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Comprehensive analysis of the disaster risk reduction system for the agricultural sector in Uzbekistan

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Abbreviations and acronyms

ACTED	Agency for Technical Cooperation and Development
DRR	Disaster risk reduction
EWS	Early warning systems
FAO	Food and Agriculture Organization of the United Nations
GCF	Green Climate Fund
GDP	Gross domestic product
GEF	Global Environment Facility
GFDRR	Global Facility for Disaster Reduction and Recovery
GIS	Geographic information systems
GPS	Global positioning systems
IBRD	International Bank for Reconstruction and Development
ICARDA-CAC	International Centre for Agricultural Research in the Dry Areas, Central Asia and the Caucasus programme
MoA	Ministry of Agriculture
MoES	Ministry of Emergency Situations
NEAP	Uzbek National Environmental Action Plan
SSES	State System for Prevention and Response to Emergency Situations
UNDP	United Nations Development Programme
UNDRR	United Nations Office for Disaster Risk Reduction
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development
UzAIFSA	Agency for the Implementation of Projects in the Field of Agro Industry and Food Security of the Republic of Uzbekistan
UzRICLCI	Uzbek Research Institute Cereal and Legume Crops under Irrigation
UzRIPI	Uzbek Research Institute of Plant Industry
UzStat	State Committee of the Republic of Uzbekistan on Statistics
WFP	World Food Programme
WMO	World Meteorological Organization

Executive summary

Natural and biological hazards. In recent decades, emergencies caused by natural and human-made disasters have become more frequent and severe in Uzbekistan, with drought, flooding, earthquakes, landslides and mud flows among the most common hazards. Uzbekistan has faced several cases of extreme drought in the past 20 years, with crop yield losses of 45 percent to 75 percent in the worst affected areas (FAO, 2017). These have had a considerable negative impact on people´s livelihoods and food security. As the main water consumer in the Aral Sea basin, Uzbekistan suffers from water shortages. Approximately 80 percent of the water that supplies the country's irrigation sector comes from the Amu Darya and Syr Darya rivers, which start in neighbouring countries, a fact that can cause tension between those countries. According to AQUASTAT (2012), more than 90 percent of crops are grown on irrigated land, while the demand for water to promote food safety for a fast-growing population will only increase over the coming years. The low-input cropping systems dominated by cereal monoculture and intensive tillage common in the country can lead to the development of diseases, weeds and pests, and has a negative influence on yields. After the country gained independence (in 1991), farmers, who had been workers, became managers responsible for all activities and decisions on their farms, as well as for disease control, provision of winter forage, and ensuring access to markets, which often led to a decline in productivity across the country (ICARDA-CAC, 2016).

Agriculture and food security. Agriculture plays a major role in the country's economy, in 2019 generating 25.5 percent (combined agriculture, forestry and fisheries sectors) of gross domestic product (GDP), 8.4 percent of total exports, and employing about 26.2 percent of the country's labour force, which amounts to more than 3.5 million people (UzStat, 2020a). Uzbekistan has 20.26 million ha of farmland, and in addition, almost 4.2 million ha of irrigated land. Crop production and livestock production are equally important for the agricultural sector, accounting for 50.2 percent and 49.8 percent, respectively, of total agricultural production (in USD) in 2019. Forests cover almost 25 percent of the country's total territory, while around 80 percent of the country is classified as desert or semi-desert. Therefore, a limited access to water has a strong influence on state land policy and the issue of land privatization. To ensure national food security, the area under irrigated winter wheat has increased in recent years. A long-cycle cropping system for cotton and alfalfa was largely replaced by the shorter crop rotation of spring cotton and winter wheat. As a result, wheat production in Uzbekistan for the 1991–2016 period increased 17-fold, while cotton production decreased by about 21 percent due to the reduced planting area (Nurbekov *et al.*, 2018). Most of the achievements in cotton and wheat production are based on high-input-use technologies which are not sustainable on a long-term basis. The demand for agricultural production is expected to continue to grow in Uzbekistan as the government is planning to increase the export potential of many agricultural crops, including fruit and vegetables. Livestock production is a major livelihood support system and a social safety net for 49 percent of the population (15.3 million people) living in rural areas. According to the Global Nutrition Report (2020), Uzbekistan is currently off track in reaching a number of global targets designed to address malnutrition. At the same time, there is not enough data to assess the situation for children under five years old.

Regulatory framework. The Government of Uzbekistan recognizes the country's vulnerability to natural hazards and has taken important steps to manage disaster risks. The protection of the population and territories against disasters is one of the priority areas of the country's national security policy. The government has created a strong legal basis for the protection of the population against natural hazards, particularly through the Law on the concept of national safety (adopted on 29 August 1997), and Law on protection of population and territories against emergency situations of natural and man-made character (adopted on 20 August 1999). However, at the moment there is no clear regulatory framework on disaster risk reduction (DRR) in agriculture, while proper policy support on DRR would be needed to reduce the harmful effects of natural hazards in agriculture. Uzbekistan has made some progress in incorporating climate-change considerations into the country's national strategies, plans and governmental decrees. Uzbekistan also submitted three National Communications to the United Nations Framework Convention on Climate Change (UNFCCC). At the same time, Uzbekistan still lacks a comprehensive, nationwide framework focused on climate-change adaptation.

Institutional framework. A large number of organizations (ministries, agencies, companies and state inspections) participate in emergency management activities in the country, including the Ministry of Emergency Situations (MoES), Centre of Hydrometeorological Service at the Cabinet of Ministers of the Republic of Uzbekistan (Uzhydromet), Ministry of Internal Affairs, Ministry of Health, Ministry of Defence, Ministry of Agriculture (MoA), and Ministry of Water Resources, among others. The Department of Emergency Situations under the Cabinet of Ministers coordinates all activities of the ministries and organizations involved in disaster prevention and reduction measures. At local level, community leaders are responsible for disaster management. There are sector-oriented concepts and target programmes on natural hazards in place. For agriculture-related disasters, the State System of Emergency Situations functional and territorial subsystems' action plans have been developed, approved and are systematically adjusted based on decrees, laws and resolutions. However, the existing system lacks effective institutional coordination among all of the parties involved. The MoES is responsible for the dissemination of warnings for the population, reduction of the impact of disasters, and liquidation of the after-effects of disasters. As part of the DRR system, MoA is responsible for disease control. Uzhydromet is the state governing body responsible for tasks in the field of hydrometeorology. The State Committee on Veterinary and Livestock Development under the Cabinet of Ministers is responsible for animal health protection, protection of population from invasive zoonoses, and protection from disease transfer from other states.

Early warning systems (EWS). Uzhydromet carries out monitoring of disasters using up-to-date types of observations (satellite information, surface monitoring), and keeping an information system on dangerous hydrometeorological phenomena. The MoES and Uzhydromet operate the National Center for DRR Monitoring, the major function of which is to provide early warning and propose measures to alleviate the impacts of natural hazards within a changing climate. In case of hydrometeorological danger, Uzhydromet forwards the relevant warnings to the MoES and other government bodies responsible for decision making. Uzhydromet assists with coordination and communication in DRR, including cooperation among national and local authorities, as well as the support of local communities. Some of the main challenges of the country's EWS include: limited financial resources, lack of technical capacity, and lack of harmonization among the instruments, tools and institutions involved. Information on market prices as well as a number of other useful services are provided to farmers for free via the AgroMart web portal.

Agrometeorology services. Uzhydromet is also responsible for agrometeorology in Uzbekistan. Agrometeorological observations are carried out at 65 stations and 36 posts located in all regions of the country. Uzhydromet uses statistical methods for forecasting yields. The analysed data is sent to MoA and the Ministry of Water Resources in order to organize carefully the crop rotation plan for the upcoming year. Support for agrometeorology is an important task of Uzhydromet, which has a central department of agrometeorology and regional offices in each of the 13 regions. Farmers can get the information from district-level agricultural departments and water-resources departments. Uzhydromet develops a decadal agrometeorological bulletin which provides an overview of agrometeorological conditions by region and an assessment of their impact on the growth and development of major crops. It should be mentioned that Uzhydromet does not provide agricultural advice to farmers, but it does provide weather forecasts to MoA, as well as provincial and district-level agricultural departments. Some of the challenges include a lack of financial resources, a lack of automatic meteorological stations, uneven distribution of the stations across the country, outdated infrastructure and equipment, and the need to strengthen the capacity of personnel.

Disaster risk reduction in agriculture. Access to information on natural hazards and DRR in agriculture is almost non-existent in Uzbekistan. As there was no available information on mapping of natural hazards, emergency action plans, vulnerability assessments, preparedness plans, or geographical information systems (GIS) capacities, it was not possible to identify clearly the gaps, challenges, lessons learned, recommendations and opportunities to improve action plans in the country. At the moment, no statistics on disaster damage and losses are regularly collected in the country for any of the agricultural subsectors (crops, livestock, forestry, fisheries). Insurance companies are playing an increasing role in providing natural hazard insurance to farmers. When it comes to agriculture, only around 30 percent of crops are covered by any insurance, and only a few cases of livestock insurance were reported. Since the insurance is indemnity based, it requires lengthy verification procedures for triggering the payments. Alternative index-based insurance options could provide new opportunities by not only reducing transaction costs (resulting in lower insurance fees), but also in terms of more transparent ways of triggering payments.

Programmes and projects related to disaster risk reduction. Various international organizations, including the International Bank for Reconstruction and Development (IBRD), International Development Association (IDA), Global Environment Facility (GEF), and the European Union, together with key national institutions – such as specialized agencies, the MoES, MoA, Ministry of Water Resources, United Nations Development Programme (UNDP) Uzbekistan – are implementing a number of programmes and projects addressing the agricultural sector, DRR, and adaptation to climate change.

Conclusions and recommendations. There is a strong legal basis for the protection of the population against natural hazards in Uzbekistan; however, it does not directly address climate change or the agricultural sector. There is no clear regulatory framework on DRR in agriculture. Uzhydromet works closely with local, provincial and national authorities to coordinate their emergency preparedness plans. So far, DRR has attracted limited attention at the political and institutional levels, despite various programmes and government resolutions. The MoES is responsible for the development and realization of state policy in the field of prevention of emergency situations, protection of life, and health of the population. The Department of Emergency Situations under the Cabinet of Ministers coordinates all activities of the ministries and organizations involved in DRR. However, the existing system still lacks an effective institutional coordination mechanism for these various actors and of their roles. The MoA does not perform any specific tasks related to DRR, apart from disease control. Uzbekistan does not have a national platform for DRR.

The MoES is responsible for the distribution of warnings among the general population, measures to reduce the impact of disasters, and management of their consequences. Early warning information comes mainly from Uzhydromet, state quarantine inspection, and MoA. However, at the moment, there is no comprehensive EWS in place to guide water allocation and crop and pasture planning and management. The main obstacles include limited financial resources, a lack of technical capacity, and a lack of harmonization among the institutions involved, including a limited availability of data. Food-price monitoring and some services for farmers are easily accessible through the AgroMart web portal. While farmers do not have direct access to agrometeorological information, some data is provided by Uzhydromet through MoA and regional and district-level agricultural departments. Based on this data, MoA in collaboration with agricultural departments make decisions on the crop rotation system. Still, farmers have limited access to meteorological data and cannot decide which crops they should plant; nor do they have a say in rotation. It should be noted that access to information on natural hazards, including DRR in agriculture, is very limited in Uzbekistan. Data on natural hazards is available only for official use for the preparation of governmental reports; it is not made available to the wider public. At the moment, no statistics on disaster damage and losses are collected regularly in the country, for any of the agricultural subsectors. As reported by Muradullayev, Bobojonov and Mustafaqulov (2016), only around 30 percent of crops are covered by any kind of insurance. At the same time, there are only a few cases of livestock insurance in the country.

In view of DRR and EWS activities, and considering critical issues in terms of the regulatory framework, the key recommendations include:

Policy recommendations:

- Incorporate climate change, DRR and EWS considerations into the national regulatory system.
- Introduce a comprehensive, nationwide policy for climate-change adaptation.
- Integrate DRR, climate-change adaptation, and EWS into sectoral agricultural development plans and socioeconomic development strategies.
- Seek possibilities for improving technological and digitization options in accordance with an overall national development framework.
- Develop a joint climate-change adaptation and DRR strategy and action plan, which would ensure the safety and mitigation of effects from natural hazards, and specifically cover drought risk management.
- Government to remain committed to the implementation of the crop diversification policy.
- Recommendations for the improvement of the institutional framework and coordination mechanisms:
- Introduce an effective institutional mechanism for coordination between all actors involved in DRR, and of their roles.
- Increase capacities of MoA and Ministry of Water Resources to address natural hazards affecting agriculture.

- Provide opportunities for the capacity development of national agricultural research institutes, with a particular focus on young scientists.
- Establish a national platform for DRR in the country.
- Strengthen the Network of Steering Committees for Floods Control at all levels.
- Support cooperation with other countries in Central Asia under the Sendai Framework, potentially through a national platform for DRR.

Recommendations for the improvement of early warning systems:

- Undertake regular disaster risk assessments.
- Organize capacity-development activities in EWS and particularly in price/market information systems.

Recommendations for the improvement of agrometeorology services:

- Carry out capacity-development activities for Uzhydromet staff.
- Explore the possibility of creating a task force gathering all relevant stakeholders for providing user-tailored agrometeorology services.
- Provide farmers with direct access to daily climate data.
- Scale up feedback mechanisms and regular assessments to understand better if farmers' needs and preferences, in terms of agrometeorology services, are being met.
- Increase the frequency of meteorological observations, including short-term and long-term forecasting.
- Improve the quality of monitoring and forecasts of production and yields of all agricultural crops.

Recommendations for the improvement of the disaster risk reduction system:

- Enhance international cooperation on DRR to maintain and develop partnerships and collaboration through establishing platforms among different international organizations.
- Create a database on the occurrence of natural hazards and DRR activities in the country.
- Encourage the government to invest in DRR through the provision of more detailed information on the costs and benefits of natural-hazard mitigation activities.
- Global positioning systems (GPS) zoning and mapping across the country should be carried out, to identify which areas are most exposed to disasters.
- Expand opportunities and the technical basis for index-based insurance options to spread coverage by reducing transaction costs.
- Develop crop insurance systems based on Earth observation data and agrometeorological information.
- Implement crop diversification techniques.
- Strengthen phytosanitary capacity by merging plant protection with quarantine functions.

Introduction

The Europe and Central Asia (ECA) region is prone to various natural hazards, including flooding, drought, hail, avalanches, landslides, and storms. With climate change, these extreme weather events, as well as temperature and precipitation changes, are expected to increase in frequency and severity and threaten to reduce yields and productivity in crops, livestock, fisheries, and forestry, as well as impact food security, nutrition and ecosystem services. The agricultural sector, and specifically smallholders, herders, fishers and foresters, are particularly vulnerable to the adverse impacts of climate change, since they are dependent on the sector for their food and livelihoods.

This Comprehensive analysis of the disaster risk reduction system for the agricultural sector in Uzbekistan is part of a series of country baseline studies on the DRR system in the agricultural sector, conducted by the FAO Regional Office for Europe and Central Asia. The other countries included in the study series are Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Republic of Moldova, Tajikistan, Turkmenistan, and Ukraine. Similar reports analysing the DRR and management system for the agricultural sector in Western Balkan countries (Albania, Bosnia and Herzegovina, Montenegro, North Macedonia, and Serbia) were completed in 2018.[1]

The country baseline studies review the current status of DRR, EWS, and agrometeorology services in the agricultural sector, including legislation, policies, capacities, and services related to the DRR system, and assess the gaps and needs to improve and strengthen these areas. The results of the country studies will be used as technical background reports for the development and implementation of capacity-development initiatives.

This report was developed based on primary (interviews) as well as secondary (literature review) data sources. Information on gaps, challenges, constraints and opportunities was collected through semi-structured interviews with relevant national officials and experts, following provided guidelines and a questionnaire. Questions were largely based on the questionnaire of the Capacity for Disaster Reduction Initiative (CADRI)[2] Capacity Assessment and Planning Tool for Disaster Risk Management for Food Security and Agriculture and for Climate Services. The interviews took place in June and July 2019, and the list of organizations interviewed can be found in Annex I.

This study was conducted under the FAO Regional Office for Europe and Central Asia's Regional Initiative 3 that focuses on "managing natural resources sustainably and preserving biodiversity in a changing climate".

[1] The Western Balkan studies are available at https://www.fao.org/europe/resources/disaster-risk-reduction-and-management/en/#c589778

[2] CADRI brings together six United Nations organizations – FAO, OCHA, UNDP, UNICEF, WFP and WHO. This UN-led inter-agency initiative delivers customized capacity-development support in DRR.

Country background

In Uzbekistan, the climate is arid continental in the vast steppe plains of the central and western parts of the country, while it is continental but moderately rainy (with snow in winter) in the east, where hills and mountains can be found. The length of the day in summer is about 15 hours, and in winter at least nine hours. The coldest month is January. Summer temperatures often surpass 40 °C, while winter temperatures may fall to as low as -40 °C.

Most of the country is quite arid, with average annual precipitation of between 100 mm and 200 mm, occurring mostly in winter and spring. In most of the country, annual rain does not exceed 200 mm to 300 mm (Nurbekov *et al.*, 2013). Between July and September, there is little rain. Precipitation is not typical to desert and semi-desert climates in the west, while it is slightly higher in the semi-arid steppe parts of the east and centre. In the mountains, precipitation increases, especially on more exposed slopes, while the temperature naturally decreases with altitude. Summer is sunny, and also the driest season across the country. Uzbekistan is exposed to cold air masses from Siberia, especially in the northwest, but also in the centre and south, where they alternate with warmer air masses coming from the south. The clash of these different air masses can cause strong winds – for instance, the warm wind that blows from the southwest can bring dust storms.

Natural and biological hazard profile

Natural hazards

Uzbekistan is vulnerable to earthquakes, drought, flooding, mudslides, and landslides. Climate change, according to the World Bank's Country Partnership Framework for Uzbekistan (World Bank, 2016), will result in higher temperatures, greater variability in precipitation, and increased frequency of extreme weather events. These events increase the pressure on water resources, land, biodiversity, and ecosystems. Table 1 shows that Uzbekistan has faced several natural hazards since 1991 (more detailed data is not available). In 2000 and 2001, northwest Uzbekistan experienced the worst drought, and water shortages, in living memory. Agriculture is exposed to fluctuations of weather and climatic conditions and, compared to other sectors of the economy, is most sensitive to noticeable changes in these conditions (sharp fluctuations in temperature, precipitation and river discharge), more frequent drought, and outbreaks of pests and diseases of crops and animals. The timely development of measures and actions to adapt to prevailing and expected climatic and weather conditions, and proper implementation of agrotechnical measures to obtain high and sustainable crop yields, is impossible without specialized agrometeorological monitoring and services.

There have been several drought-affected years, frost years, and heat winds (affecting cotton) in Uzbekistan. The effect these disasters have on the population and agricultural production are worsened by several factors – settlements located in disaster-prone areas, debilitating land and water use, lack of regulations and standards for hazard risks, and failure to comply with building codes and land-use plans (Ministry of Agriculture specialists, personal communication, 2019).

Table 1. Recorded disasters caused by natural hazards in Uzbekistan, since 1992

Disasters	Date	Number of people affected	Killed
Landslide	January 1992	400	0
Earthquake	15 May 1992	50 000	9
Flooding	July 1998	25 000	95
Landslide (avalanche)	24 November 1999		24
Drought	April–June 2000	500 000	0
Drought	April–June 2001	600 000	0
Flooding	February-March 2005	1 500	
Drought	2006, 2008, 2010-2011	N/A[3]	
Earthquake	19 July 2011		13
Flooding	May 2020	70 050	

Source: Ministry of Emergency Situations, Ministry of Agriculture, Uzhydromet, personal communication, 2019; **EM-DAT**. 2020. *EM-DAT: The Emergency Events Database*. Université catholique de Louvain (UCL), CRED, D. Guha-Sapir. Brussels, Belgium. Cited 11 July 2020. www.emdat.be

According to the INFORM Index for Risk Management, natural hazards with the highest scores that can affect the country are earthquakes, followed by drought, flooding and epidemics (INFORM, 2020). Analysis from the World Bank and Global Facility for Disaster Reduction and Recovery (GFDRR, 2016) shows that rare but extremely high-impact flooding could affect two million people and cause capital losses equal to 5 percent of the country's GDP.

[3] Data is not available.

Earthquakes

Earthquakes pose a major risk in Uzbekistan. Small tremors are quite common for the country, but more serious ones can be extensive and affect large areas. The eastern part of the country is most prone to this hazard – particularly the Namangan, Andijan and Fergana regions – with the annual average cost to GDP of around USD 2 billion (World Bank and GFDRR, 2016). The strongest earthquakes to have occurred in the twentieth century were in Andizhan (1902), Tashkent (1946 and 1966), and Gazli (1976 and 1984), which resulted in huge economic losses and human casualties. During the Tashkent earthquake in 1966, ten people were killed, 1 000 were injured, and around 100 000 were left homeless; 28 000 buildings were destroyed, including 200 hospitals and clinics, and 180 schools, mainly in the Old Quarter of Tashkent, the most damaged area. Thousands of ancient, one-story adobe houses were destroyed. Additional damage was sustained from after-shocks (MoES representatives, personal communication, 2019). More recent earthquakes happened in 1992 and 2011, each causing approximately ten fatalities per event (World Bank and GFDRR, 2016).

Landslides

Landslides pose another threat to the lives and livelihoods of Uzbekistan's population, with 2 000 landslides and 8 300 landslide displacements recorded over the past 50 years. Forty percent of the mountainous area is susceptible to landslides, avalanches, mud flows and debris processes, while 17 percent is at risk of landslides (MoES representatives, personal communication, 2019).

