<td>Kazakhstan</td>
<td>United Nations Development Program (UNDP)</td>
<td>Ministry of Agriculture, Kazakhstan</td>
<td>1.90</td>
<td>2015–2020</td>
<td>The objective of the project is to change land use practices in the arid (steppe) and semi-arid zones of Kazakhstan to ensure ecological integrity, food security and sustainable activities. (<a href="https://www.kz.undp.org/content/kazakhstan/ru/home/projects/sdu/agroincentives.html">https://www.kz.undp.org/content/kazakhstan/ru/home/projects/sdu/agroincentives.html</a>)</td>
</tr>
<tr>
<td>Climate Change Sustainable Land Management for Economic Development in Central Asia</td>
<td>Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan</td>
<td>GIZ</td>
<td>Ministry of Energy and Committee of Forestry and Wildlife under the Ministry of Ecology, Geology and Natural Resources</td>
<td>Data n/a</td>
<td>2017–2020</td>
<td>Achievement of results that enable land users, government agencies and private sector in Central Asia to use integrated, economically and environmentally sustainable forms of land use with consideration to climate change. (<a href="https://www.giz.de/en/worldwide/14210.html">https://www.giz.de/en/worldwide/14210.html</a>)</td>
</tr>
<tr>
<td>Ecosystem approach for adaptation to climate change in the high mountain regions of Central Asia</td>
<td>Kazakhstan, Kyrgyzstan, Tajikistan</td>
<td>GIZ</td>
<td>Green Economy Department under the Ministry of Energy of Kazakhstan</td>
<td>Data n/a</td>
<td>2015–2020</td>
<td>The project aims to develop and implement measures and approaches for adaptation to climate change based on the ecosystem approach in small-scale water basins using international experience. The objective of the project is to help people adapt to climate change through nature. (<a href="https://www.giz.de/en/worldwide/40944.html">https://www.giz.de/en/worldwide/40944.html</a>)</td>
</tr>
<tr>
<td>Strengthening Regional Collaboration and National Capacities for Management of Wheat Rust Diseases (CAC-Rust)</td>
<td>Central Asia, including Kazakhstan</td>
<td>FAO-Turkey Partnership Programme,</td>
<td>FAO</td>
<td>1.06</td>
<td>2020–2024</td>
<td>Regional collaboration, monitoring, surveillance, race analysis, development of national strategic programme for prevention and management, and capacity development.</td>
</tr>
</tbody>
</table>