Strong winds and dust storms

Around 80 percent of the area affected by strong winds and dust storms is located in the Karakalpakstan, Khorezm, Bukhara, Navoi, Surkhandarya and Kashkadaraya provinces of Uzbekistan. According to Uzhydromet (2020), the southern part of the country is often hit by "afghan" storms that, along with a strong wind that carries a lot of sand, is frequently observed in Surkhandarya province (almost 19 times a year). With a wind speed of around 5 m/s to 7 m/s, this affects the agricultural sector, leading to productivity losses of between 5 percent and 10 percent, and causing damage in livestock and health issues.

Water scarcity

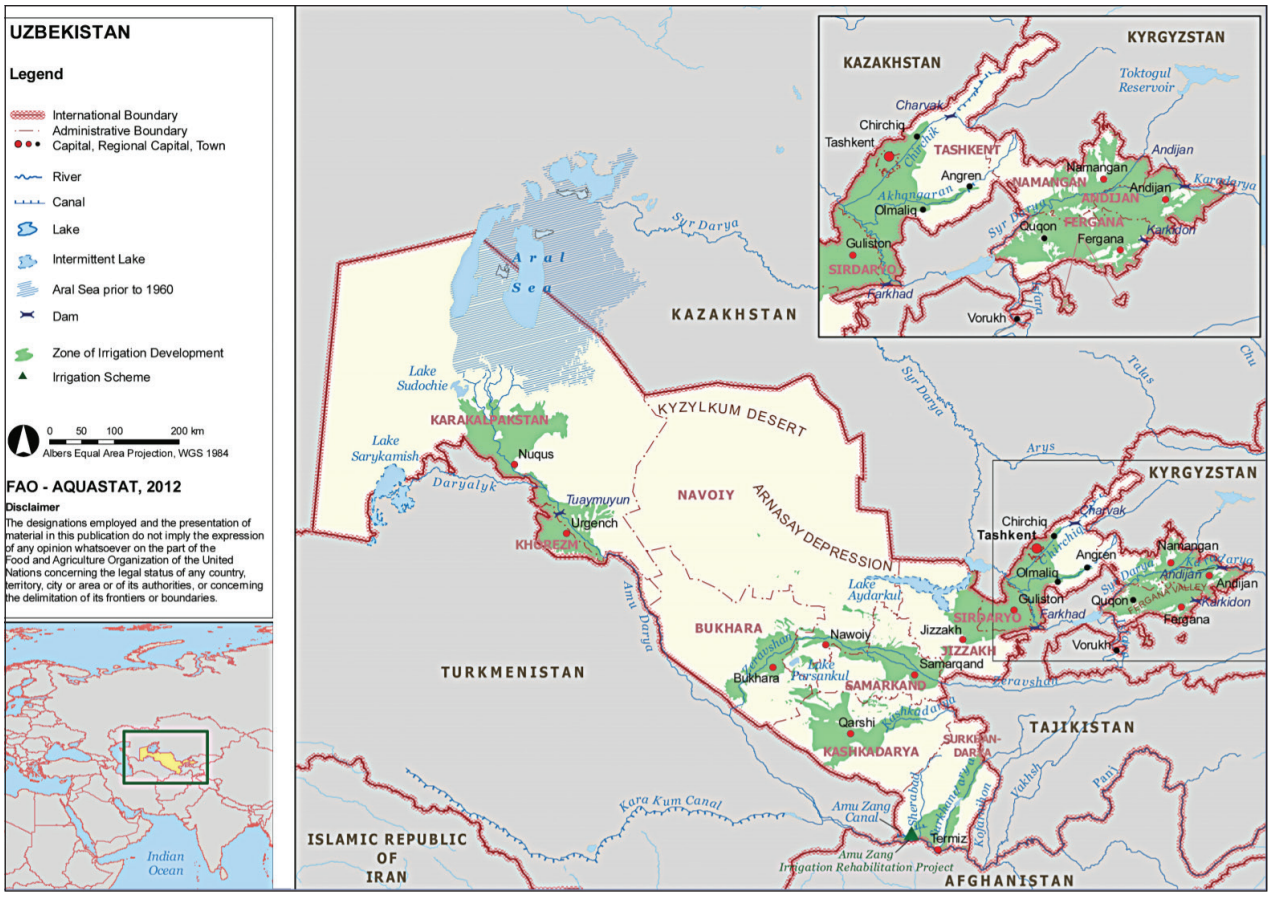
Scarcity of water resources in Central Asia is also one of the main risks for agricultural development. Water is the main resource for agricultural production, and finding solutions for the problems of rational irrigation and water use is extremely important for ensuring the sustainability of food systems. Water resources are unevenly distributed and are in short supply in most of Uzbekistan. The plains that occupy two-thirds of Uzbekistan's territory have little water, while there are only a few lakes. The Amu Darya and Syr Darya rivers – which originate in Central Asia – are the two largest suppliers of water and sources of irrigation in the country. Uzbekistan has the lowest stock of renewable water resources per capita (1 635 m^3/year) and is the only country in the region considered to be experiencing "water stress" (ICARDA-CAC, 2006).

Each state in Central Asia has its own water and environment policy, with the provision of clean drinking water as the top priority. As national environmental services struggle with severe budget constraints and difficulties in implementation and enforcement, there are major differences between the states in terms of natural resources management, environment, and human health. For example, the rehabilitation of the disaster zone around the Aral Sea is a major burden for three states – Kazakhstan, Uzbekistan and Turkmenistan. These states have spent huge amounts – estimated at USD 650 million per year – on efforts for socioeconomic and environmental stabilization. The economic and environmental potential of joint regional action in soil and water conservation has not yet been fully appreciated.

Being the main water consumer in the Aral Sea basin, Uzbekistan suffers from water shortages, since approximately 80 percent of the flow of the Amu Darya and Syr Darya rivers (and also local waterways) – that the country depends on for irrigation – starts in neighbouring countries, leading to multiple conflicts of interest. In 2018, the irrigated area covered 4.26 million ha in total. While this parameter has not changed that much since the late 1990s, during this time period the population of the country has grown considerably – from around 24 million people in 1998 to almost 33 million in 2018. Correspondingly, the area of irrigated land per capita has dropped from almost 0.17 ha to less than 0.13 ha, or by around 26 percent (FAO, 2020a).

According to AQUASTAT (2012), more than 90 percent of crops are grown on irrigated land, irrigated farming already consumes more than 92 percent of total intake, and the demand for water will increase to promote food safety for a fast-growing population (Figure 1).

Figure 1. Zones of irrigation development in Uzbekistan



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
Source: **AQUASTAT**. 2012. *AQUASTAT Survey – Uzbekistan*. 23 pp.

Drought

Uzbekistan is located in arid and semi-arid areas vulnerable to frequent drought (Gupta *et al.*, 2009). Because of this, agricultural production is possible only through supplemental irrigation in most of the country (Chub, 2007). Major sources of irrigation are the glacier-fed Amu Darya and Syr Darya rivers, which have high flow variability (Dukhovny, Sorokin and Stulina, 2008; Sorg *et al.*, 2012). During years characterized by a minor drought, this variability could be compensated by the country's vast network of 55 water reservoirs; however, during major and protracted drought events, the current reservoir total capacity of about 20 km^3 is not sufficient. Furthermore, the need for irrigation water is growing rapidly (Cai, McKinney and Rosegrant, 2003). Increasingly, the imbalance between the availability of water and growing water demands is exacerbating the impacts of even previously mild drought years.

As a result, Uzhydromet (2020) reported that over the past two decades, Uzbekistan has faced four occurrences of extreme hydrological drought (in 2000-2001, 2006, 2008, and 2010-2011). After one of the worst drought events in 100 years in 2000-2001, yield losses were 45 percent to 75 percent in the worst-affected downstream areas (FAO, 2017). These have also had substantial negative impacts on livelihoods and food security. During the drought of 2000-2001, it was reported that cereal production declined by 10 percent, cotton production by 17 percent, and rice production by 60 percent, resulting in about USD 130 million of losses (World Bank, 2006). The biggest losses occurred in the downstream areas of Uzbekistan, where about 600 000 people were in need of food aid to the value of USD 19 million (World Bank, 2006; FAO, 2017). In this context, Mirzabaev and Tsegai

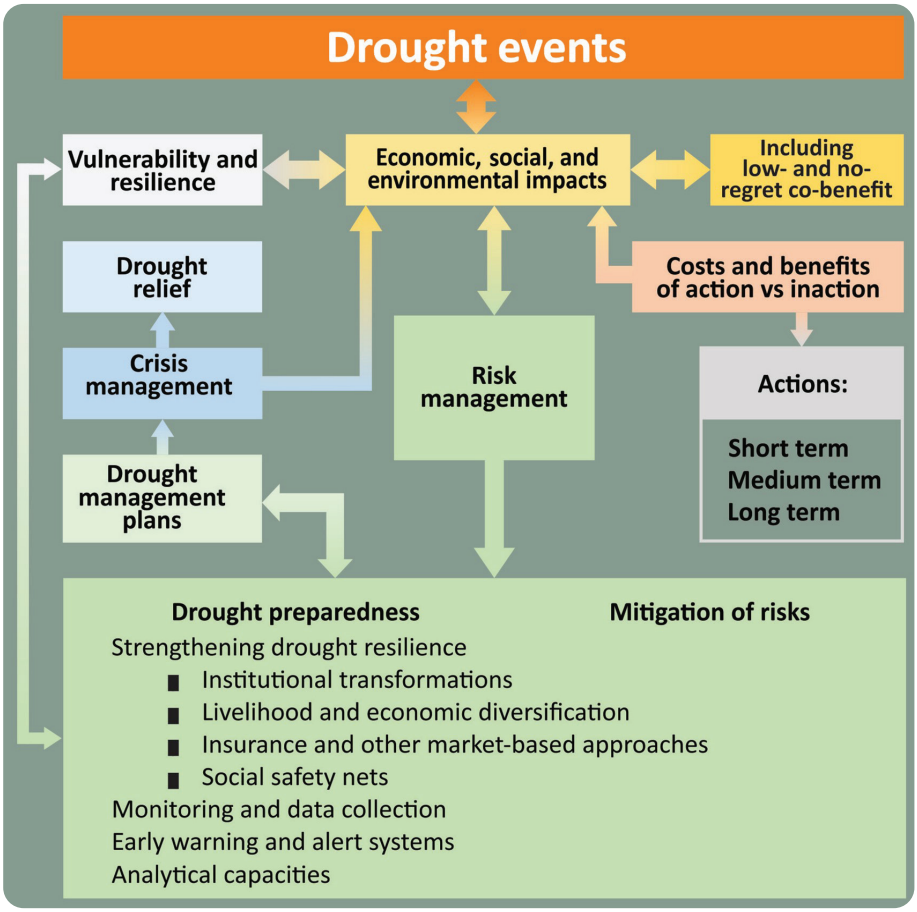
(2012), in their research of the situation in Central Asia, found that a 30 percent reduction in irrigation water availability may lead to a drastic increase in wheat prices, of about USD 400 per tonne, compared to normal hydrological years.

A study by Nurbekov and Mirzabaev (2017) found that based on farmer perception, more heavily populated upstream areas of the country experienced drought more frequently, compared to downstream provinces. Large-scale drought is more common in downstream areas (Karakalpakstan), which are often the focus of development activities. However, in terms of their economic impact, milder drought in highly productive and heavily populated areas can cause more damage than more severe drought in less populated downstream territories. It is important to take this difference into account when implementing drought-risk mitigation activities (Nurbekov and Mirzabaev, 2017).

The extent of drought costs and impacts are modulated by vulnerability and resilience to drought, which are affected by actions to reduce drought risks. However, a usual course of action in Uzbekistan in the past has been responding to drought through costlier post-crisis management, rather than proactive and economically more efficient drought risk mitigation, which is currently being increasingly promoted. In this regard, climate change is expected to increase the frequency and severity of drought in Uzbekistan (Sorg *et al.*, 2012), making crisis management approaches even less affordable. If proactive drought risk management is socially optimal compared to reactive crisis management, then the question is: what are the barriers and opportunities for the transition from crisis management to drought risk management in Uzbekistan? On the other hand, drought-risk mitigation actions include a variety of risk-management activities carried out before the occurrence of drought in order to minimize their impact on people, the economy, and the environment (Figure 2).

Hydrological drought (deficits in surface and sub-surface water levels below a certain threshold) could further exacerbate even more frequent and widespread conditions where the available water supply cannot satisfy the human and environmental water needs (when the supply of water is smaller than the demand) in Uzbekistan, affecting not only agricultural production, but also residential and industrial water users. The traditional approach in dealing with drought in Uzbekistan is to respond to disaster once it happens, rather than implement proactive strategies (FAO, 2017). Such tactics can also be related to the fact that sufficient data on the economic benefits from DRR and mitigation is still lacking, and thus the government is often reluctant to fund such activities (Ding, Hayes and Widhalm, 2011). At the same time, Zilberman *et al.* (2002) even support the idea of responding

Figure 2. Conceptual framework of drought-risk mitigation activities



Source: **Gerber, N. & Mirzabaev, A.** 2017. Benefits of Action and Costs of Inaction: Drought Mitigation and Preparedness. In: *Drought and Water Crises: Integrating Science, Management, and Policy*, Second Edition, edited by D. Wilhite and R. Pulwarty. Boca Raton, Florida, CRC Press, Taylor & Francis Group; **Nurbekov, A. & Mirzabaev, A.** 2017. Strengthening Agricultural Resilience against Droughts in Uzbekistan: From Crisis Management to Drought Risk Mitigation. *Food Security in Eurasia 2017: Case studies*. Editors Per Pinstrup-Andersen, S.A. Shoba, P.P. Sorokin. 126 pp.

to drought only post factum, since it can be economically reasonable taking into account all the uncertainties and limited empirical evidence of the efficiency of drought-risk mitigation measures. It is quite common that actual disasters often serve as triggers for significant improvement of the relevant regulatory, institutional and technological components of DRR, even if the very same changes were proposed a long time before the event (Zilberman *et al.*, 2002).

Aral Sea disaster

The Aral Sea, which is fed by two main rivers, the Amu Darya and Syr Darya, is situated in the centre of the deserts of Central Asia and functions as a gigantic evaporator, with an area of 68 000 km^2. It was the fourth-largest inland lake in the world before 1960, and is now the largest inland salt reservoir. It has become synonymous with an environmental catastrophe representing one of the world's worst ecological disasters. Since the 1960s, the Aral Sea has been shrinking due to unplanned irrigation. In the USSR era, massive quantities of water from Amu Darya and Syr Darya were diverted for the irrigation of cotton, with a consequent decrease in river water flowing into the Aral Sea (Khamrayev, 2005). This trend has continued in the post-USSR era period, leading the Aral Sea to shrink dramatically.

The Aral Sea had been reduced to 10 percent of its original size by 1997, splitting into four lakes – the North Aral Sea, the eastern and western basins of the once far larger South Aral Sea, and one smaller intermediate lake. Satellite images taken by the National Aeronautics and Space Administration (NASA) in August 2014 revealed that for the first time in modern history, the eastern basin of the Aral Sea had completely dried up. Liston (2014) reported that the eastern basin is now called the Aralkum Desert. It reached its lowest level in 2014, due to the decades-old water diversions for irrigation, and a more recent drought (Howard, 2014). Its water table has decreased by five times. Uzbekistan, in cooperation with the international community and the United Nations in the country, has taken urgent action to mitigate the negative effects of this environmental catastrophe, for instance through the planting of drought-resistant saxaul trees. Following an initiative of the president of Uzbekistan, large-scale work has begun on the improvement of the dry bottom of the Aral Sea. The saxaul plantations are tailored to fit the current ecological situation.

The Aral Sea disaster is the best example of environmental devastation in Uzbekistan. Every year, many tonnes of salt are lifted from dried-out former parts of the Aral Sea and carried as far as 800 km away from the lake. Large parts of western Uzbekistan are recovering from a severe salt storm in 2018 that damaged vegetation. The salt leaves a white dust on farmers' fields and fruit trees that ruins most of the crops. However, the Aral Sea disaster is only the most visible indicator of environmental decay. The Soviet approach to environmental management brought decades of poor water management and a lack of water or sewage treatment facilities, inordinately heavy use of pesticides, herbicides, defoliants, and fertilizers in the fields, and construction of industrial enterprises without regard to human or environmental impact. These policies present enormous environmental challenges throughout Uzbekistan (ICARDA-CAC, 2016).

The desiccated bed of the Aral Sea has become one of the major sources of active wind erosion, which affects 56 percent of the irrigated area in Uzbekistan, posing a risk for land degradation. It has been estimated that during strong dust storms, as much as 1.5 tonnes/ha to 6.5 tonnes/ha of dust containing 0.3 tonnes/ha to 1.0 tonnes/ha of toxic salts are blown away from the sea bed and deposited on adjacent lands (United Nations Environment Programme and Glavgidromet, 1999). Khorezm, along with neighbouring Karakalpakstan, is the largest populated area exposed to the wind-borne consequences of the Aral Sea disaster (Khamzina, 2006). Salt-tolerant crop and tree-based interventions have the potential to provide ground cover, thereby reducing the movement of toxic salts. Taking into account the above-mentioned aspects, "bio-drainage" technology in the short-term has the potential to improve the productivity of 56 percent of irrigated land in Uzbekistan that is subject to wind erosion and land degradation (Choukr-Allah *et al.*, 2016).

Biological hazards

Plant pests and diseases

Agricultural production, processing and related services are important sources of income in Uzbekistan. Agriculture usually suffers from the negative consequences of pests and diseases, which causes significant economic damage and yield reduction of up to 15 percent (Baboev, Turakulov and Khasanov, 2014). In Uzbekistan, the low-input cropping systems dominated by cereal monoculture and intensive tillage obviously lead to the development of diseases, weeds and pests, and exert a negative influence on yields, which decreases profit margins.

The most common crop diseases are yellow and brown rust that affect wheat, and root rots, while the main method of controlling them is pre-sowing treatment of seeds, and crops that are partly treated with fungicides. From 1999 to 2010, epiphytotic yellow rust in wheat was recorded in the country five times (1999, 2003, 2005, 2009 and 2010) and the disease caused significant economic damage to grain production (Baboev, Turakulov and Khasanov, 2014). Crop rotation, in addition to soil fertility improvement, plays an important role in the control of pests, weeds and diseases (Nurbekov, 2018). Effective preventive crop protection measures can help farmers efficiently manage pests and diseases, for instance crop rotation, planting date, and timely pesticide application. In this case, farmers need to know the biology of pests and the history of disease development, as well as plant pathology in general. As many factors influence the development of pest and diseases, it is crucial to step in at the most sensitive points. It can be carried out through best crop management practices, a suitable combination of different methods, or the choice of a selective method.

More than 150 locust species can be found in Uzbekistan, and of those, about 15 species can cause significant damage to agriculture (Tufliev, 2019). The most dangerous locust species are Asian locust, Moroccan locust and Italian locust (Calliptamus italicus). These three locust species infest all 12 provinces and the (autonomous region) Republic of Karakalpakstan. During the past ten years, the annual anti-locust treatments covered areas ranging from 282 500 ha in 2012 to 625 400 ha in 2010 (FAO, 2010; FAO, 2012). During severe locust outbreaks, over 1 million ha can be treated with pesticides in Uzbekistan. The Moroccan locust, which is the most economically significant locust pest (typically demanding about 80 percent of all treatments), affects the two southern provinces, Kashkadarya and Surkhandarya, as well as Tashkent province in the north and Jizzakh province in the central part of the country. The Italian locust infests primarily the central provinces, namely Jizzakh, Navoiy and Samarkand, as well as the Republic of Karakalpakstan in the northwest, which also harbours important Asian migratory locust breeding areas in the Aral Sea zone. In south Uzbekistan, annual damage to cotton due to the Moroccan locust can exceed USD 2 million. These southern provinces share locust issues with the neighbouring countries of Afghanistan and Turkmenistan. In Commonwealth of Independent States countries, the largest concentration of the Moroccan locust is in Uzbekistan, which is particularly important to control due to the risk of infestation across the country's border (Gapparov, 2014).

Animal pests and diseases

Livestock farming uses the largest amount of land in Uzbekistan, with over 50 percent of the land area used as desert and mountain pasture, as well as part of the irrigated land (Veterinary Agency, 2020). Compared to crop production, changes in the development of the livestock sector after the country's independence came much faster – first, since livestock farmers have a much more decentralized system and major infrastructure; and second, because the severe decline in rural incomes has driven a rapid increase of livestock numbers to meet short-term economic objectives, which comes at the expense of sensitive arid ecosystems.

While information on disease prevalence is limited, it is clear that animal diseases continue to limit animal production performance, and in the case of zoonoses, threaten public health. Nevertheless, the State Committee on Veterinary and Livestock Development recognizes the importance of improving disease prevention and

control, and prioritizes the control of several zoonoses and transboundary diseases (including brucellosis, echinococcosis, foot-and-mouth disease, tuberculosis, pest of small ruminants, rabies, and anthrax). Improving the capacity to prevent, early detect, rapidly respond, and control the spread of animal diseases such as foot-and-mouth disease or brucellosis will positively impact the performance of animal production and reduce the threat to human and wildlife health. Eventually, this will contribute to livelihoods and food security, and reduce poverty, particularly in rural areas. In parallel, action must be taken to improve farm and livestock management to reduce the burden of animal diseases through raising awareness and capacity among farmers and livestock owners.

After independence, individual farmers became responsible for managing all the activities and decisions on their own farms, including disease control of animals, winter forage, and access to markets, which led to a decline in productivity in some cases across the country (ICARDA-CAC, 2016).

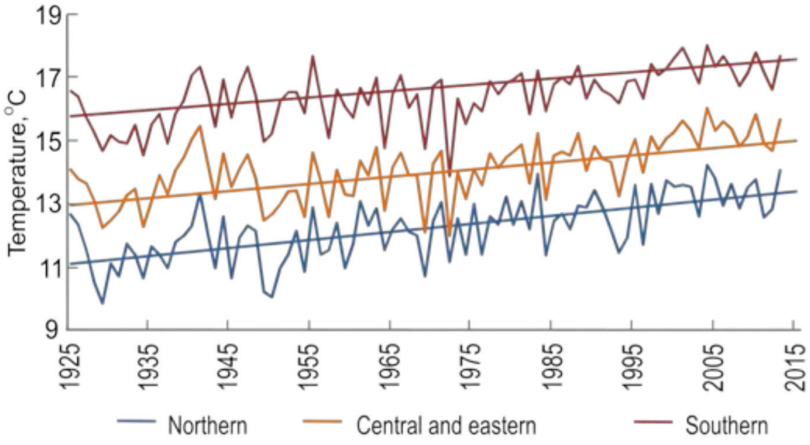
COVID-19

It is also important to mention the risks and impacts of the COVID-19 pandemic. Uzbekistan experienced quite a significant disruption in the functioning of transportation services in agrifood value chains due to the movement control measures that were introduced in 2020. A significant reduction in wages (of up to 50 percent) was reported by livestock farmers. At the same time, the Government of Uzbekistan introduced a number of policies, many of which were in effect until the end of 2020. In March 2020, tax rates for the use of water resources for irrigation were reduced by 50 percent (in place until the end of October 2020). In April 2020, import tariffs were removed on certain products, including poultry meat and edible offal, fish, milk and cream, butter, eggs, vegetables, dried leguminous vegetables, wheat or meslin flour, and cereal grains. The same month, a mechanism for fast tracking the customs clearance of imported food products was introduced, a national body was created to ensure the implementation of urgent tasks in agriculture, and a set of measures was identified for the development of food projects. Farmers reported that the government provided support in various forms, including subsidies for vegetables in greenhouses, tax payment extensions, and soft loans (FAO, 2020b).

Climate change

Uzbekistan has a generally dry climate with long, warm to hot summers, and moderate winters. The country can be broadly divided into two climatic zones: a desert and steppe climate in the western two-thirds of the country, and a temperate climate, characterized by dry summers and humid winters, in eastern areas. The climate in southern areas is characterized as arid and subtropical. The terrain of Uzbekistan is mainly sandy desert with dunes (which comprise 78 percent of the country's land), foothills, and parts of the Tien-Shan and Gissar-Alay mountain ranges. The desert plains receive only around 80 mm to 200 mm of precipitation annually, while the foothills can get from 300 mm to 400 mm, and the mountainous regions up to 600 mm to 800 mm per year. The desert and steppes are characterized by short winters with thin and unstable snow cover, and hot dry dusty summers. The mountains (over 2 000 m) have high rain (up to 950 mm per year), while desert areas have low rain (100 mm per year). Rain occurs mostly from late autumn to early spring, dropping off significantly during the summer months. The country is prone to large fluctuations in temperature, both seasonally and from day to day. The temperature ranges vary across the country. Uzbekistan is exposed to a range of weather-related extreme events, including dust storms, mud flows, flooding, drought, and avalanches (Central Intelligence Agency, 2020; GERICS, 2016; Uzhydromet, 2016; GCF, 2019; World Bank, 2020).

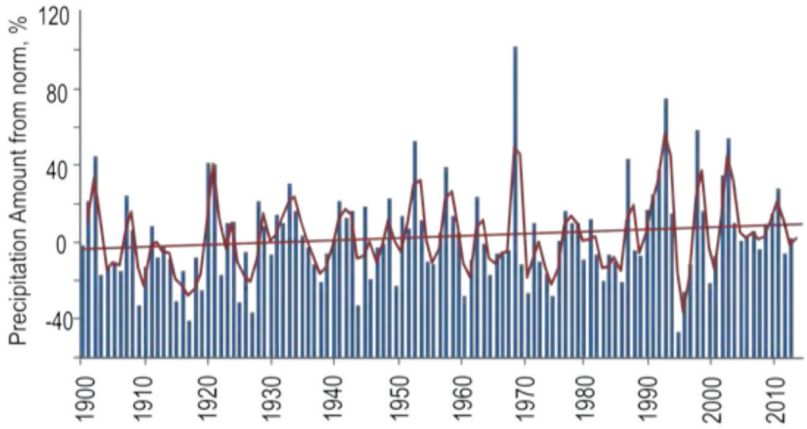
Figure 3. Change in average annual temperatures, 1925–2013



Source: **Uzhydromet.** 2016. *Third National Communication of the Republic of Uzbekistan under the UNFCCC*. Tashkent, Centre of Hydrometeorological Service at Cabinet of Ministers of the Republic of Uzbekistan. https://unfccc.int/sites/default/files/resource/TNC%20of%20Uzbekistan%20under%20UNFCCC_english_n.pdf

Uzbekistan has an extreme continental-type climate, with hot dry summers, unstable weather in winter, and wide fluctuations in seasonal and daily temperatures. The average air temperature in January is –3.2 °C (coldest month), and in July it is 27.2 °C (hottest month); however, these parameters vary greatly across the country. For instance, the temperature in Uzbekistan's deserts can reach 45 °C to 49 °C, while the minimum temperature in the south can drop to –25 °C (USAID, 2018). Figure 3 shows a tendency towards increasing air temperatures over recent decades in different parts of the country (Uzhydromet, 2016). Over the 1901–2013 period, the average annual temperature increased by 0.13 °C per decade. For the 1983–2013 period, the increase was 0.51 °C per decade. The most significant increases were recorded at low altitudes during winter months (USAID, 2018).

Figure 4. Variation in annual precipitation (% of long-term average), 1900–2013



Source: **Uzhydromet.** 2016. *Third National Communication of the Republic of Uzbekistan under the UNFCCC*. Tashkent, Centre of Hydrometeorological Service at Cabinet of Ministers of the Republic of Uzbekistan. https://unfccc.int/sites/default/files/resource/TNC%20of%20Uzbekistan%20under%20UNFCCC_english_n.pdf

Figure 4 shows the changes in precipitation (on average across the

country) over the 1900–2013 period. A slight increase can be noticed over the years; however, analysis of the available data did not show a significant trend in precipitation changes due to the high variability of this parameter (Uzhydromet, 2016). Nevertheless, every 30 years there was an increase in precipitation of around 5 percent (USAID, 2018).

Projected changes in the country's climate include the following:

- Increase in annual mean temperature of 1.3 °C to 2.1 °C by 2030, of 1.8 °C to 3.3 °C by 2050, and of 2 °C to 5.4 °C by 2085.
- Increase in annual maximum temperature of 2.1 °C to 6.3 °C and increase in minimum temperature of 2.2 °C to 5.6 °C by 2085.
- Long-lasting heat waves are projected to increase in duration by three to nine days by 2030, by between four and 17 days by 2050, and by between six and 43 days by 2085.
- Anticipated changes in total annual precipitation ranges from a decrease of 3 percent to an increase of 12 percent by 2030, and a decrease of 6 percent to an increase of 18 percent by 2085, with most projections showing an increase.
- Likely increased precipitation between November and April, with precipitation in other months remaining stable or decreasing slightly.
- Dry spells are expected to grow longer by up to four days, by 2085.
- Overall increase in arid conditions due to changing precipitation patterns and increased temperatures.
- Heavy rain events are projected to increase in intensity by 3 percent to 11 percent, and in frequency by 7 percent to 36 percent by 2030; and in intensity by 7 percent to 23 percent, and frequency by 12 percent to 74 percent, by 2085 (GERICS, 2016; Uzhydromet, 2016).

Ford *et al.* (2015) support the importance of adaptation as a key component of the efficient response to climate change. It requires making adjustments to reduce vulnerability or increase resilience in response to observed or expected climate change and associated extreme weather effects.

The Intended Nationally Determined Contributions of Uzbekistan to the Paris Agreement include the adaptation of the agricultural and water-management sectors, where the application of conservation agriculture is crucial. Conservation agriculture, or resource-effective agriculture, involves farming practices that help to conserve the land and environment while achieving desirable sustainable yield levels. It can be applied not only for carbon sequestration into the soil, but also as a facilitating system of an improved water balance on farmland which would result in better adaptation to new climate conditions. This approach is based on the integrated management of soil, water and agricultural resources to achieve the objective of economically viable, ecologically sound, and socially acceptable agricultural production. In Uzbekistan, conservation agriculture has been trialled for wheat, sunflower, mung bean, sesame, and sorghum, and the results have been quite encouraging. According to information from MoA, 600 000 ha of wheat is planted using minimum tillage into standing cotton in the country every year (Nurbekov *et al.*, 2013).

Globally, the consequences of climate-induced disasters are increasing, and Central Asia is one of the regions most affected by climate change. In this situation, it is especially important for Uzbekistan to shift from disaster response to a more proactive approach in dealing with natural hazards, particularly through the promotion of prevention and mitigation measures. The agricultural sector should not be viewed only as a victim of disasters, but rather as part of the comprehensive solution focused on improving overall disaster resilience. Risk-sensitive agriculture can help prevent some hazards from becoming disasters, through sustainable resource management. It can also support affected populations in case of an emergency, ensuring access to food and livelihoods. A limited recognition of such services and functions provided by the sector often leads to the underfunding of agriculture-related DRR activities.

Agriculture and food security profile

Land resources

Uzbekistan has a total area of 44.89 million ha, which includes 20.26 million ha of farmland, 4 198 900 ha of irrigated land, and 221 200 ha occupied by settlements. Forests cover almost 25 percent of the country's total territory (more than 11 million ha) (Table 2). Uzbekistan is among the top ten countries in the world in terms of the proportion of total forest area designated primarily for soil and water protection (69 percent of forest area) (FAO, 2020d). According to AQUASTAT (2012), almost 94 percent of all irrigated land (around 3.9 million ha) uses surface water sources, with the remaining using groundwater. Around 80 percent of the country is classified as desert or semi-desert. Therefore, limited access to water has a strong influence on government land policy and the issue of land privatization. However, in some cases, evidence is emerging that unaccountable and opaque land allocation processes have led to valuable farmland being taken out of the rural economy for housing construction, leading to economic losses. Due to the fact that the irrigation networks are not maintained properly, and the lack of ownership of land, 450 000 ha of previously irrigated land has become unsuitable for cultivation over the past 30 years. According to Presidential Decree No. 5742 (dated 17 June 2019), Uzbekistan has more than 1 million ha of land that can be used to cultivate agricultural crops (Presidential Decree, 2019a).

Table 2. Land categories, as of 1 January 2019

Categories of land resources	Total land area		Irrigated land	
	ha thousands	%	ha thousands	%
Farmland	20 261.6	45.13	4 198.9	9.35
Land settlements	221.2	0.49	50.9	0.11
Lands used for industry, transport, communication, defence and other purposes	857.1	1.91	12.4	0.03
Lands used for nature protection, health improvement and recreational purposes	704.4	1.57	0.6	0.001
Lands used for historical and cultural purposes	14.3	0.03	–	–
Forestry land	11 153.3	24.84	41.8	0.09
Water land	833.7	1.86	4.7	0.01
Land reserve	10 846.8	24.16	2.2	0.005
Total land	***44 892.4***	***100***	***4 311.5***	***9.6***

Source: State Committee of the Republic of Uzbekistan on Land, Resources, Geodesy, Cartography and State Cadaster, personal communication, 2019.

Farm structure

Uzbekistan has gone through several waves of farm restructuring and land reallocation. The government's farm consolidation between 2008-2009 and 2016 led to the creation of a dual system where smallholders (commonly known as *dehkan*)[4] who cultivate an average area of 1 ha, producing livestock and horticulture products, coexisted with large individual farms (enterprises) with an average size of 40 ha to 60 ha, which were producing cotton and wheat under a centrally planned system in which production orders are given by the state. The 2019 restructuring was aimed at doubling the size of cotton and wheat farms to an average of 100 ha (World Bank, Schweizerische Eidgenossenschaft and IAMO, 2019).

[4] Small-scale family farms *(dehkans)* that produce and sell agricultural products using the labour of family members on a land plot granted to the head of the family for life inherited ownership.

In 2019, 70.1 percent of the total volume of agricultural production came from *dehkan* (private) farms, 26.9 percent from farm enterprises,[5] and the remaining 3 percent from organizations carrying out agricultural activities.[6] As of 1 January 2020, there were in total 5 million *dehkan* farms, 92 600 farm enterprises, and 27 600 organizations carrying out agricultural activities (UzStat, 2020b). The average *dehkan* farm size is 0.20 ha in irrigated, and 1 ha in rainfed conditions, and the average size of farm enterprises is 30 ha in the irrigated areas and around 100 ha in rainfed conditions, while the size of an agricultural organization is typically around 1 500 ha. Only about 4 percent of private farming enterprises are headed by women. While there is no data available on *dehkan* farms, it is rare for women to be formal heads, even though in migrant households they tend to be de facto farm managers (FAO, 2019a).

Crop production

In 2019, crop production accounted for 50.2 percent of total agricultural production (in USD), not considering fisheries (UzStat, 2020b). High yields in the agricultural sector can be achieved only with rational use of land and water resources. Farmland use planning, as it was practised in the USSR, is still common in Uzbekistan. A major feature of the planning system is the categorization of farmland productivity based on a range of variables that relate to soil characteristics and fertility. The development of the farms is constrained by the limited potential and abilities in cropping, tillage methods, soil fertility improvement, on-farm water management, and high product quality (Nurbekov *et al.*, 2010). There is an urgent need to pilot changes in agricultural practices in order to improve agricultural production in the irrigated areas of Uzbekistan (Nurbekov *et al.*, 2013). Table 3 outlines the area and productivity of various crops in Uzbekistan from 1991 to 2016.

Table 3. Area (ha thousands) and productivity of selected crops, 1991–2016

Year		1991	2000	2010	2015	2016
Wheat Area, 000 ha		226	1 028	1 156	1 145	1 135
Wheat yield t/ha		1.71	2.76	4.89	5.81	5.92
Wheat production, 000 t		386	2 837	5 651	6 652	6 719
Cotton Area, 000 ha		1 721	1 445	1 450	1 445	1 423
Cotton yield, t/ha		2.72	2.18	2.54	2.18	2.61
Cotton production, 000 t		4 680	3 149	3 684	3 149	3 714
Fruit Area, 000 ha		50	139	180	262	267
Fruit yield, t/ha		15.8	5.1	9.5	12.4	11.8
Fruit production, 000 t		790	709	1 712	3 248	3 149
Intensive orchard	Area, 000 ha	0	0	10	37	41
	Yield, t/ha	0	0	15.32	21.41	24.24
	Production, 000 t	0	0	155	790	982
Vegetables	Area, ha	166	35	173	194	205
	Yield, t/ha	18.8	18.3	25.6	30.2	27.1
	Production, 000 t	3 113	637	4 426	5 859	5 566

Source: **Nurbekov, A., Aksoy, U., Muminjanov, H., & Shukurov, A.** 2018. *Organic Agriculture in Uzbekistan: Status, practices and prospects*. Tashkent, FAO. www.fao.org/3/i8398en/I8398EN.pdf

The main crops grown in the country are cotton, wheat, barley, rice, maize, potatoes, and horticultural crops (fruit and vegetables). Uzbekistan was a major producer of cotton, vegetables and fruit during the USSR era. About 70 percent of irrigated land was devoted to cotton production, whereas feed crops (alfalfa, rye, barley, and maize) were grown in rotation with cotton and supported limited livestock production. Wheat, one of the key food security crops, was mostly imported from other regions of the USSR where local production met only 20 percent of domestic demand. In Uzbekistan, since 1994, the area under irrigated winter wheat has increased to ensure national food security, so that the former, long-cycle cotton-alfalfa cropping system was largely replaced by shorter crop rotation of spring cotton and winter wheat. As a result of area extension

[5] An independent economic entity that conducts commercial agricultural production on leased land plots.
[6] A legal entity that has the right of economic management over the land, produces agricultural products (crops and livestock) and provides agricultural services.

and yield increase, wheat production in Uzbekistan increased by 17 times during the 1991–2016 period (from 386 000 tonnes in 1991, to 6 719 000 tonnes in 2016). On the other hand, cotton production decreased by about 21 percent due to a reduced planting area (Table 3). Fruit and vegetables are also becoming important in most of the regions, as export opportunities become more attractive. The absence of alfalfa in current crop rotations has diminished humus and micronutrient levels in the soil. It has also reduced the soil structure benefits derived from alfalfa's root system. Crop rotation with feed legumes or pulses is extremely important for soil health and management of plant diseases.

The World Resources Institute projects that Uzbekistan will be among the world's 33 most water-stressed countries by 2040. By 2050, cotton and wheat yields are projected to decrease by between 6 percent and 10 percent, and by between 14 percent and 17 percent, respectively (Uzhydromet, 2016). Such declines will have major implications both for food security and the balance of payments, further emphasizing the need to move to more sustainable water-management and crop-management practices. Horticultural crops use less water than cotton. Aldaya, Munoz and Hoekstra (2010) estimated that about 4 426 m^3 of water is required to grow a tonne of cotton in Uzbekistan, and about 2 068 m^3 of water is required for wheat.

Most of the achievements in cotton and wheat production are based on high-input use technologies including water, seed, fertilizers, and pesticides, which are not sustainable on a long-term basis. As a result of land privatization, holdings are getting smaller and high-input use technologies become unsuitable for them. Technologies which are sustainable and effective in using a low or optimal level of inputs could help in saving seeds, water, and fertilizers, and reducing production costs. In addition to these, by adoption of cotton–wheat rotation by planting winter wheat in standing cotton using minimum tillage equipment, this could spare land for growing other crops, in particular legumes such as chickpea, lentil, field pea for food, or alfalfa for forage.

Timely policy support is critical for any breakthrough in agriculture through the adoption of any appropriate technology. Farmers need adequate support for seeds or other propagation materials of new crops and inputs (like fertilizers, pesticides, and so on) for crop diversification. Furthermore, there should be appropriate pricing support and procurement policy for these crops. Farmers also need credit for buying various inputs and machinery, which should be made available to them at affordable low interest rates through rural banks. Multiplication of prototypes of less costly machinery and other types of equipment requires government support. As an example, raised bed planters and no-till drills, flame weeders or similar tools have to be manufactured and publicized. Their import is a costly affair and hence promoting their manufacture in Uzbekistan is critical. Similarly, policy support for the use of water-saving technologies such as sprinkler, drip and plastic mulching of furrows in cotton or wheat are urgently needed in the national interest. Promotion of these technologies would require appropriate subsidies and government intervention, beside ongoing efforts on land privatization, crop diversification and capital investment in agriculture for linking farmers to markets.

There is a number of measures that can be applied to support crop diversification, such as introducing new crops or improved varieties and climate-resilient cultivars, capacity development of agricultural production techniques, including crop diversification, climate adaptation, and so on (Nurbekov, 2018). The strength of project design and implementation depends on how the technology package is applied and to what extent the collaboration and participation of relevant stakeholders are included.

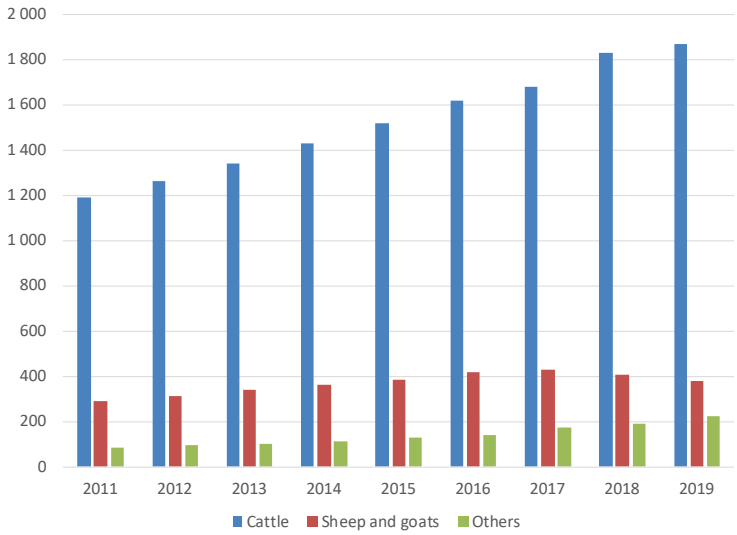
Livestock production

Livestock production is important for the overall agricultural sector and its development. Livestock production is a major livelihoods support system and a social safety net for more than 49 percent of the population who live in rural areas. In 2019, livestock production accounted for 49.8 percent of total agricultural production, not considering fisheries (UzStat, 2020b). This is a growing sector. Over the 2011–2019 period, meat production steadily increased (Figure 5). According to the State Agency on Statistics, almost 95 percent of all livestock is reared on small *dehkan* farms and private farm enterprises. Small ruminants which are used for meat, as well as for their skins and wool, are raised in semi-arid and desert locations in the west, where horse and camel rearing can also be found. Karakul sheep rearing is important as well.

In general, livestock productivity is low – for example, average milk yield is 1 700 litres per lactation. Dairy production is concentrated in irrigated areas closest to urban centres, while beef production is mostly

concentrated in low mountain pastures. The Government of Uzbekistan hopes to increase livestock productivity through the adoption of new technologies, and to develop further processing and packaging capabilities to add value to domestic and export products.

Figure 5. Meat production in all farm categories (tonnes thousands), 2011–2019



Source: **UzStat.** 2020a. Open Data. *State Committee on Statistics of the Republic of Uzbekistan.* Cited 3 December 2020. https://stat.uz/en

Fisheries

Fisheries currently plays a rather minor role in the country, in 2019 representing only 0.6 percent of total production (services) of the combined sectors of agriculture, forestry and fisheries. In total, 115 200 tonnes of fish was produced in Uzbekistan in 2019. Organizations carrying out agricultural activities play the major role in fish farming. In 2019, they produced 49.8 percent of all fish in the country (in volume), followed by farm enterprises (41.7 percent). *Dehkan* farms are least involved in this activity, producing only 8.5 percent of fish (UzStat, 2020b). The main cultivated fish species are cyprinids (silver carp, grass carp, big head carp), as well as walleye, Eastern bream, catfish and snakehead. Fish are bred in ponds (carp), pools (trout) or stocked reservoirs (white carp, white Amur). Fishing is carried out in two main lake systems – in the Amu Darya delta, and the Aidar-Arnasay lake system. Aquaculture production has been on the rise since 2010 (FAO, 2020c).

Export and import of agricultural products

Demand for agricultural production is expected to continue to grow in Uzbekistan as a result of increased export opportunities. It is important to note that Uzbekistan is currently increasing the production of fresh fruit and vegetables, as well as dried produce, for export markets. Overall, for the 2015–2019 period, both imports and exports increased, reaching almost USD 1.8 billion and USD 1.5 billion, despite a dip in 2016-2017 (Table 4). Uzbekistan imports mainly processed foods (around 60 percent), while exports are predominantly raw agricultural products (84 percent of the total) such as sugar, sunflower oil and meat.

Table 4. Dynamics of import/export of foods and beverages (USD millions)

		2015	2016	2017	2018	2019
Import	Total	1 436.7	1 321.2	1 134.4	1 413.2	1 787.5
	Raw	367.7	375.8	342.4	492.3	716.3
	Processed	1 068.1	945.5	792.0	920.8	1 071.2
Export	Total	1 288.1	663.4	843.4	1 062.6	1 465.9
	Raw	1 221.8	598.9	712.7	907.5	1 237.3
	Processed	66.2	64.5	130.7	155.1	228.6

Source: **UzStat.** 2020a. Open Data. *State Committee on Statistics of the Republic of Uzbekistan.* Cited 3 December 2020. https://stat.uz/en

The share of agricultural products as a proportion of total exports in 2019 was 8.8 percent in terms of volume, and 8.4 percent in US dollars. The share of imports for the same year was 7.8 percent in volume terms (7.4 percent in USD) (UzStat, 2020a). The Government of Uzbekistan is anticipating an increase in agricultural productivity through the adoption of new technologies such as intensive orchards and greenhouses, and the further development of processing and packaging capabilities to add value to domestic and export products. The government also plans to develop the country's textile sector, improve the value added chain and hence process more of its own raw cotton into intermediary or consumer goods for export. By 2020, it was envisaged to increase the production of cereal crops to 8.5 million tonnes with a growth rate of 16.4 percent, increase the production of potatoes by 35 percent, other vegetables by 30 percent, fruit and grapes by 21.5 percent, meat

by 26.2 percent, milk by 47.3 percent, eggs by 74.5 percent, and fish by 250 percent. At the same time, export volumes of these types of food should increase significantly (UzA, 2016). Kazakhstan, the Russian Federation and China are the main markets for exports from Uzbekistan. The latest data shows that in 2019, food imports for Uzbekistan accounted for around 9.3 percent of total merchandise imports. In 2019, the country imported agrifood products mainly from Kazakhstan (USD 504.5 million, or 32 percent of total agrifood imports). Other important countries selling agrifood products to Uzbekistan are Brazil (USD 347.4 million) and the Russian Federation (USD 324.9 million) (UzStat, 2020a).

Nevertheless, there are a number of challenges in the export of agricultural products, ranging from a lack of technologies, to the impact of the climate. Better results cannot be achieved unless relevant stakeholders solve the weaknesses identified, such as improving the availability of relevant technologies, increasing access to water resources, mainstreaming technologies for adapting to climate change, and strengthening value chains and lessons learned (Nurbekov, 2018).

Socioeconomic information

The rural population in Uzbekistan made up 49.57 percent of the total in 2019, according to the State Committee on Statistics (UzStat, 2020a). The annual urbanization rate in Uzbekistan is negative and has stabilized at –0.23 percent. Uzbekistan has a large youth population, and rural residents are slightly younger on average than their urban counterparts (FAO, 2019a). In 2018, the workforce accounted for around 57.1 percent of the country's total population (18.8 million people), of which around 53.3 percent is urban and 46.7 percent is rural (UzStat, 2020a). Agriculture plays a major role in the economy, in 2019 contributing 25.5 percent to the GDP and employing more than 3.5 million people (26.2 percent of country's total labour force), many of whom were underemployed (UzStat, 2020a). At the same time, almost 80 percent of workers in this sector are involved informally, particularly through work on family farms, seasonal/temporary work, or self-employment. Women generally have very limited opportunities to find work outside the agricultural sector; they tend to be involved in low-skilled manual labour and seasonal/temporary work, and they are overrepresented in informal employment. On average, women's wages are only around half those of men (FAO, 2019a). Labour migration is a common feature in rural areas where limited employment and income-generating opportunities act as push factors for both women and men (UzStat, 2020a).

The agricultural sector is also very important for food security and for reduction of rural poverty. Agriculture is an important source of income and stability in rural areas. In Uzbekistan, the reliance on agriculture as a major source of income is associated with a lower risk of poverty. After achieving independence, Uzbekistan put major emphasis on agricultural growth and efforts towards developing its own market economy. During this transition, large inefficient *shirkat* (company) farms were disbanded and a number of small private farms were established. This led to an increase in labour migration from rural areas as these new private farming enterprises required less staff. Overall public spending on agriculture from 2016 to 2018 averaged 2 percent of GDP (Ministry of Finance and the State Committee of the Republic of Uzbekistan on Statistics, personal communication, 2019).

Poverty and malnutrition

The Ministry of Economy and Industry was transformed into the Ministry of Economic Development and Poverty Reduction by Presidential Decree No. 4653 dated 26 March 2020. This happened due to a number of factors, one of which was the need to create a concrete and transparent mechanism for managing the economy with a focus on results in the context of liberalization and widespread adoption of market approaches. It is required to form a modern institutional system for the rapid identification and solution of existing problems, ensuring unity in the activities of all relevant structures. The Government of Uzbekistan holds the control over farmland to ensure cotton production for export revenues and wheat production for food self-sufficiency. Household plots are small, but vital for producing vegetables, fruit, and livestock grown for households and the domestic market. Uzbekistan produces enough agricultural products to feed its population and, as of 2011, the country has achieved self-sufficiency in almost all major products, including vegetables, fruit, potatoes, meat, eggs and milk, although it still had a deficit in the production of wheat and vegetable oil (Khamrayev *et al.*, 2017). According to FAOSTAT's Food Balance, in 2018 food supply in kcal per capita per day reached 3 011 (FAO, 2020a).

The share of the population in Uzbekistan living below the poverty line was reported at 14.1 percent in 2013, according to the World Bank collection of development indicators, compiled from officially recognized sources. According to preliminary calculations of the Ministry of Economic Development and Poverty Reduction, between 12 percent and 15 percent of the country's population (four or five million people) currently live in poverty (MinEconomy, 2020). Poverty is more common for rural communities and according to the conducted assessment, in 2015 around 70 percent of the country's poor lived in rural areas (FAO, 2019a). A lack of jobs, unemployment, and the informal work in rural areas, are also causes of poverty and malnutrition.

According to the Global Nutrition Report (2020), Uzbekistan is currently off track in reaching a number of global targets addressing malnutrition. At the same time, there is an insufficient amount of data to assess the situation regarding children under five years of age. As of 2006, overweight was common among 12.2 percent of children under five, while stunting and wasting were common among 19.6 percent and 4.4 percent of children under five, respectively. Regarding children and adolescents (aged 5–19), for the 2000–2016 period, there was a declining trend in terms of underweight (13.4 percent for girls and 16.8 percent for boys, in 2016). However, the prevalence of both overweight (exceeding 16 percent for both girls and boys) and obesity were increasing. Among adults, the prevalence of overweight (48.9 percent for females and 47.3 percent for males, in 2016), obesity, as well as diabetes (more than 10 percent in 2014), were similarly increasing. Taking the country's population as a whole, the proportion of undernourished people has dropped quite significantly since 2001 (when it was 18.8 percent), reaching 6.3 percent in 2017 (Global Nutrition Report, 2020).

The level of income and level of consumption of the local population are indicators of poverty and economic access to food. Absolute poverty, first of all, means food insufficiency and malnutrition. The concept of absolute poverty often implies an inability to meet the requirement of minimum subsistence, which is expressed as daily food consumption of 2 100 calories per person (World Food Programme, 2008). According to FAO, around 6.3 percent of the population in Uzbekistan suffers from undernourishment (FAO, 2019b).

Policies and regulatory framework in disaster risk reduction and agriculture

International conventions

According to the law of Uzbekistan **On international treaties of the Republic of Uzbekistan** (No. 518, of 6 February 2019), international treaties signed by Uzbekistan, along with generally recognized principles and norms of international law, are an integral part of the legal system of the country. International treaties are subject to strict and mandatory implementation by Uzbekistan in accordance with the norms of international law. If fulfilment of an international treaty would require the adoption of a legislative act, the relevant state bodies, in agreement with the Ministry of Foreign Affairs and the Ministry of Justice of Uzbekistan, must prepare a proposal for the adoption of the relevant legislative act to implement the provisions of an international treaty. Currently, Uzbekistan participates in the following international treaties and conventions on disaster risk management, climate change, and food security:

- Vienna Convention for the Protection of the Ozone Layer (1985);
- Montreal Protocol on Ozone Depleting Substances (1987);
- Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (1989/1992);
- Convention on Biological Diversity (1992);
- Convention on the Protection and Use of Transboundary Watercourses and International Lakes (1992);
- United Nations Framework Convention on Climate Change (UNFCCC) (1994);
- United Nations Convention to Combat Desertification (1994);
- Cartagena Protocol on Biosafety to the Convention on Biological Diversity (2000);
- Stockholm Convention on Persistent Organic Pollutants (2001);
- Kyoto Protocol of the UNFCCC (2005);
- Hyogo Framework for Action 2005–2015 (2005);
- Sendai Framework for Disaster Risk Reduction 2015–2030 (though it does not currently have a national platform for DRR) (2015);
- Paris Agreement (2015);
- Transforming our World: the 2030 Agenda for Sustainable Development (2015).

Climate change

Uzbekistan has taken deliberate steps to incorporate climate-change considerations into its national strategies, plans, and governmental decrees. The country has also submitted three National Communications to the UNFCCC and their Intended Nationally Determined Contribution. However, Uzbekistan still lacks a comprehensive, nationwide framework for climate-change adaptation. Legislative actions have mainly consisted of decrees issued by the president and various cabinet ministers regarding climate-change mitigation

measures for individual sectors (such as energy, water, agriculture). Since 2016, Uzbekistan has been in the process of developing a National Adaptation Plan, which as of May 2021 was still in the process of being formulated (GCF, 2019).

Climate change could be a big problem in Uzbekistan in the near future as the long-term climate-change forecast is for increased temperatures and decreased water availability across the country. Uzbekistan has also started to address climate-change adaptation at the national and subnational levels. The government has identified a series of agriculture-based interventions as priorities to strengthen the resilience of farmers, most notable of which is crop diversification and plans to reduce water consumption in agriculture by adopting water-saving technologies such as a drip and sprinkler irrigation system. In the absence of control and adaptive management, this is expected to increase the burden of waterborne diseases, as well as health issues caused by dust storms and desertification.

National regulatory and policy framework related to disaster risk reduction

The Government of Uzbekistan recognizes its vulnerability to natural hazards and has taken important steps to manage disaster risks. The protection of the population and territories against disasters caused by natural hazards, or of a human-made or environmental character, is one of the priority areas of the national security policy in Uzbekistan. It is essentially aimed at ensuring the safety and protection of the population against various disasters and emergencies (Ministry of Emergency Situations, 2005). Uzbekistan has started to reform and modernize agriculture and the water sector, improve land reclamation and irrigation, and increase land fertility and yields. There is a number of presidential decrees, resolutions and regulations of the Cabinet of Ministers related to natural hazards and EWS, which have been adopted in the country since 1991. The subsection below provides some information on important laws, decrees, and policies.

Legislative/regulatory frameworks

The Government of Uzbekistan has created a strong legal basis for the protection of the population against natural hazards. Among them is the law of Uzbekistan **On the concept of national safety** (No. 467-I, of 29 August 1997). The Ministry of Agriculture (MoA) is responsible for the food security aspect of this law, as part of overall national safety, while the vital national interests recognize the maintenance of optimum ecological conditions for the ability of any person to live, the protection of health of the people, and the creation of a stable ecological situation. In January 2001, the Ministry of Emergency Situations (MoES) started cooperation with the US Federal Emergency Management Agency (FEMA) on providing a framework for various programmes of emergency preparedness and disaster-mitigation cooperation.

A fundamental document addressing this problem is the law of Uzbekistan No. 824-I **On protection of population and territories against emergency situations of natural and manmade character** (adopted on 20 August 1999, last amendments in 2019). The law regulates public relations and determines the main tasks, organizational principles of establishing and functioning to protect the population and territories against natural hazards in the country. It is aimed at prevention and counteracting the development of emergency situations, reduction of losses from emergencies, and emergency response. It proclaims citizens' rights to protection of their lives, health and property in case of emergency situations, and also defines the responsibilities of government authorities entrusted with this mission. The law establishes the main principles, goals, objectives and ways of protection of the population and territories against emergency situations by government and administrative authorities at all levels as well as by enterprises, agencies and organizations. A key feature of the law is that it involves, through self-governance bodies, people at large in operation of the government system of emergency prevention and recovery. It does not directly address climate change or the agricultural sector.

There is a decree of the president of Uzbekistan dated 19 February 2007 No. 585 **On disaster prevention and relief measures related to flooding, mud flows, avalanches and landslides** (latest amendments in 2019). Ministries (including MoA), committees, and centres set up and maintain procedures to prepare for and respond to any accidents and emergency situations and prevent or mitigate associated impacts. Uzhydromet is mainly responsible, working closely with local, regional and national authorities to coordinate their emergency preparedness plans. Uzhydromet, together with the Ministry of Water Resources, monitors the readiness of the irrigation system (canals, dams, water intakes, and so on) for the accident-free passage of mud flows and flood waters in order to protect agricultural crops from yield losses.

If the upcoming year is expected to be dry, a corresponding presidential decree will be adopted to mitigate potential consequences – for example, the presidential decree **On emergency measures to mitigate expected water scarcity in 2007** (27 April 2007 No. 629), whose main objective was to improve agricultural water productivity in stressed basins where agriculture is commonly irrigated. This can be achieved through a switch from flood irrigation to sprinklers or drips, but capital costs are significant. Regulations on the introduction of a drip irrigation system on cotton producing farms were adopted on 27 December 2018 (No. 4087). The phases include purchasing equipment, installation, getting subsidy approval, and reimbursement. For the first time, the subsidy scheme was introduced in 2019 when only cotton-producing farmers were eligible for subsidies, and farmers got almost USD 1 000/ha if they installed a drip irrigation system.

According to the decree of the president dated 19 April 2013 No. 1958 **On measures for further improvement of the meliorative condition of irrigated land and rational use of water resources for 2013–2017**, the drip irrigation system is being increased every year. In accordance with the decree dated 23 December 2016 No. 2697 **On the Investment Programme of the Republic of Uzbekistan for 2017**, the functions of the department for the management of the fund for the improvement of irrigated land plans is now responsible for the allocation of funds. In order to improve further reclamation and irrigation infrastructure, a state programme on improvement of irrigated land and the rational use of water resources was established for the period 2013–2017. More than USD 1.2 billion was allocated for its implementation. As part of the programme, a 1 771 km drainage network was built and reconstructed in 2013-2014, and 24 700 km of repair work carried out. Around 360 units of reclamation equipment were purchased at low interest rates. In addition, reclamation of irrigated land on an area of over 1 700 000 ha was carried out.

The resolution of the Cabinet of Ministers of the Republic of Uzbekistan No. 1027 (dated 28 December 2017) focuses **On the creation of a Unified System for monitoring, information exchange and forecasting of natural, manmade and environmental emergencies**. It defines the main tasks of this Unified System, approves its organizational and functional structure and the corresponding regulations. Apart from natural hazards in general, this document considers the widespread infectious diseases of people, farm animals and plants as a source of emergency. It includes the damage to agricultural crops and trees leading to significant material damage as one of the indicators to consider in case of an emergency. The resolution includes a list of monitoring and forecasting information provided by participants of the Unified System which among other types of disasters specifically addresses infectious diseases of agricultural animals and damage to agricultural plants by diseases and pests. The MoA is one of the participants of the system and, depending on the type of disaster, it is responsible for providing information about the event, and information on its consequences. The State Committee on Veterinary and Livestock Development provides information in the case of infectious diseases of agricultural animals.

One of the recent decrees of the president, No. 533 of 17 April 2018, **On measures for radical improvement of system of government management in agriculture and water resources**, was adopted with the aim of organizing the accumulation of agricultural and food products, to ensure the year-round provision of food products at stable prices for the population.

There is a complex programme of measures on mitigating the consequences of the Aral Sea disaster, restoration and the socioeconomic development of the region for 2015–2018, adopted on 29 August 2015 (No. 255). The president approved decree No. 2731 dated 18 January 2017 **On State programme on development of the Aral region for 2017–2021**. The decree aimed at improving the conditions and quality of life of the population of the region, providing for the implementation of projects worth UZS 8.422 trillion (USD 84 billion). The programme also includes measures to improve water-use efficiency in agriculture, to organize haloxylon plantations, and seed production of drought- and salt-tolerant crops. Afforestation works were carried out on 500 000 ha in 2019. Afforestation fixes movement of sand, slows down desertification processes, wind speeds, stops dust particles in the air, and improves climate-change resilience in general. Fieldworks to plant haloxylon were carried out on 1.26 million ha, with 1 500 tonnes of haloxylon seeds prepared for the work in 2020-2021.

The decree of the president No. 4204 **On measures to increase the efficiency of combating desertification and drought in the Republic of Uzbekistan** was adopted on 22 February 2019. It focuses on the protection of land from the effects of excessive pressure of drought to maintain a continued supply of food, and save water

and energy for future generations. The resolution was made to entrust the State Committee for Forestry with additional functions:

- Implementation of measures on prevention of desertification (planting trees and shrubs across Uzbekistan which serve to improve the air quality and protect the environment from pollution) and increase areas covered by forests.
- Fulfilment of the UN Convention to Combat Desertification (UNCCD) obligations of Uzbekistan on desertification and drought.
- Effective collaboration with international and regional organizations on desertification and drought issues.
- Coordination of the work of the ministries (MoA and Ministry of Water Resources), agencies and local executive authorities, involved in the development and implementation of programmes and projects for desertification and drought in Uzbekistan.

Warnings on avalanches and mud flows are issued based on conducted monitoring, realized according to the decree No. 4305, dated 2 May 2019, **On the measures for the prevention of emergency situations related to the flood, mud flow, snow avalanche and landslide phenomena and elimination of their consequences**. This decree defines the tasks of the ministries and agencies involved in organization of monitoring of nature and anthropogenic phenomena and elimination of their consequences.

The resolution of the Cabinet of Ministers of the Republic of Uzbekistan No. 515 (dated 26 August 2020) focuses **On further improvement of the state system for prevention of and response to emergency situations of the Republic of Uzbekistan**. It defines the structure of the system, as well as the main functions of the ministries, agencies, local governmental bodies and other involved organizations in terms of protection of the population and territories from emergency situations.

Policies and plans

In 2006, Uzbekistan adopted a **State Programme on Earthquake Risk Reduction** and in 2011 established an earthquake impact preparedness programme. As part of the programme, the Earthquake Simulation Complex at the Institute of Civil Defence was opened in Tashkent in 2015.

A **State Programme on Forecasting Emergency Situations of Natural and Technological Character** was approved by a resolution of the Cabinet of Ministers No. 71 of 3 April 2007 (latest amendments in 2020). The purpose of this state programme is to provide a guaranteed level of protection of the population and territories from emergency situations, risk reduction and mitigation of accidents and natural hazard-induced disasters in the country, taking into account the achievements of national science and technology, as well as international experience in the field. Agriculture is not addressed directly in the programme. However, the Ministry of Agriculture and Water Resources of Uzbekistan (which in 2018 was divided into MoA and the Ministry of Water Resources), as well as Uzhydromet, play important roles in the implementation of the programme. The MoA and the Ministry of Water Resources are responsible for the assessment of flood-prone areas, mud flow and flood-control structures, epizootics and epiphytotics.

The definition of EWS, formulated after the Indian Ocean tsunami of 26 December 2004, states that EWS can be used to detect a wide range of events, such as vehicular collisions, missile launches, disease outbreaks, and so forth. Analysis of the legislation of Uzbekistan in the area of EWS is considered in this report in the context of the four main components identified by the United Nations.

According to the **Uzbek National Environmental Action Plan** (NEAP), which was approved in 1997 and supported by UNDP and GEF, the deterioration of irrigation and drainage systems is now the primary cause of land degradation in the country. Deteriorating drains in conjunction with poor water-management practices has led to progressive salinity in the soil and groundwater supplies. Discharges from the drainage system have further affected fisheries in downstream areas. The NEAP identifies national strategic priorities for maintaining, restoring and enhancing environmental quality, improving the sustainable use of natural resources, and mainstreaming environmental protection and sustainable use into other economic sectors. The state budget allocation for the implementation of the programme is around USD 400 million per annum.

It is clear that DRR is very important for sustainable agriculture in Uzbekistan. An assessment of the national regulatory and policy framework related to DRR in Uzbekistan is needed. However, it has been observed that there is no clear regulatory framework on DRR in agriculture and it would require proper policy support on DRR in order to reduce the impact of natural hazards affecting the sector.

National laws and policies for the agricultural sector

Within the context of the agricultural sector, the regulatory framework encompasses laws, decrees, recommendations and guidelines that govern organization and crop management, crop rotation, crop diversification, and modern technology. A review of existing regulations and instruments on crop management is presented in this section. In general, these sectoral regulations rarely address the topics of DRR and climate change.

The Government of Uzbekistan is planning to increase crop production and productivity through the application of modern agricultural techniques, including the provision of resource-saving technologies and appropriate crop-management practices. State farms are gradually moving from state control to private ownership. Moreover, commercial banks operating in rural areas offer government-funded credit lines for local agricultural enterprises. In a national drive for food security, the Government of Uzbekistan has set a clear goal of liberalizing its agricultural economy by reducing the role of the public sector and encouraging private-sector participation and investment. This economic liberalization, coupled with policy and regulatory reforms, has had a profound impact on the organization of the agricultural sector in general, and seed sector in particular.

In 1996, the Government of Uzbekistan adopted an **agricultural development policy** (Resolution of the Cabinet of Ministers No. 157) in order to achieve food security and economic development. The policy enabled rapid economic growth in the agricultural sector, particularly in the development and adoption of modern wheat and cotton varieties. In view of the increasing population, further advances are required in agricultural research to achieve increased production and productivity. This policy did mention flooding and landslides.

On 7 February 2017, by the decree of the president No. 4947, the **Action Strategy for five priority areas of development of the Republic of Uzbekistan in 2017–2021** was adopted. The five main directions of the strategy cover: (i) improvement of state and public affairs; (ii) ensuring the rule of law and further reforms of the judicial system; (iii) development and liberalization of the economy; (iv) development of social services; and (v) ensuring the security, inter-ethnic harmony and religious tolerance, the implementation of balanced, mutually beneficial and constructive foreign policy (Presidential Decree, 2017b).

Presidential Decree No. 5853 of 23 October 2019 adopted Uzbekistan's **Agriculture Development Strategy for 2020–2030**. The strategy has defined priority areas for implementation, in particular the development and implementation of the national policies on food security, including ensuring food safety and improving diets, and producing food items in the required quantities. To create a favourable agro-industrial sector climate and value chain, the strategy envisages the introduction of market principles for purchase and sale of agricultural products, development of a quality control infrastructure, export promotion, and the production of competitive agricultural products with high added value. According to the strategy, the role of the state in the agricultural sector will gradually decrease. At the same time, it is planned to increase the investment attractiveness of the industry with an increase in the flow of private capital to modernize, diversify and support the stable growth of the agrifood sector. The strategy mentions the adoption of a national action plan to prevent the negative effects of climate change on the productivity of agricultural crops in the country. According to the strategy, it is also planned to allocate 1 percent (as a percentage of total funds allocated for the agricultural sector) for disaster risk management and this share should increase gradually (Presidential Decree, 2019b).

The system of rational use of natural resources and environmental protection will be improved, and rural-development programmes will be implemented through this strategy. The document focuses on research and development, education, information and advisory services for agriculture. The strategy also supports increased efficiency and phased redistribution of government spending, with sectoral programmes to be

developed aimed at increasing labour productivity in farms, improving product quality and creating high added value. It is planned to create a transparent system of sector statistics, supporting the implementation of reliable methods for collecting, analysing and disseminating statistical data using digital technologies. The decree approved the composition of a coordination council for the implementation of the strategy, MoA assigned as the working body, with the prime minister in charge.

The country's major **Law on land** was adopted in 1998 (last amendments in 2020). According to this law, land is the property of the government and can be leased by individuals or groups for periods between 10 and 50 years, and cannot be the subject of sale or purchase. Land can be used as collateral for obtaining credits by the person who has temporary long-term lease rights. Land can be leased with the approval of the government, namely the Cabinet of Ministers, on a competitive basis. Community level, district and provincial authorities *(hokims)* function as the link between the Cabinet of Ministers and farmers.

The **Uzbekistan's Development Strategy** (2017) outlines the social, economic and environmental policy goals for the sustainable development of Uzbekistan. This strategy covers a number of topics relevant to the agricultural sector and to rural livelihoods. Measures focusing on improving living standards across the country, addressing the environmental degradation of the Aral Sea, and enhancing natural resource management via improved land and water management, are included in the strategy. The strategy also mentions the "adoption of systemic measures to mitigate the negative impact of climate change and drying of the Aral Sea to the development of agriculture and the livelihoods of people" (Presidential Decree, 2017b). A number of measures focusing on the modernization and intensive development of agriculture are mentioned in the strategy:

- Deepening of structural reforms and achieving rapid development of agricultural production, ensuring food security, expansion of production of eco-friendly products, achieving significant increase of export potential of the agricultural sector.
- Further optimization of the sown areas, aimed at reducing the acreage of cotton and cereal crops, planting on released lands of potatoes, vegetables, forage and oilseeds, creating new intensive gardens and vineyards.
- Encouraging and creating of favourable conditions for the development of farms, especially multidisciplinary ones, which are engaged in agricultural production and processing, preparation, storage, marketing, construction works and provision of services.
- Implementing of investment projects on construction of new, reconstruction and modernization of existing processing plants, equipped with modern high-end equipment for more advanced processing of agricultural products, production of semi-finished and finished food products, as well as packaging products.
- Further expansion of infrastructure for storage, transportation and sale of agricultural products, provision of agrochemical, financial and other up-to-date market services.
- Further improvement of irrigated land, development of the network of reclamation and irrigation facilities, widespread introduction in agricultural production of intensive methods, especially modern water- and resource-saving agricultural technologies, using high-performance agricultural machinery.
- Carrying out research and development aimed at creating and introduction of new crop varieties and animal breeds with high productivity, resistant to diseases and pests and adapted to local soil, climatic and environmental conditions.
- Adoption of systemic measures to mitigate the negative impact of climate change and drying of the Aral Sea and promote the development of agriculture and the livelihoods of people.

Many good technologies are available, which should be promoted on a large scale, for which favourable policy support is needed. In 2002, the State Scientific Committee was re-established and named as the Center for Science and Technology under the Cabinet of Ministers, Republic of Uzbekistan. The state programmes for basic research, science and technology development and innovation are being financed by the centre. The Government of Uzbekistan has allocated some money for conservation agriculture, laser land levelling, drip irrigation, and soil-improving technology projects through the centre. This funding can accelerate the adoption of the mentioned practices and technologies programme. In order to continue further research on conservation agriculture, more funding support will be critical.

The law **On breeding livestock production** (No. 165-I of 21 December 1995, with latest updates on 12 November 2019), provides guidelines for the creation, preservation, reproduction and rational use of breeding resources for the improvement of breeding and productive features of animals; ensuring reliability of the consideration of the origin, productivity, assessment by type and other features of the breeding resources used in selection process; carrying out testing of producers on the quality of progeny; breeding of animals with new useful genetic features; effective use in selection of the most valuable world gene pool; increase in breeding and productive features and the accelerated reproduction of highly productive animals in commercial herds; increase in cost efficiency and competitiveness of the whole industry of livestock production.

Presidential Decree, No. 2841 of 16 March 2017 **On additional measures to deepen economic reforms in animal husbandry** was adopted to ensure the priority and place of private property in animal husbandry, effective use of pastures, to increase the volume of livestock production and increase competitiveness.

Presidential Decree No. 3281 of 15 September 2017 **On measures for rational allocation of agricultural crops and forecasted volumes of agricultural production in 2018** also ensures the further increase in the planting area for vegetables, melon, oilseed, forage, legume crops, potato, and intensive orchards and vineyards. The resolution notes that the dominant position of wheat and cotton in agricultural production does not meet the goal of achieving crop diversification with a balanced crop pattern in the country.

According to the decree No. 5330 dated 12 February 2018 **On measures to radically improve the system of agriculture and water sector governance**, the Ministry of Agriculture and Water Resources was split into the Ministry of Agriculture, and the Ministry of Water Resources. The MoA now deals with unified policy on agriculture and food security aimed at comprehensive modernization of the sector, implementation of scientific and technical achievements, modern resource-saving technologies, and intensive agricultural technologies and best agronomic practices, including coordination of state bodies on research in aspects such as drought, disease, and pest tolerance. The Ministry of Water Resources implements a unified policy on water-resources management, and develops state policy on water use and protection of water resources, as well as on the prevention and elimination of the harmful impacts of water.

Institutional framework of the disaster risk reduction system

This section identifies strengths, but also potential gaps and shortcomings, in the institutional structure currently in place – including early warning systems (EWS) in view of its responsiveness to local farmers' needs – as well as with regard to the operational approaches currently applied at national, district and local levels to manage and prepare for disaster risk in agriculture.

Government stakeholders

At present, countries in Central Asia face great danger through natural phenomena such as earthquakes, flooding, landslides and mud flows, as well as through possible terrorist attacks aimed at the destruction of dams, or bursting of high-altitude lakes (MoES, 2005). This analysis of stakeholder groups is focused on the main actors in DRR in Uzbekistan, namely: the MoES, Uzhydromet, MoA, Ministry of Health, Ministry of Water Resources, Agency of Plant Protection and Quarantine, State Committee on Veterinary and Livestock Development, Academy of Science, *Jogorgy Kenes* of Karakalpakstan Autonomous Republic,[7] Tashkent city municipality, *khokimiyats* in all provinces,[8] relevant research institutes and local administrations, and major organizations with institutional roles in mitigating DRR and providing early warning and forecasts on natural hazards.

The following organizations (ministries, agencies, companies, state inspections) participate in emergency management activities in the country – the MoES, Uzhydromet, Ministry of Internal Affairs, Ministry of Higher and Secondary Special Education, Ministry of Public Education, Ministry of Health, Ministry of Defence, MoA, Ministry of Water Resources, Ministry of Finance, Ministry of Economic Development and Poverty Reduction, State Committee on Ecology and Environmental Protection, State Committee of Geology and Mineral Resources, Ministry of Construction, Academy of Sciences, Ministry of Transport, State stock company *Uzkimyosanoat*, National holding company *Uzbekneftegaz*, national television and radio broadcasting company, National air company Uzbekistan Airways, state stock railway company Uzbekistan Railways, Ministry of Energy, insurance companies, Ministry of Housing and Communal Services, Ministry for Development of Information Technologies and Communications, state inspection *Sanoatkontekhnazorat*, and National Council of the Red Crescent Society of the Republic of Uzbekistan. The primary task of these government ministries and agencies is to develop and carry out measures which ultimately reduce the consequences of emergency situations of a natural and technological character.

State System for Prevention and Response to Emergency Situations

The State System for Prevention of and Response to Emergency Situations (SSES) is the main framework in the country that manages and coordinates activities related to the implementation of national policy on disaster prevention and management; emergency forecasting; collection, analysis and distribution of related information; education of the population, governmental officials, rescue services and others on emergency response; disaster response. The organizational and functional structure of the SSES is presented in Table 5 below.

[7] Parliament.
[8] Provincial governments.

Table 5. Organization and functional structure of the State System of Prevention and Response to Emergency Situations

	Managing bodies	Operational bodies	Emergency response forces and facilities	Reserves of financial and material resources for emergency response
National level	Central office of the MoES; the central (administrative) apparatus of the ministries and departments and other organizations that are part of the SSES.	National Center for Emergency Response and Management of the MoES; ministries that are part of the SSES and duty-dispatching services of central (administrative) offices of departments and other organizations; stationary and mobile control points.	Civil Defence Forces; Republican specialized and rescue structures directly and operatively subordinated to the MoES; rescue services and rescue structures; general and special functional structures.	Reserves of the Reserve Fund of the Cabinet of Ministers and material resources of the state reserve; departmental reserves of financial and material resources; funds from international donor organizations; the system of warehouses and reserves of the Red Crescent Society of Uzbekistan.
Local level	Local public administration bodies; departments of emergency situations of the Republic of Karakalpakstan, regions and the city of Tashkent, departments of emergency situations of districts and cities; authorized divisions of organizations.	Operational control centres of emergency departments of the Republic of Karakalpakstan, provinces and the city of Tashkent; operational and management teams of emergency departments of cities and districts; duty and dispatch services of organizations; stationary and mobile control points.	Rescue services and rescue facilities; general and special functional facilities.	Reserves of financial and material resources of local public authorities; funds from international donor organizations; the system of warehouses and reserves of the Red Crescent Society of Uzbekistan.
Level of objects	Administration of facilities and authorized structural subdivisions.	Duty and dispatch services of facilities; stationary and mobile control points.	Rescue facilities; special functional facilities; civil protection facilities.	Reserves of financial and material resources of objects; departmental reserves of financial and material resources of the corresponding higher-level organization.

Source: based on the resolution of the Cabinet of Ministers of the Republic of Uzbekistan No. 515 (dated 26 August 2020) On further improvement of the State System for Prevention of and Response to Emergency Situations of the Republic of Uzbekistan.

The main members of the SSES include:

- Ministry of Emergency Situations;
- National Guard of the Republic of Uzbekistan;
- Ministry of Internal Affairs;
- Ministry of Defence;
- Ministry of Health;
- Ministry of Economic Development and Poverty Reduction;
- Ministry of Finance;
- Ministry of Employment and Labour Relations;
- Ministry of Foreign Affairs;
- Ministry of Higher and Secondary Special Education;
- Ministry of Public Education;
- Ministry of Preschool Education;
- Ministry of Agriculture;
- Ministry of Water Resources;
- Ministry of Transport;
- Ministry of Construction;
- Ministry of Housing and Communal Services;
- Joint stock company *Uzsuvtaminot;*
- Ministry of Support of Mahalla and Older Generation;
- Ministry of Energy;
- Ministry for Development of Information Technologies and Communications;
- Ministry of Innovative Development;
- Academy of Sciences of the Republic of Uzbekistan;
- State Customs Committee;
- State Committee on Ecology and Environmental Protection;
- State Committee on Geology and Mineral Resources;
- State Committee for Industrial Safety;
- State Committee for Veterinary Medicine and Animal Husbandry Development;
- State Forestry Committee;
- Ministry of Tourism and Cultural Heritage;
- State Committee of the Defence Industry;
- State Asset Management Agency of the Republic of Uzbekistan;
- Centre of Hydrometeorological Service;
- Agency of Plant Protection and Quarantine;
- National Television and Radio Company of Uzbekistan;
- Information and Mass Communications Agency under the President of the Republic of Uzbekistan;
- Joint stock company *Uzkimyosanoat;*
- Joint stock company Uzdonmakhsulot;
- Association *O'zsanoatqurilishmateriallari;*
- Insurance companies;
- Red Crescent Society of Uzbekistan.

The Department of Emergency Situations under the Cabinet of Ministers coordinates all activities of the ministries and organizations involved in disaster prevention and reduction measures, through the Unified System for monitoring, information exchange and forecasting of emergency situations. At local level, community leaders are responsible for disaster management. The department covers the following activities:

- It ensures the creation of state reserves of financial and material resources for disaster management.
- It is responsible for financial and resource support capabilities for the prevention and liquidation of emergency situations, provides special appliances and other material and technical means.
- It classifies the state of emergency situation and determines the degree of involvement of the executive power for its elimination.
- It monitors the activities of ministries, departments, and local authorities in the protection of population and territories from emergency situations.

There are sector-oriented concepts and target programmes on natural hazards, which are specified depending on the area of activity and nature of a disaster. In the case of agriculture-related disasters, the SSES functional and territorial subsystems' action plans have been developed, approved and are systematically adjusted based on the decrees of the president of Uzbekistan, the laws of Uzbekistan, and resolutions of the Cabinet of Ministers.

UNDP Uzbekistan (2012) reported that a Disaster Preparedness and Response Group (UN DPRG) was established under the United Nations Resident Coordination Office in Tashkent, becoming part of the UN Country Team. The group has representation of all United Nations agencies, the National Red Crescent Society, and other humanitarian agencies working in Uzbekistan such as Doctors Without Borders, and the Agency for Technical Cooperation and Development (ACTED).

The major conclusion of the government stakeholder analysis (MoES, 2005) was that numerous organizations are contributing vital elements of DRR mitigation strategies in Uzbekistan, but that effective institutional coordination between these different actors was still lacking. In this regard, the development of a functional DRR mitigation and preparedness strategy could be a vital step for improving coordination between stakeholders.

Ministry of Emergency Situations

The Ministry of Emergency Situations (MoES) was established by Presidential Decree No. 1378 dated 4 March 1996. The MoES is the main state body responsible for leading and managing activities in the field of civil protection, and prevention and response to emergency situations caused by accidents, catastrophes and natural hazards. While the ministry acts as a Hyogo Framework focal point, at the moment there is no official focal point established for the Sendai Framework. The MoES is responsible for the development and realization of state policy in the field of prevention of emergency situations, protection of life and health of the population, and creation and maintenance of management with the state system of the prevention and actions in emergency situations. The ministry is the coordinating body and has a department in the Karakalpakstan Autonomous Republic, Tashkent city, and provincial and district emergency situations departments all over Uzbekistan, with an appointed person who is responsible for disaster management. Functions of the ministry cover: geological acts of nature (earthquakes, landslides, rock falls); dangerous hydrometeorological calamities (flooding and flash flooding, mud flows, avalanches, high winds, heavy rain); emergency epidemiologic, epizootic and epiphytotic situations (special danger infections, epidemics, clustered illnesses of unidentified aetiology, intoxication by toxic substances, mass food intoxications); situations coming from changes in the condition of land (soil, entrails of earth); situations coming from the change in the structure and characteristics of the atmosphere (air); situations coming from changes in hydrosphere conditions.

The MoES is responsible for the dissemination of warnings for the population and taking measures towards the reduction of disasters and liquidation of after-effects of possible catastrophes. In addition, the ministry communicates with other relevant ministries to inform them of the character of any dangerous hydrometeorological disaster or other natural hazards in the country. For example, the public-service agencies receive warnings about possible storm phenomena (for example, heavy snow or rain) which can cause damage to transport and other communications in populated areas.

The MoES is also involved in drought crisis management in Uzbekistan. During the severe drought of 2000-2001, it played a vital role in providing the affected populations with access to potable water and emergency food aid. Although it does not engage directly in ex-ante drought-risk mitigation activities, it seems a combination of drought crisis preparedness actions involving the MoES and drought-risk mitigation activities led by other stakeholders would provide synergies that are not available when isolating drought crisis preparedness from drought-risk mitigation.

Ministry of Agriculture

The Ministry of Agriculture (MoA) is the government body responsible for agriculture. It tasks itself directly and indirectly through its national and regional bodies. The MoA is a legal entity whose main tasks and scope of work are:

- implementing a unified policy on agriculture and food security aimed at comprehensive modernization of the sector, implementation of scientific and technical achievements, modern resource-saving technologies, and intensive agrotechnologies and best agronomic practices;
- coordinating state bodies, agricultural enterprises and other organizations dealing with food security in Uzbekistan;
- increasing the export potential of economic sectors by producing competitive products, conducting in-depth marketing research, attracting foreign investments and gratuitous technical assistance (grants);
- creating necessary stock of agricultural products and foods for year-round and uninterrupted supply for the population at stable prices;
- ensuring extended processing of agricultural products, improved mechanisms of the public–private partnership, as well as enhanced participation of business entities in socioeconomic development of the territories;
- developing integrated targeted, sectoral, and territorial programmes aimed at dynamic and balanced development of agriculture, food security, increased employment and improved livelihoods of the rural population, and stable prices of food in the internal market;
- ensuring systemic integration of education, science, agricultural production and training and retraining of staff, taking into account current and prospective needs of agriculture for highly qualified experts;
- mitigating drought risks and providing early warning and forecasts on drought.

In accordance with the tasks, MoA carries out the following functions:

- advises the Cabinet of Ministers on issues related to the main directions of government policy in the field of agriculture;
- carries out market research on agricultural products, provides information to agricultural producers;
- participates in attracting foreign and local investment, and provides rational use of budgets in agriculture;
- develops methodology related to production and financial activity of companies active in agriculture;
- coordinates the activity of entities that specialize in seed breeding, variety testing and elite seed production;
- gives recommendations to the Cabinet of Ministers on labour issues in agriculture;
- controls compliance with quarantine rules, anti-epizootic measures and animal, poultry and fishery disease protection;
- organizes complex research, studies and forecast of distribution of pests, diseases and weeds, provides chemical and biological means of protection for farmers;
- organizes methodological support for agricultural entities and population in the field of plant protection, provides (on contractual basis) agrochemical services;
- organizes protection measures in combating highly hazardous plant pests.

The MoA establishes all necessary conditions for the activities of councils for solving problems in the field of:

- development of cotton breeding;
- development and processing of vegetables and viticulture vines;
- development of livestock breeding;
- rational use of land and water resources, and increase of soil fertility;
- mechanization and chemical processing of agriculture.

Within the SSES, MoA's functions include:

- ensuring timely collection, analysis and provision of emergency information necessary for agricultural production;
- organization of production and delivery of agricultural products to the population affected by emergency situations;
- organization of agricultural and food reserves in the necessary volume to provide the population with food throughout the year and at consistently stable prices;
- provision of deep processing and storage of agricultural food products;
- organization and implementation of measures to prevent and eliminate accidents at facilities;
- provision of information on food safety, accidents and emergencies at facilities, measures taken, and emergency procedures, to the MoES and the population;
- organization and implementation of measures to prevent the spread of infectious plant diseases and their elimination;
- implementation of systematic measures for pest and weed control, agrochemicals, and soil protection;
- provision of information on the agrochemical situation in emergency zones to the MoES and to citizens;
- Monitoring the organization and operation of the Plant Protection and Agrochemical Control Service of the SSES.

Ministry of Water Resources

According to the Decree of the President of Uzbekistan dated 12 February 2018, No. 5330 **On measures to radically improve the system of agriculture and water sector governance**, the Ministry of Agriculture and Water Resources of Uzbekistan was split into MoA and the Ministry of Water Resources. The Ministry of Water Resources is a member of the flood committee under the Cabinet of Ministers. The main tasks and scope of work of the ministry are:

- implementing a unified policy on water resource management, as well as coordinating state bodies, water-management agencies and other organizations in the area of rational use and protection of water resources, prevention and elimination of harmful impacts of water;
- sustainable and wise water supply to the territories and economic sectors, reclamation of land;
- ensuring reliable operation of the irrigation and land reclamation system, reservoirs, pumping stations, and other water-management and hydraulic facilities; organizing protection of large and important sites of the water sector;
- increasing responsibility of water users and consumers for careful and rational use of water resources, improving culture of water use;
- implementing scientific and technical achievements, modern water-saving technologies, best water practices, innovative methods of water management and water use;
- developing a water sector professional development system, intensifying integration of water-management agencies with education and scientific entities, taking measures for practical implementation of scientific achievements;
- developing interstate relations in the area of management and use of transboundary water resources, attracting foreign investments and technical assistance (grants), as well as intensifying interactions with international water organizations.

In particular, the Ministry of Water Resources develops forecasts of water limits for the next year, on the basis of which farmers can choose varieties and crops for planting.

Within the SSES, the functions of the ministry include:

- ensuring the reliability and safe operation of large and especially critical water bodies;
- organization and monitoring of the hydrological regime of reservoirs, rivers and channels, flooding, catastrophic flooding, natural impacts on hydraulic structures;
- forecasting the safety of the use of hydraulic structures in reservoirs, rivers and channels, where accidents and catastrophes are possible;
- determination of the need to change the mode of operation of water management facilities or their use, discharge of water from reservoirs in order to prevent accidents;
- diagnostics of technical condition, safety assessment of hydraulic structures;
- design, construction, operation, reconstruction and repair of large and especially critical water management facilities;
- monitoring of the state of hydraulic structures in reservoirs, rivers and canals;
- creation of local automatic alarm and warning systems on large water bodies;
- establish, develop and implement a set of urgent measures to prevent flooding and their consequences;
- provide information on expected flooding and catastrophic flooding associated with the collapse of dams and hydraulic structures to the MoES and to citizens;
- organization and implementation of necessary irrigation and land reclamation measures in emergency situations, especially in flooded areas.

State inspection Gosvodhoznadzor

The state inspection for control and supervision over conditions and safety of large and particularly important water facilities *(Gosvodhoznadzor)* at the Ministry of Water Resources is a state authority, authorized in the field of state supervision of safety of hydraulic structures, and participates in flood-control activities in the country. Its key task is to undertake state control and supervision over:

- reliability and safety of operation of large and particularly important water facilities;
- design, construction, operation, reconstruction and repair of large and particularly important water facilities, including organization of project expertise, control of construction quality and acceptance for operation;
- safeguarding of large and particularly important water facilities.

Centre of hydrometeorological service (Uzhydromet)

The Centre of Hydrometeorological Service at Cabinet of Ministers of the Republic of Uzbekistan (Uzhydromet) is the state governing body responsible for tasks in the field of hydrometeorology in Uzbekistan. The objectives of Uzhydromet are the development and improvement of the state system of hydrometeorological observations, provision of hydrometeorological information to sectors of the economy, scientific research activities, improvement of short-term and long-term weather forecasts, observe water availability of rivers, and climate change. Observations of the water regime of hydrological objects in the basins of the Amu Darya and Syr Darya rivers is also one of its functions. Uzhydromet conducts hydrometeorological and agrometeorological observations on the whole territory of Uzbekistan. Long-term observation stations are the responsibility of Uzhydromet. It is also a member of the World Meteorological Organization (WMO).[9]

The main tasks of Uzhydromet are to monitor the provision of users with hydrometeorological data, to provide a warning service, and to prepare analytical warning information.

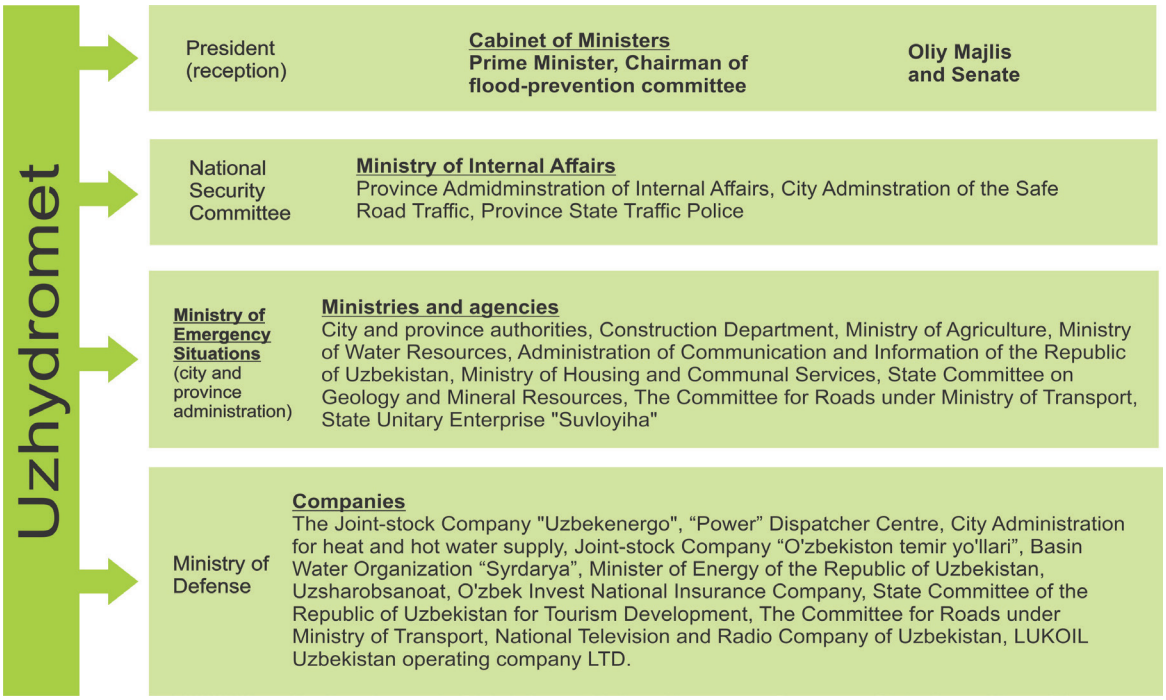
[9] A specialized agency of the United Nations with 191 member states and territories (Uzhydromet, 2020). It is the UN system's authoritative voice on the state and behaviour of the Earth's atmosphere, its interaction with the land and oceans, the weather and climate it produces, and the resulting distribution of water resources.

Within the SSES, the functions of Uzhydromet include:

- forecasting and monitoring of catastrophic hydrometeorological events;
- identifying areas where flood and avalanche response is required;
- organization and monitoring of environmental pollution (atmosphere, soil and surface water), the hydrological regime, and flooding risk;
- provision of hydrometeorological information to the MoES and its relevant subsystems, warning in case of extremely high levels of environmental pollution;
- organization and management of the service for hydrometeorological observations of the occurrence and development of natural hydrometeorological phenomena, pollution of atmospheric air, soil and surface water.

Uzhydromet forwards the relevant warnings to the Cabinet of Ministers and other government bodies responsible for decision making in certain emergency situations. The mass media is a main distributor of hydrometeorological warnings, including dissemination of messages to mobile communication operators with the subsequent dissemination of SMS messages with relevant recommendations – whether it concerns heat waves, avalanches, or mud flow danger (Figure 6) (Chub, 2013).

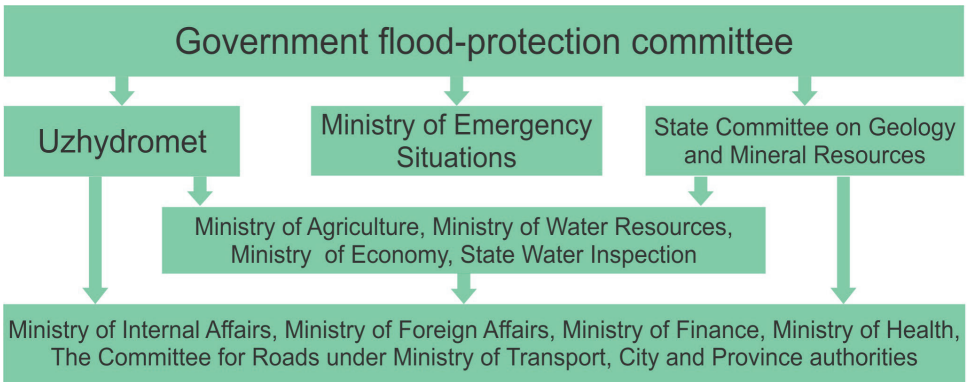
Figure 6. Scheme of warning for main hydrometeorological disasters



Source: modified from **Chub, V.E.** 2013. *Systems of early warning of the main nature disasters with public notification in Uzbekistan.* Input Paper prepared for the Global Assessment Report on Disaster Risk Reduction 2015. 8 pp. www.preventionweb.net/publication/systems-early-warning-main-nature-disasters-public-notification-uzbekistan

Flooding is very frequent, and is commonly caused by snow melt, severe storms, or by mountain lakes breaking their banks. Additionally, extreme weather conditions and temperatures, both in summer and winter, can be a major hazard in the country. A government flood protection committee collects all data related to flooding, and provides information to Uzhydromet, the MoES, and State Committee on Geology and Mineral Resources. These organizations then submit the data to relevant agencies and ministries, as shown in Figure 7.

Figure 7. Ministries and agencies that monitor flooding



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State Committee on Forestry

In order to ensure effective implementation of government policy in the field of forestry, sustainable use of forest resources, as well as pursuant to other tasks envisaged in the state programme on realization of the Action Strategy of five priority directions in the development of Uzbekistan 2017–2021, the president adopted the decree **On establishment of State Committee of the Republic Uzbekistan on forestry** and **On arranging activities of the State Committee of the Republic of Uzbekistan on forestry**. The State Committee on Forestry works under the Cabinet of Ministers. The committee implements state policy in forestry directed at the rational use of forest resources, efficient management of the forestry fund, preventing diversification, and so on. The committee protects forests from fire, pests and diseases, illegal cutting and other violations of forest legislation. The committee also works together with the MoES on preventive practices with regard to landslides, flooding, earthquakes and other natural hazards. The committee has a department on emergency situations such as fire, landslides and flooding. Still, the department has weak linkages with the MoES. Within the SSES, the functions of the State Committee on Forestry include:

- prevention of afforestation in geologically and hydrometeorologically dangerous areas;
- protection of forests from fires and epiphytotics;
- provision of information and forecast data on possible emergencies in the field of forestry to the MoES.

State Committee on Veterinary and Livestock Development

A presidential decree **On measures for cardinal improvement of the state veterinary service management system** (adopted on 1 June 2017, No. 5067) established the State Committee on Veterinary and Livestock Development in Uzbekistan. The committee was established on the basis of the Main State Veterinary Department under the Ministry of Agriculture and Water Resources. The committee is included in the Complex of the Cabinet of Ministers on Agriculture and Water Resources, Processing of Agricultural Products and Consumer Goods.

The main objectives of the committee are:

- implementation of a single state policy in the field of veterinary science, coordination of interaction of the relevant bodies in the sphere of veterinary science, licensing of veterinary activities;
- creation of state programmes on further development of the veterinary service, ensuring protection of imports from infectious diseases of animals, implementation of modern methods of treatment and prevention of animal diseases, development of new types and forms of veterinary medicines by application of domestic and international scientific achievements;
- implementation of preventive measures directed to monitoring of ensuring epizootic well-being, ensuring early identification, diagnostics and prevention of spread of infectious animal diseases;

- ensuring state supervision in the sphere of compliance with law on veterinary science, timely development and realization of system and high-quality measures for prevention of offences in this sphere;
- coordination of departmental and productive activity of veterinary service on protection of animals against diseases, safety of products and raw materials of animal origin;
- control of quality and turnover of veterinary medicines and feed additives.

The State Committee on Veterinary and Livestock Development is responsible for animal health protection, protection of the population from invasive zoonoses, protection of the territory of Uzbekistan from disease transfer from other states, conducting of unified public veterinary oversight, addressing of veterinary–sanitary issues and environment protection issues, training and retraining of veterinary specialists, and advanced research and technology transfer. The Government of Uzbekistan aims at strengthening the capacity of the public State Committee on Veterinary and Livestock Development to prevent and control zoonotic, transboundary and production diseases, which variously constrain productivity and cross-border trade, and are a risk to human health.

The organizational structure of the State Committee on Veterinary and Livestock Development reflects the administrative division of the country into provinces *(viloyat)* and a city (Tashkent) with the status of a region, districts *(tuman)*, towns with district status, and villages of different levels. The head of the regional veterinary office is appointed by and reports to the regional veterinary service of Uzbekistan on all technical matters and is directly responsible for enforcement of legislation in the region. Within these organizational units, specific structures to control animal epidemics are created (anti-epizootic department), with a particular role in activities related to disease outbreak control and monitoring of animal health at provincial and district levels. They are supported by the Veterinary Service at the Ministry of Internal Affairs known as the Veterinary Militia (police), with significant capacity and authority to carry out official duties and controls equal to police officers (stopping and checking vehicles, limit movements during outbreaks, destroy illegal consignments, and so on).

Agency of Plant Protection and Quarantine

Within the SSES, the main function of the Agency of Plant Protection and Quarantine is to organize and coordinate the distribution and control over quarantine plants in certain regions of the country that are widespread or can cause significant damage to plants.

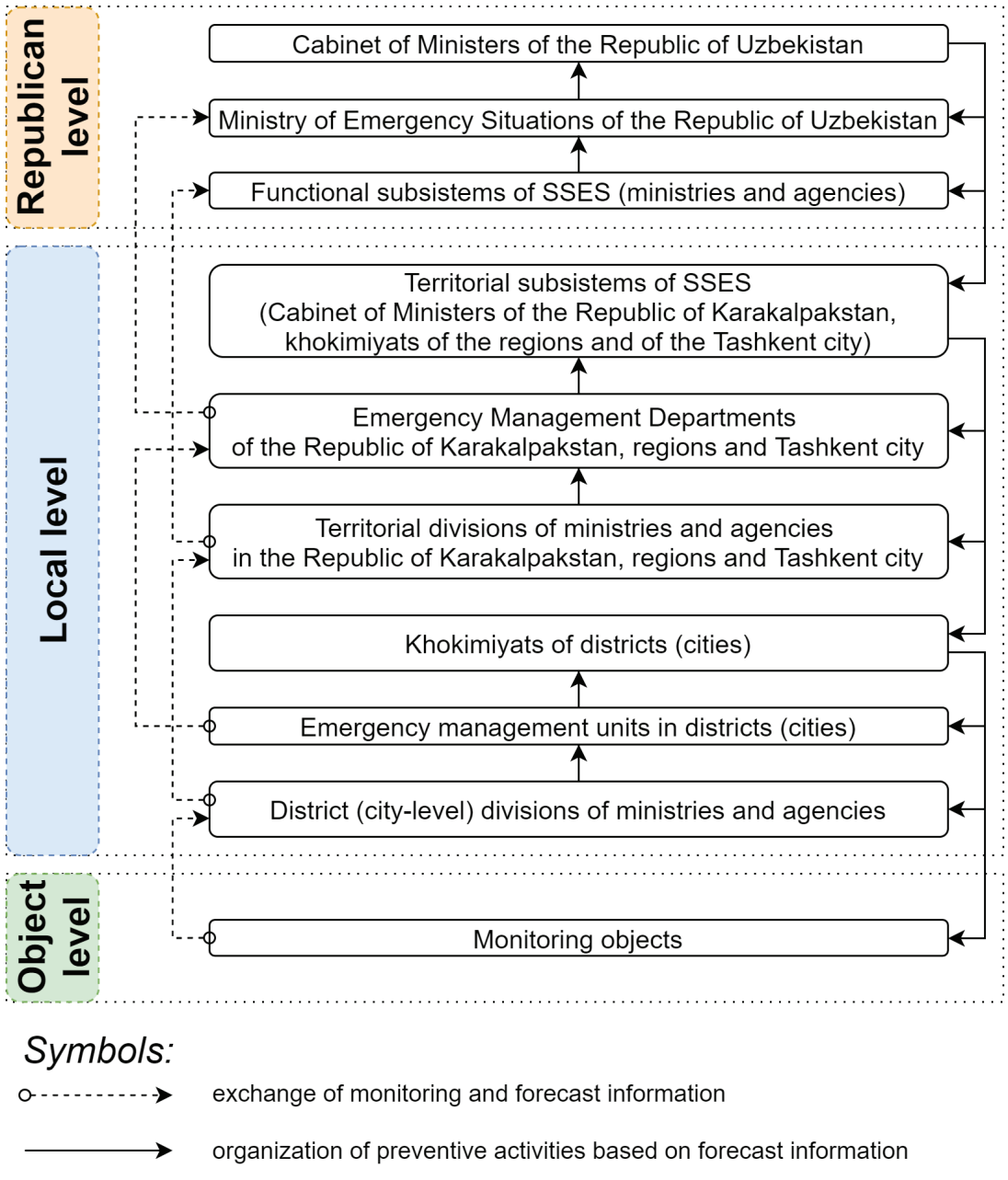
Unified System for monitoring, information exchange and forecasting of emergency situations

The **Unified System for monitoring, information exchange and forecasting of natural, manmade and environmental emergencies** was established in 2017, following a resolution of the Cabinet of Ministers of the Republic of Uzbekistan No. 1027 (dated 28 December 2017). It is the main coordination and information sharing mechanism in the country. This Unified System is an integral part of the SSES. Its main tasks and corresponding functions are defined as:

- Early identification of potential sources of natural, human-made and environmental emergencies, organization and implementation of systematic monitoring and control over them:
  - conducts systematic monitoring and laboratory control over objects under monitoring;
  - determines and assesses the risks of emergency situations;
  - collects, processes and analyses information on the characteristics and status of potential sources of emergencies, as well as on the facts of disaster occurrence and on their consequences on all levels of the Unified System.
- Providing automated and continuous exchange of information on monitoring and forecasting of emergency situations, as well as information on their occurrence and consequences:
  - forms and develops a database of sources of emergency situations and a registry of potentially dangerous objects;
  - organizes the creation and maintenance of specialized GIS, provides systematic input and update of monitoring data with detailed zoning of territories according to the degree of risk;
  - provides mutual exchange of monitoring information about the precursors and the state of potential sources of emergency situations in a common information space of a Unified System;
  - provides to the governing bodies of the SSES early warning information on potential emergencies and recommendations for management decisions on their prevention;
  - improves the existing information and communication systems for monitoring and forecasting emergency situations;
  - ensures the protection of special information, including state secret information.
- Early forecasting of the scale and characteristics of possible dangerous natural and human-made processes and phenomena that can lead to emergency situations:
  - collects, processes and analyses operational monitoring information, as well as information on the occurrence of disasters and their consequences;
  - develops situational scenarios and models for the potential sources of emergency situations with an indication of their possible consequences;
  - provides regular short-, medium- and long-term forecasts of the occurrence of emergency situations, and the scale of their consequences;
  - provides information, analytical, organizational and methodological support for the functioning of the Unified System.
- Development of recommendations for the prevention and elimination of emergency situations, as well as the reduction of their consequences:
  - based on emergency forecasts, develops proposals to improve measures on prevention, elimination and reduction of disasters' consequences;
  - participates in the development of targeted, scientific and technical programmes for the prevention and elimination of emergency situations, as well as the reduction of their consequences;
  - performs a preliminary calculation of human and material resources required for localization and elimination of the consequences of emergency situations.

The Unified System consists of various divisions (services, institutions, inspections, departments, laboratories) of state and economic management bodies, local government bodies, and other organizations whose functions include monitoring, information exchange, and forecasting of natural and human-made hazards within the SSES framework. The Unified System has republican, local, and object levels (Figure 8). Management and state control over the activities of the Unified System is carried out by the MoES. Interaction between the system's participants is carried out with a clear division by areas of responsibility according to the following principle: object — district (city) — region (Republic of Karakalpakstan, Tashkent) — republic. Consistent exchange of monitoring and forecast information is carried out following this principle. Participants of the Unified System are obliged to provide the MoES and its territorial divisions monitoring and forecast information on the state and possible activation of sources of emergency situations, as well as information on the state of dangerous natural and human-made processes and phenomena.

Figure 8. Organizational and functional structure of the Unified System for monitoring, information exchange and forecasting of natural, manmade and environmental emergencies



Source: based on the resolution of the Cabinet of Ministers of the Republic of Uzbekistan No. 1027 (dated 28 December 2017).

Depending on the situation, the scale of the predicted natural and human-made hazards, or the occurred disasters, the functioning of the Unified System is carried out in one of three modes:

- day-to-day activities
- high alert state
- emergency situation

The following activities are carried out in "day-to-day" mode:

- monitoring and control of the objects under monitoring, of the situation on potentially dangerous objects and the surrounding territories;
- collection, exchange, processing and analysis of monitoring information, input and update of monitoring data in GIS;
- forecasting of the situation, risk assessment of dangerous natural and human-made processes and phenomena leading to emergencies;
- development of recommendations to improve emergency prevention and elimination measures, as well as to reduce their consequences;
- participation in the planning and implementation of targeted, scientific and technical programmes on the early identification of risk factors and threats of emergency situations, as well as on the improvement of the stable functioning of economic facilities in case of disaster occurrence;
- measures to equip the units of the Unified System with modern technical means, as well as to train and improve the skills of its specialists.

The following activities are carried out in "high alert" mode:

- enhanced monitoring (if necessary) of the state of emergency sources;
- collection, exchange, processing and analysis of monitoring information, modelling the development of possible emergencies;
- rapid and current forecasting of emergency situations;
- preliminary calculation of human and material resources required for prevention and localization of the consequences of possible emergencies;
- development of proposals for the prevention of potential emergencies and reduction of their consequences.

The following activities are carried out in "emergency situation" mode:

- dispatching of special groups of the Unified System to the emergency zone;
- defining the boundaries of the emergency zone;
- continuous monitoring and rapid forecasting of the development of an emergency situation;
- development of proposals and measures aimed at localizing and reducing the consequences of an emergency.

As mentioned earlier, MoA and the State Committee on Veterinary and Livestock Development participate in the Unified System and, depending on the type of disaster, are responsible for providing information about the event or its consequences. Together with other relevant agencies and organizations, MoA is particularly involved in the following types of emergencies: dangerous geological phenomena (landslides, land subsidence); meteorological and hydrometeorological hazards; infectious diseases of agricultural animals (together with the State Committee on Veterinary and other relevant organizations); damage to agricultural plants from diseases and pests (together with the joint stock company Uzagrokimokhimoya); situations related to changes in the state of the land (soil, subsurface, including the facts of intensive soil degradation and desertification); situations related to changes in the state of the biosphere; fires; exceeding the maximum permissible concentration of pesticides in the soil (extremely high pollution); accidents with the release (threat of release) of biologically hazardous substances.

Research institutes

Research Institute of Seismology

The Research Institute of Seismology of the Republic of Uzbekistan Academy of Sciences was established to forecast future earthquakes, after Tashkent earthquake in 1966. The institute has seismic stations equipped with seismometric tools for registration and analysis of seismic events, prognostic seismic stations equipped with tools for earthquake forecasting, and special equipment for seismic sounding and study of soil conditions. In 2015, the programme opened the Earthquake Simulation Complex at the Institute of Civil Defence in Tashkent.

Uzbek Research Institute Cereal and Legume Crops

The Uzbek Research Institute Cereal and Legume Crops under Irrigation (UzRICLCI) was established in 1997 in Andijan by the Ministerial Decree No. 413. According to the decree, 11 new experimental stations were established for a crop improvement programme and seed sector development in each of the provinces. At present, there are 75 scientific staff at the UzRICLCI including all its branch offices or experimental stations, excluding the Gallayaral branch. The institute has three professors and 16 candidates of agricultural sciences, eight laboratories, which deal with various aspects of the development of varieties, plant physiology and seed production, in particular grain and legumes. In the context of natural hazards, the institute is developing frost-, drought-, heat-, diseases-tolerant cereal and legume crop varieties, which are better adapted to climate change (ICARDA-CAC, 2006).

Gallayaral research station

The Gallayaral research station operates under the UzRICLCI. It is one of the oldest research centres in the country, founded in 1913 as a breeding station for rainfed crops. Its scientists have made an important contribution to its formation and development of research on grain, legumes and oilseeds in dry conditions. Since its inception, the institute has contributed greatly to the improvement of varieties and the production of seeds for cereals, legumes and alfalfa.

The objective of the breeding programme at Gallayaral research station is to develop cultivars with good grain quality, high-yield potential, and resistance to drought and diseases – both under irrigated and rainfed conditions. The area covered by local varieties had decreased to almost 100 000 ha in 1998, but this has now increased to close to 200 000 ha (seed production development centre, personal communication, 2019). The Gallayaral branch is funded by state programmes. It has six government-funded projects on wheat, barley, legumes and oil crops breeding, and soil and crop management, under both rainfed and irrigated conditions.

Uzbek Research Institute of Plant Industry

The Uzbek Research Institute of Plant Industry (UzRIPI) was established in 1924. The institute works on plant genetic resources and has undertaken a breeding programme on sunflower, groundnuts, triticale and other cereal crops under irrigated conditions. There are 108 people working in the institute, 72 of whom are scientific staff. There are two branches, in Andijan and Surkhandarya provinces. Annually, the UzRIPI provides 400 to 600 accessions of different crops to 20 research institutions in Uzbekistan for further evaluation, of which 250 to 350 accessions are of cereals, legumes and oil crops resistant to drought and diseases (ICARDA-CAC, 2006).

Human resources development

The collapse of the USSR had a considerable impact on research systems. The newly independent republics inherited a wealth of national research institutions from the Soviet system. Although these form a foundation on which to build collaborative research, they are not equipped to respond to structural changes in national agricultural sectors and the emerging market economies. In particular, they lack the institutional and human capacity to formulate and implement policy. Moreover, the breakdown of the central planning system has severed links between researchers and producers. Researchers now have no formal communication channels to disseminate information, knowledge, and new technologies.

The national agricultural research institutes in Uzbekistan are staffed by qualified scientists but have suffered from isolation and lack of resources. They need immediate assistance in, for example, short-term specialist training in new and advanced research methods and techniques, training for technical support staff, and opportunities to learn about current trends and knowledge by participating in international seminars, workshops and symposia. Because the average age of staff in most institutions is over 60 years, training of young scientists is also a priority. Young scientists represent the region's future research capacity. Currently they are not attracted to agricultural research, because there are no incentives and because the infrastructure for research is poor.

Associations and advisory services

Farmer associations, rural advisory services, and water user associations are considered to be highly important for providing farmers with knowledge of disaster-risk mitigation activities, such as flood information, earthquake notifications, new drought-resistant crop varieties, modified agronomic practices, and the application of sustainable land management and water-saving irrigation practices. However, despite the ongoing efforts, the use of sustainable land management and water-conserving irrigation practices remains low. Few if any studies identify the reasons behind such low adoption rates (Nurbekov and Mirzabaev, 2017). Research institutes and universities could play a bigger role by conducting such studies and providing insights on what needs to be done to improve technology uptake.

Early warning systems

Early warning systems (EWS) can be defined as a set of capacities needed to generate and disseminate timely and meaningful warning information on possible extreme events or disasters (such as flooding, drought, fire, earthquakes) that threaten people's lives (UNDRR, 2009). The term "early warning" is used in many fields to describe the provision of information on emerging dangerous circumstances where that information can enable action in advance to reduce the risks involved. Early warning systems exist for natural geophysical and biological hazards, complex sociopolitical emergencies, industrial hazards, personal health risks and many other related hazards (Mercy Corps and Practical Action, 2010). In Uzbekistan, early warning information comes from Uzhydromet (for hydrological, meteorological and climatological-related disasters such as flooding, frost, and drought), from State Quarantine inspection (for diseases and pests outbreaks), from MoA (for example, crop forecasts), from local and indigenous sources, media sources and increasingly from internet early-warning services. The basis for early-warning dissemination includes the seasonal forecast that provides an indication of temperature and precipitation behaviour during the course of the season. Uzhydromet also provides hydrological forecasts twice a year: an autumn–winter forecast is provided in September, and a spring–summer forecast is provided in March.

The availability of EWS information on natural and biological hazards helps farmers make informed decisions in order to reduce potential risks to agricultural productivity in general. It helps farmers by enhancing their increasing profitability power. For EWS to be effective, it is essential that they are integrated into policies on disaster mitigation. Good governance priorities include protection of the public from disasters through the implementation of DRR policies. However, currently EWS are not well connected with the DRR system in Uzbekistan. Disaster risk reduction measures require long-term plans and early warning should be seen as a strategy to reduce effectively the growing vulnerability of communities and assets. Information on EWS is a crucial resource for the development of the agricultural sector in the country and is a basic necessity that can bring success to everyday life, including farming activities.

These days, Uzbekistan is facing drought problems, and future climate scenarios show that the frequency of drought will increase. Drought problems will become deeper and cover vast territories in Uzbekistan. This will affect both food security and the livelihoods of the population. Therefore, adaptation measures aimed at alleviating the water deficit are very important. It is necessary to develop and implement EWS to increase readiness for drought. A study on Strengthening Agricultural Resilience against Drought in Uzbekistan: From Crisis Management to Drought Risk Mitigation (Nurbekov and Mirzabaev, 2017) revealed that drought poses a particular challenge in the Aral Sea region (one of the drought-prone areas in Uzbekistan). Its impact is severe in every respect: economic, health, social and environmental.

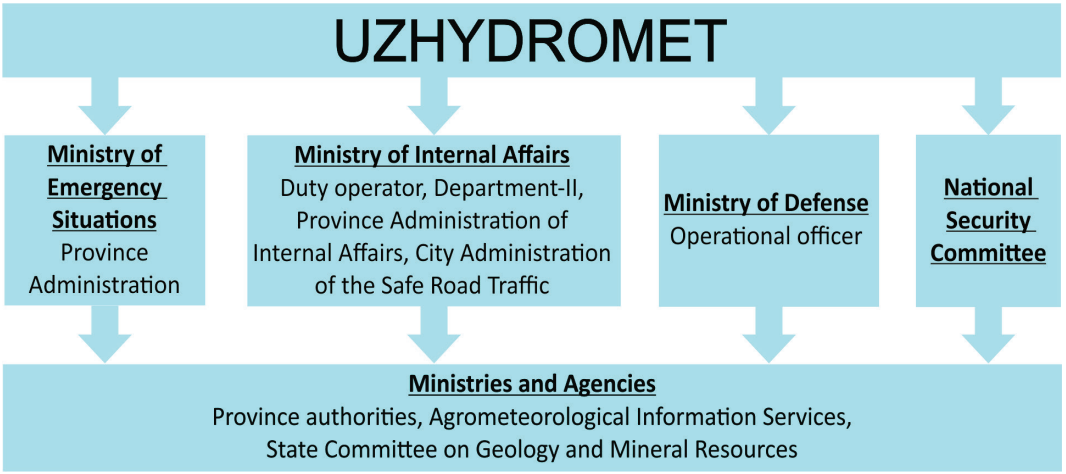
Institutional framework and structure of early warning systems

The MoES and Uzhydromet operate the National Center for DRR Monitoring, the major function of which is to provide early warning and propose measures to alleviate the impacts of natural hazards under a changing climate.

Monitoring of disasters related to climate is one of the main components of EWS, since changes to the global climate lead to variations in the characteristics of disasters and increase in their frequency – particularly in the case of extreme phenomena such as drought, mud flows, flooding and storms. Such processes are under constant monitoring and forecasting (the forecast models are corrected respectively). Other warnings, disseminated via special alert schemes (such as radiogram and faxes; most recently information is disseminated through different mass media including telegram channels and Facebook) cover the following types of emergencies: sudden temperature decrease and weather changes; frosts; heavy precipitation; thunderstorms and wind; long-lasting snow storms; dangerous surges and onsets of lakes and marine water; high water level; ice arriving earlier than normal; occurrence and duration of meteorological conditions that are unfavourable for the dispersion of harmful admixtures in the atmosphere (Chub, 2013). Any warning is preceded by the work of different specialists at Uzhydromet – collection, monitoring and analysis of raw data or processed forecast information; calculations using forecast systems; analysis of the results; decision making on the basis of forecasts (regarding warnings); issuing the forecast (warning); informing government bodies and other relevant agencies and institutions. There is no coordination between Uzhydromet and MoA in terms of warnings specific for the agricultural sector; MoA only receives weather information.

In periods of mud flow or avalanche activity, warnings are forwarded to all government bodies responsible for operation and maintenance of road communications and recreation services. For avalanches, warnings are issued through the scheme presented in Figure 9. All relevant ministries get the warnings, depending on the character of the hydrometeorological disaster. For example, public-service agencies receive warnings about possible storm phenomena which can cause damage to the transport and other communications in populated areas (such as heavy snow or rain). When the risk of drought and water shortage occurs, the warnings are forwarded to MoA and Ministry of Water Resources, which enables them to take necessary measures to eliminate the consequences of drought and limited water in the agricultural sector.

Figure 9. Scheme of warning for avalanches



Source: modified from **Chub, V.E.** 2013. *Systems of early warning of the main nature disasters with public notification in Uzbekistan.* Input Paper prepared for the Global Assessment Report on Disaster Risk Reduction 2015. 8 pp. www.preventionweb.net/publication/systems-early-warning-main-nature-disasters-public-notification-uzbekistan

Coordination, collaboration and dissemination mechanisms

Uzhydromet carries out the monitoring of natural hazards using up-to-date observations – satellite information, surface monitoring, and an information system on dangerous hydrometeorological phenomena. In case of hydrometeorological danger, Uzhydromet forwards the relevant warnings to the MoES and other government bodies responsible for decision making. The schemes include the MoES, Ministry of Internal Affairs, Ministry of Defence, MoA, Ministry of Water Resources as well as the agencies, enterprises and mass media. The MoES is responsible for the distribution of warnings among the general population and taking measures for the reduction of disasters and liquidation of after-effects of possible catastrophes.

The mass media is the main actor in the distribution of such information, including dissemination of messages to the mobile communication operators with the subsequent dissemination of SMS messages with the relevant recommendations – in the case of possible heat waves, during avalanches, and mud-flow danger.

Uzhydromet is responsible for maintaining two state cadastres – the state water cadastre "Annual data on the regime and resources of surface waters", and the "State cadastre of zones of high natural hazard. Unit: Areas of increased hazard hydrometeorological phenomena". The state water cadastre is managed jointly by Uzhydromet (responsible for surface water), the State Committee on Geology and Mineral Resources (responsible for groundwater), and the Ministry of Water Resources (responsible for the section on water use). On the basis of bilateral agreements, the exchange of hydrological and meteorological information was arranged, including sharing storm warnings with countries in Central Asia. The list of transmitted information is presented in detail in the agreements and the means of transmission are described. Under agreements, the exchange of operational data, historical data, forecasts, and estimates are implemented.

An extremely important component of preparedness, prevention and mitigation is the capacity to obtain and use early warnings of impending hazards or threats. There are limitations and obstacles to the timely forecast of extreme events, however, and a number of factors can also limit the effectiveness of warnings in influencing public behaviour. Both sets of constraints must be borne in mind by environmental health managers. Warning systems vary greatly, as does the amount of forewarning that they give. Warnings must give sufficient time to enable environmental health preparedness and prevention activities to be carried out. Information on warnings are distributed through the mass media, and provincial, district and local community administrations.

Market information systems

In 2017, AgroMart (agromart.uz), a private-sector service provider, was launched. AgroMart is a project implemented by the Organization for Security and Co-operation in Europe (OSCE) Coordinator in Uzbekistan, developed together with the national Farmers' Council. Its goal is to create a useful, accessible and user-friendly web portal for everyone involved in the agricultural sector. AgroMart provides a platform for consultations, expertise, trade and information (AgroMart, 2020). It offers the following features:

- current market prices for 55 agriculture commodities (wholesale prices for agricultural products at local farmers' markets across the country and by region, updated every week);
- free and qualified consultations with experts in more than ten areas of agriculture;
- a trading platform to promote services and products;
- useful materials, best practices, video training and latest news, events and developments in the world of agriculture.

Data on market prices is collected through AgroMart's regional representatives in each of the following regions: Andijon, Fergana, Jizzakh, Khorezm, Namangan, Samarkand, Syrdarya, Tashkent, and Republic of Karakalpakstan. These regional representatives collect the data from major wholesale markets in the respective regions (from one to three per region) and assign minimum and maximum prices per commodity, using a specific template. After the collected data is submitted to the web portal and automatically processed by the system, it becomes freely available publicly to all visitors of the web portal, with no restrictions. In addition, monthly price dynamics are also analysed and published using a dedicated Telegram (social media) channel (also freely accessible for all users). AgroMart also distributes monthly reports using an email list to international stakeholders.

All information and services are provided for free via AgroMart's web portal. It is necessary to register on the website to be able to receive consultation from the specialists. AgroMart has not been using external tools for data analysis. However, it is planned to integrate such solutions and connect them through application programming interfaces to the web portal, so that users can compare current prices in the local market against those in the international commodities market. The price report system also suffers from some of the same limitations as the State Committee of the Republic of Uzbekistan on Statistics (UZStat) data and reporting; namely, it only publishes weekly prices and it does not disaggregate prices based on specific commodity types, grades, or quality.

AgroMart is the only available source of comprehensive information on market prices and related services in the country (AgroMart, 2020). At the same time, there is an ongoing regional project of FAO on Strengthening Capacity in Price and Market Information Systems and Policy Monitoring in Response to COVID-19 and Other Shocks (2020–2024). Uzbekistan was selected as one of three pilot countries for the national capacity development project, including the development of price tools for analysis and dissemination.

Current gaps, limitations, constraints and challenges of early warning systems

In spite of significant efforts made by the Government of Uzbekistan, there are still several gaps, limitations, constraints and challenges that require due attention to be paid for a more efficient and effective performance. One of the major challenges for EWS is how to serve better the agricultural sector with weather forecasts, water prognosis, and warnings on plant and animal diseases. Other issues are related to inadequate linkages among research and education, farmers and other stakeholders, poor infrastructural development, and an insufficient number of early warning specialists to cater to diversified agricultural services. Three of the main obstacles to undertaking comprehensive EWS assessments (in the agricultural sector in particular), are:

- limited financial resources;
- lack of technical capacity; and
- lack of harmonization among the instruments, tools and institutions involved, including limited availability of data on localized losses, and difficulties connecting local disaster impact assessments with national monitoring systems and loss databases (Nurbekov and Mirzabaev, 2017).

At the same time, the quality of collected data needs to be controlled in order to avoid possible gaps in the series used for calculations, and to eliminate records affected by errors. Most EWS are not cost effective because of missing elements such as extension services in the country. At best, the reports stop at government offices. There is no comprehensive EWS in place to guide water allocation, and crop and pasture planning and management. Despite the strong capacity of Uzhydromet, high-resolution, tailored forecast products are not readily available to potential users – sectorial ministries, various local authorities with land management responsibilities, and farmers. Uzhydromet is planning to improve its forecast resolution in collaboration with the Regional Integrated Multi-Hazard Early Warning System for Africa and Asia (RIMES), which has capability for 9 km resolution forecasting (Uzhydromet is willing to participate in the system, but is not a member yet).

Despite numerous pilot initiatives that demonstrate good agriculture and natural resources management practices, there is no government policy or financial incentives for the large-scale adoption of measures with strong adaptation value.

Despite the impressive number of stations that make up the observation network of Uzhydromet, only seven of them are automated, while the rest are operated manually. Manual operation significantly hinders efficiency of the observation network (timeliness of measurement data collection and transmission, high net costs, and problems of human tampering).

Deteriorating hydrological services, particularly in carrying discharge measurements, maintenance and servicing of the agrometeorological stations, is also a challenge. This creates further limitations for data quality assurance in using data and information from all meteorological stations. Scientific and technological research and development, application of equipment and equipment renovation, is also limited in terms of quality and effectiveness.

Alternatives to a drought EWS could be water provision investments in the form of water storage structures at the domestic level, but that would happen with storage quantity constraints and centralized reservoirs, with the associated distribution costs. Furthermore, there would be high evaporation losses. Underground storage would mitigate this but construction costs would be much higher.

Science-based extension services for subsistence *dehkan* farmers were established in 2018 to assist in farm-based climate risk management in the Autonomous Republic of Karakalpakstan, including subdistrict and community-level climate field school/extension created to support direct outreach to farmers, and localized

training in adaptation practices (through the Developing climate resilience of farming communities in the drought-prone parts of Uzbekistan project). The climate field school/extension provided supplementary, situation-specific communication with farmers, complementing the existing dissemination system, which is more technical and currently operates essentially through and for the government. This approach was to reduce potential losses due to a lack of preparedness and understanding vis-a-vis the business-as-usual non-project alternative. The capacity built through the climate field school/extension service also resulted in maximum value being achieved from the investments in the EWS and the observation and data integration system which support it, as farmers will know how to interpret and react to weather information.

Agrometeorology services

This section describes the role of the Centre of Hydrometeorological Service of the Republic of Uzbekistan, Uzhydromet, which is the main government body responsible for hydrometeorology in Uzbekistan. The centre is responsible for the principal information base for describing the climate of Uzbekistan, its variability, and its long-term trends. It has a mandate from the MoES to monitor all the hydrological and meteorological activities in Uzbekistan. The scope of work includes the development and improvement of the hydrological and meteorological observations system, provision of information to different sectors of the economy, conducting scientific research activities, improvement of short-term,[10] medium-term,[11] and long-term weather forecasts,[12] water availability in rivers, and climate change (Uzhydromet, 2020). The Government of Uzbekistan has set up special funds for nationwide weather modification and rural meteorological services.

Uzhydromet has significant experience in designing the models of river runoff formation and their use for hydrological calculations and forecasts of the Aral Sea basin rivers. It has developed models, for example, to describe the process of river runoff formation, from revealing regularities of precipitation formation, and for calculation of melted and rain input on the watershed surface.

Uzhydromet uses statistical methods for forecasting the yield. Analysed data is sent to MoA and the Ministry of Water Resources in order to organize carefully the crop rotation plan for the coming years. In order to improve the quality of analysed data, Uzhydromet started to study Decision-Support System for Agro-technology Transfer (DSSAT) models to simulate crop growth, development and yield. The crop models require daily weather data, soil surface and profile information, detailed crop management and crop genetic information as input.

Tashkent is one of 29 regional meteorological centres that undertake collection of meteorological information, preparation and dissemination of weather and forecasting charts in Central Asia and the Near East, and in the Asian part of the Russian Federation. Uzhydromet also has responsibility for the World Weather Watch system (Uzhydromet, 2020), and it monitors natural hazards and provides information to relevant government bodies. All data is gathered by using satellite information, surface monitoring, and maintaining an information system on hydrological and meteorological hazards. Uzhydromet provides 24-hour monitoring – it observes, analyses, provides weather forecasts, and warns about the behaviour of nature in various conditions, notably in air, water and soil moisture.

Agriculture is one of the priority sectors of the economy of Uzbekistan and plays a key role in maintaining social and economic stability, employment and welfare of the population, and food security. One of the most important aspects of agrometeorology services is agrometeorological forecasts. Planning measures to ensure a higher yield, its collection and storage in each specific year needs different types of agrometeorological forecasts, which are compiled with different lead times and serve as one of the objective indicators for solving many practical problems in the field of agriculture and measures aimed at improving food security.

Uzbekistan's agriculture has been dependent on the weather despite most of the land being irrigated. Uncertainties over weather and climate pose a major threat to agricultural production in the country. Extreme weather events such as heat, drought, heat waves, rain and frost cause considerable loss in crop production every year. An efficient use of available climatic resources, besides soil and water resources, could minimize the adverse effects of extreme weather and take advantage of favourable weather. Such weather can make a tremendous difference to agricultural production. Impacts of extreme events on the agricultural sector can be positive or negative. For example, in 2019, heavy spring rain positively affected the winter wheat yield, which increased in both irrigated and rainfed conditions. Agricultural planning and practices have to

[10] Short-term weather forecasts do not exceed three days (72 hours).
[11] Medium-term weather forecasts are those for three to ten days.
[12] Long-term weather forecasts cover periods of 30 days to two years.

be worked out with consideration to the overall water requirements within an individual agroclimatic zone. Uzhydromet, with support from MoA and the Ministry of Water Resources, should develop sustainable strategies to alleviate the impact of natural hazards on crop productivity. All such strategies are location-, time-, crop-, crop stage- and socioeconomic condition specific. Remote sensing and satellite information helps minimize damage (for example, the death of cattle and people) and the damage of agricultural production during times of natural calamities through EWS.

Support of agricultural meteorology is an important task for Uzhydromet, which includes the department of agrometeorology. Regional offices in each of 13 regions also have agrometeorological departments that collect and provide agrometeorological information for meteorology including forecasts on heavy precipitation, extreme snowfall, critical high and low temperatures during the vegetation periods of certain agricultural crops. The system is working to identify land use options, including crop rotation for certain districts, taking into account information collected from meteorological stations. The agrometeorological information is disseminated through MoA, the Ministry of Water Resources, provincial agricultural departments, and provincial water resource departments. Farmers can get the information from district-level agricultural departments and water resource departments. Decade agrometeorological bulletin provides an overview of agrometeorological conditions by region, and an assessment of their impact on the growth and development of major crops. The bulletin also contains information from observations of meteorological stations located in the agricultural zone. There is no direct access for farmers to this bulletin. However, it is distributed to district-level agricultural departments, through which farmers can get a printed version of the bulletin, which can then be used in day-to-day field operations.

Prepared and provided agrometeorological information and forecasts are rather effectively used at various levels when making decisions and planning agricultural work related to sowing, growing, and harvesting crops, in particular by:

- MoA;
- Ministry of Water Resources;
- Scientific-Production Center for Agriculture and Food Supply of the Ministry of Agriculture;
- Joint stock company *Uzpakhtasanoat;*
- Ministry of Economic Development and Poverty Reduction;
- Cabinet of Ministers of the Republic of Karakalpakstan and regional *khokimiyats;*
- Farms and research institutes.

All observation data at the observation sites are recorded in the agricultural field books, then the data is encrypted at stations and points according to the KN-21 code (code for compiling daily and ten-day agrometeorological telegrams) and transmitted to the regional department of hydrometeorology by means of communication (telephone, radio stations).

There are 330 observation points to monitor the environmental status and 90 weather meteorological stations, 133 hydrological stations, and points where the water balance of rivers and lakes are measured (however, there are no sediment measurements), 35 agrometeopoints (which provide seasonal agrometeorological observation to assess plant growth and development, and pasture vegetation), and 64 points to observe air pollution. Twenty-three chemical labs carry out hydrochemical and hydrobiological analysis of more than 70 pollutant elements to monitor environmental pollution under the Uzhydromet network to support agriculture all over Uzbekistan. These weather stations monitor precipitation (mm), temperature (°C), soil temperature (0, 5 cm, 10 cm, 20 cm, 30 cm, 50 cm), wind speed and direction (2 m to 10 m), sunshine duration (hours) and evaporation (mm/day). Furthermore, Uzhydromet provides information on the agrometeorological and ecological condition of the environment and provides average long-term historical data, and mid and long-term weather data, according to an approved price list.

Agrometeorological observations are carried out at 65 stations and 36 posts located in all regions in Uzbekistan. Each regional department has three to four employees working in the field of agrometeorology. There is a regular monitoring system. The 36 posts send observation data to local agricultural departments. The network of agrometeorological observations includes points located in agricultural zones, and is organized taking into account agroclimatic zoning and specialization of agriculture. It should be mentioned that Uzhydromet does not provide agricultural advice to farmers, but it does provide weather forecasts on a daily, weekly and monthly basis to MoA, and to provincial and district-level agricultural departments.

Equipment

In Uzhydromet, there is equipment for calibrating instruments on basic hydrological and meteorological elements, such as temperature, humidity, atmospheric pressure, solar radiation, wind speed and rain. The Uzhydromet centre has equipment such as Soil auger AM-29, scales, technical or electronic, soil drying oven SNOL, weight cups (set), Savinov thermometers TM-5, Thermometers maximum TM-1, Thermometers minimum TM-2, Thermometer urgent TM-3, and rain gauge. Uzhydromet has an advanced laboratory for hydrometeorological equipment calibration. Barometers, anemometers, thermometers and other hydrometeorological instruments in its observation network are regularly calibrated to ensure the quality of meteorological and hydrological data. There is a need to strengthen computing facilities for six local forecasting centres.

Challenges

There are several challenges in Uzhydromet. First, agrometeorological stations are manually operated in parallel with meteorological observations. In addition, its observation equipment is already old, there is a general equipment shortage including hydrometeorological devises, and old buildings should be replaced. This is why speciality and reliability do not match the desired necessary level. Second, observation stations are unevenly distributed across the country. Most of the collected data are processed and provided on a non-real time basis. It is necessary to hire educated professional staff in order to improve the quality of data collection. There is no capacity-development system at Uzhydromet and there is a shortage of scientific and methodological expertise. In addition, the budget of the centre is insufficient.

With the aim of strengthening the capacity of its personnel, Uzhydromet also avails of advanced training opportunities to enable its technical personnel to utilize fully new equipment and technologies through participation in short-term and long-term training courses in different projects on agrometeorology in the country and overseas. Capacity development includes training of IT personnel, forecasters and middle-management officials. Specialists in the main office and regional field offices should also undergo training to enhance their knowledge and skills in the operation and maintenance of modern equipment. No capacity-development activities are conducted for farmers.

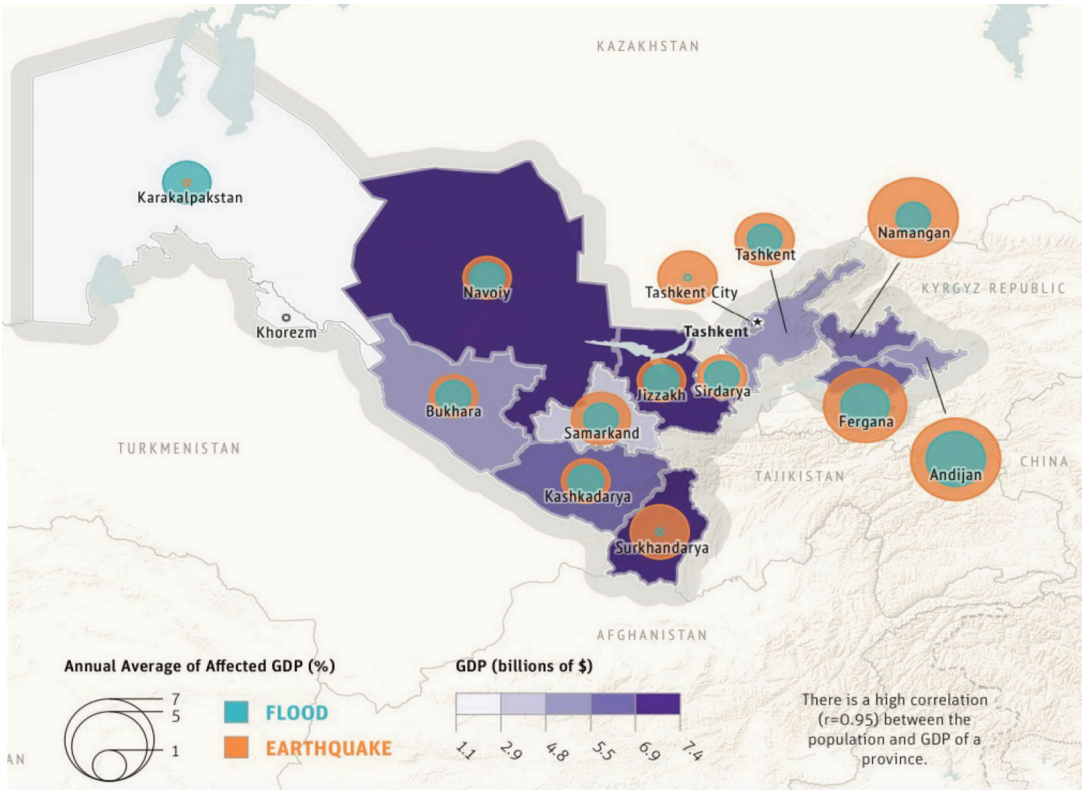
There is also a need to establish a specialized link between stations and forecasting centres, as well as to build infrastructure for 34 stations where infrastructure is obsolete. Uzhydromet provides agrometeorological data to farmers through MoA and the agricultural administration of regions and districts. Based on this data, MoA, in collaboration with agricultural departments, decides on the crop rotation system, taking into account mitigation and marketing. Farmers have limited access to meteorological data and cannot decide which crops they should plant; nor do they have a say in the rotation – they are obliged to grow crops according to government decisions.

Disaster risk reduction in agriculture

Uzbekistan is exposed to earthquakes, drought, flooding, mudslides, and landslides. Over 9 percent of its total land area is at risk from natural and human-made disasters, with nearly 66 percent of the population living in these areas and 65.5 percent of the national GDP earned there. Of all natural hazards, earthquakes cause the largest economic losses. In the last century, five notable seismic events caused widespread damage and casualties. This includes a magnitude 5.0 earthquake that happened in 1966, and which destroyed the Uzbek capital, Tashkent, affecting 100 000 people and resulting in USD 300 million in economic damage (World Bank and GFDRR, 2016).

Due to Uzbekistan's mountainous landscape and abundance of rivers, the population living in mountainous areas are also exposed to a high risk of landslides and mud flows, often triggered by earthquakes. Furthermore, according to GFDRR-supported analysis, an unlikely but extremely high-impact flood could affect two million people and cause capital losses equal to 5 percent of the country's GDP. Figure 10 shows the potential risk of flooding and earthquakes by province in Uzbekistan, estimated using flood and earthquake risk models. Greater colour saturation indicates greater GDP within each province. Circles indicate the risk of experiencing flooding and earthquakes, in terms of normalized annual average of affected GDP. The size of the circles shows the severity of such risks (World Bank and GFDRR, 2016).

Figure 10. Country risk profile (flood and earthquake) – affected gross domestic product across all provinces in Uzbekistan, based on approximations for 2015



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.
Source: **World Bank & GFDRR (Global Facility for Disaster Reduction and Recovery)**. 2016. *Europe and Central Asia Country Risk Profiles for Floods and Earthquakes*. The World Bank Group. Washington, D.C. 131 pp. www.gfdrr.org/en/publication/europe-and-central-asia-country-risk-profiles-floods-and-earthquakes

Uzbekistan recognizes its vulnerability to natural hazards and has taken important steps to manage disaster risks. After the earthquake in Tashkent in 1966, the government established the Institute of Seismology of Uzbekistan to predict future earthquakes. In 1996, the MoES was established to protect the population and coordinate efforts in DRR. To build on its DRR accomplishments, the government's priorities include:

- increasing climate resilience through the efficient use of water, land, and energy resources;
- continuing to reduce seismic risks, particularly for priority buildings in Tashkent; and
- improving information on seismic risk identification in order to make risk-informed investment and planning decisions.

Uzbekistan is already facing a deficiency of water resources, increasing land desertification and degradation, and more frequent drought, as well as other natural hazards including heavy rain, flooding and landslides, which are leading to instability of agricultural production and threatening the country's food security. It should be mentioned that access to information on natural hazards, including DRR in agriculture, is almost non-existent in Uzbekistan. As there was no available information on mapping of natural hazards, emergency action plans, vulnerability assessment, preparedness plans, or GIS capacities, it was not possible to identify clearly gaps, challenges, lessons learned, recommendations and opportunities to improve action plans in the country.

At present, natural phenomena such as earthquakes, flooding, landslides and mud flows, as well as possible terrorist acts aimed at destruction of dams, and the bursting of high-altitude lakes, pose a great danger to the country. Data on such hazards is available only for official use for the preparation of the governmental reports; it is not made available through open-access sources. This situation prevents more effective integration of disaster-risk considerations into sustainable development policies, planning and programming at all levels, with a special emphasis on disaster prevention, mitigation, preparedness and vulnerability reduction. However, there is also a big challenge related to timely prevention of all types of emergency situations, and to delays in immediate response to the arising emergencies. Resolving this issue with the existing data-sharing system could have a significant impact on the economic fate of the country.

Disaster risk assessment, hazards vulnerability analysis

Hazard mapping and geographic information systems capacities

The Resolution of the President of Uzbekistan presidential decree No. ПП-2045, dated 25 September 2013, initiated the creation of the National Geographic Information System (GIS). The National GIS was planned as an integral part of the "electronic government" system which required the creation of a satellite geodetic network, a unified computerized system of the state cadastre, and real estate registration. While National GIS is not yet fully implemented, it will allow real-time analysis and evaluation of various reliable cartographic and other data, supporting management decisions in the field of rational use and protection of natural resources, integrated development of territories and sectors of the economy and the social sphere (Jalalov, 2016).

Uzbekistan's Unified System for monitoring, information exchange and forecasting of natural, manmade and environmental emergencies uses a specialized GIS software, with monitoring of data introduced.

Still, there is a need for further implementation of GIS technologies and remote sensing methods in the country, in particular more advanced GIS, high resolution satellite imagery, and drones (Uzhydromet, 2016).

Uzbekistan is a member of the Asian Disaster Reduction Center, a regional organization working on building disaster-resilient communities and establishing networks among participating countries. The MoES and the State Committee on Geology and Mineral Resources are partners of the centre, which acts as an intermediary between Uzbekistan and international initiatives that can provide geospatial information, maps and satellite images in case of a disaster (International Charter Space and Major Disasters and Sentinel Asia Initiative). Uzbekistan itself is not a member of those initiatives at the moment (Asian Disaster Reduction Center, 2020).

Preparedness and emergency action plans

The State System of Emergency Situations functional and territorial subsystems' action plans are developed, approved and are systematically adjusted based on the decrees of the president, the laws of Uzbekistan, and resolutions of the Cabinet of Ministers (Fozilov, 2015).

Drought-risk mitigation

Drought is one of the most dangerous natural hazards for agricultural producers in Uzbekistan. Nurbekov and Mirzabaev (2017) conducted a review of the state of drought-related literature and policies in Uzbekistan and assessed the potential of various alternative technologies as well as institutional and policy options for a drought-monitoring system. The analysis showed that almost all farmers (94 percent) experienced drought shocks over the previous five years (around 2005–2010). Still, only one-third of the farmers were actually implementing any drought-coping and mitigation activities. Some of the most common of these activities were: changing crop varieties and crop types, changing planting dates, water conservation and sustainable land management practices, and reducing the area of cultivated land (Nurbekov and Mirzabaev, 2017). These approaches are among the most common drought responses in other arid drought-prone areas around the world (Gerber and Mirzabaev, 2017). The most prominent and promising drought mitigation measures that can be found in the country are (Nurbekov and Mirzabaev, 2017):

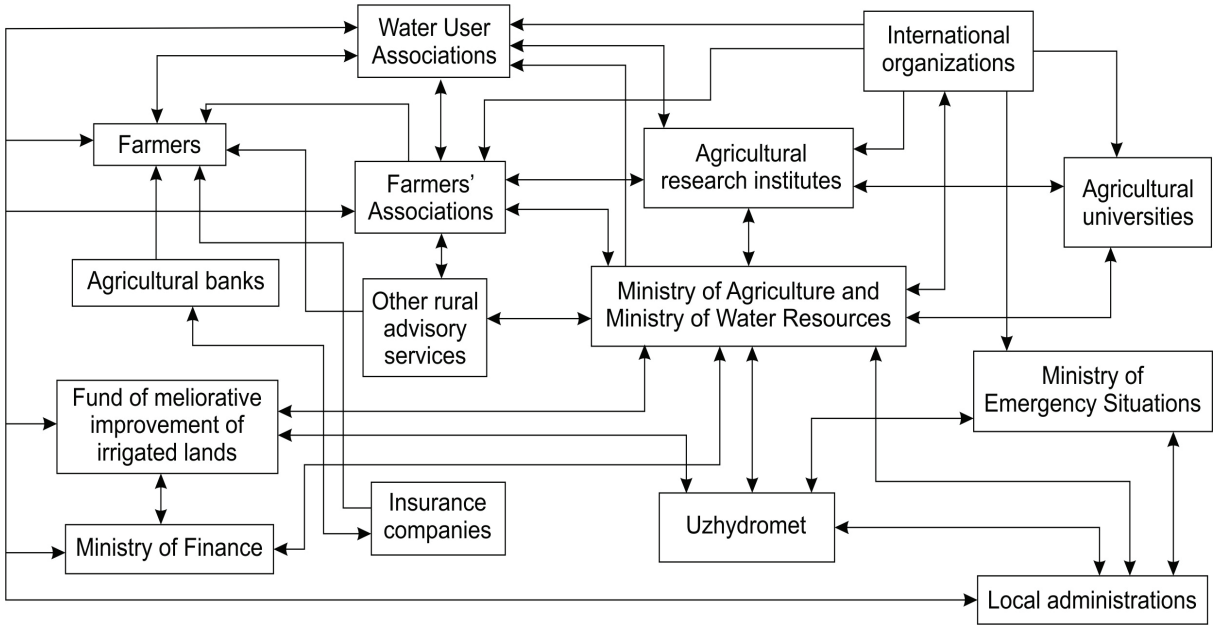
- **Crop diversification** (including the wider use of drought-tolerant crops), the major drought-risk mitigation strategy used by farmers. However, crop diversification and land relocation from cotton and wheat to other crops might not be sufficient. Existing breeding programmes mostly focus on developing new drought-resistant varieties of wheat and cotton, while more efforts are needed to improve and develop domestic seed supply chains for other, drought-tolerant crops.
- **Improvement of water use efficiency in agriculture** (including cleaning and good maintenance of irrigation and drainage networks and adoption of water-conserving irrigation techniques). On the country level, the Fund for Improvement of Irrigated Lands under the Ministry of Finance is investing in cleaning drainage and irrigation systems (particularly of larger canals). However, more support is needed on the local level, in managing smaller irrigation and drainage networks, which fall under the responsibility of local water user associations.
- **Expansion of drip irrigation system** by providing access to soft credit to farmers. However, the development of such technologies is constrained by complicated management requirements, which depend on geographical location, topography, geomorphology, farm size, local water distribution, and so on. Local water user associations would need support in the promotion of precision irrigation technologies.
- **Improvement of the extension and rural advisory services** on sustainable land management (for example, conservation agriculture practices, expanded application of improved land levelling, such as laser-guided land levelling) and water-conserving irrigation methods. Other promising areas of development include drought insurance, more opportunities for off-farm employment, and employment diversification.

Uzbekistan could use the experiences of other drought-affected countries in formulating more comprehensive drought preparedness and drought-risk mitigation plans. Crop diversification (as one of the farmers' most commonly used strategy for drought risk mitigation) can also help in fighting land degradation and in improving agricultural profits. This strategy is also quite widely promoted by the Government of Uzbekistan, for instance through the Presidential Decree No. 2460, from 29 December 2015, which sets out a longer-term strategy to diversify and intensify crop production in the country (for 2016–2020). It was planned to replace around 170 000 ha of cotton fields and 50 000 ha of wheat with other crops, such as fruit, vegetables, oilseeds, feed crops, and legumes (Nurbekov and Mirzabaev, 2017).

Some of the main challenges in implementing drought coping actions include a lack of access to credit and lack of access to inputs, which most significantly affect lower-asset agricultural producers. Another important issue, concerning mainly the poorest farmers, is access to water. Rich farmers consider the lack of information one of the biggest problems (Nurbekov and Mirzabaev, 2017). Most farmers use their own savings to fund drought mitigation activities, which also suggests limited access to credit and drought insurance. Developing these areas could play a major role in supporting drought-risk mitigation strategies in Uzbekistan. Access to information (extension) and knowledge about sustainable land management and water-conserving agronomic practices corresponds very clearly with the likelihood of a farmer implementing drought mitigation actions. Similarly, the more diverse the farmer's crop portfolio (number of different crops they grow), the more likely the farmer is to undertake some drought-coping and mitigation activity (Nurbekov and Mirzabaev, 2017).

There is also a need for Uzhydromet to improve monitoring and forecasting of hydrological phenomena, to support drought risk-reduction activities. It is important to strengthen significantly the capacities of Uzhydromet by investing in more granular and frequent weather and hydrological data collection, and improved hydro-economic modelling of drought impacts. Timely provision of information on natural hazards to all stakeholders is crucial, including governmental organizations, local administrations, and farmers (through the mass media). Currently, such information is communicated to involved parties relatively slowly, as it has to go through complicated administrative channels (Figure 11). The MoA and Ministry of Water Resources should use these forecasts, developed by Uzhydromet, in planning agricultural activities. Open access to early warning information, climate and weather data would allow research institutes and universities to contribute by developing drought, crop production and water availability models (Nurbekov and Mirzabaev, 2017).

Figure 11. Schematic map of stakeholder interactions on drought mitigation and preparedness



Source: modified from **Nurbekov, A. & Mirzabaev, A.** 2017. Strengthening Agricultural Resilience against Droughts in Uzbekistan: From Crisis Management to Drought Risk Mitigation. *Food Security in Eurasia 2017: Case studies*. Editors Per Pinstrup-Andersen, S.A. Shoba, P.P. Sorokin. 126 pp.

There is also a need to boost coordination in drought-risk mitigation activities. The National Center for Drought Monitoring under Uzhydromet can more actively collaborate with MoA and the Ministry of Water Resources and its local administrative branches. A new national strategy for drought-risk mitigation and preparedness could serve as a basis for improving the existing inter-agency coordination mechanisms. While numerous organizations participate in drought-risk mitigation activities in Uzbekistan, effective institutional coordination between these actors and their roles is still lacking. Potentially, a permanent, even if small, coordination unit can be established under the agro-industrial sector of the Cabinet of Ministers. This would be a different approach, compared to the traditionally used mechanism of ad hoc commissions that coordinate drought crisis response actions. This can also help the country to transition from drought crisis management to drought-risk mitigation (Nurbekov and Mirzabaev, 2017).

Post-disaster needs assessment and damage and loss assessment

For a national-level emergency, damage and loss assessment is conducted by a special governmental commission, covering socioeconomic and ecological consequences. This commission includes representatives of stakeholder ministries and agencies. Results are structured as recommendations for urgent measures and are shared with other relevant stakeholders. In case of a local disaster, a similar committee is formed, consisting of relevant stakeholders at the local level. Different agencies are responsible for collecting different disaster impact information (MoA participates in committees focusing on various types of disasters) (World Bank, 2018).

Based on a World Bank study, it is unclear if there is a single agency responsible for collection of all the information on disaster impact. It is also unclear how exactly damage assessment is conducted and information on disaster impact is collected, whether by using a given methodology, or based only on expert knowledge and personal assessment (World Bank, 2018).

A number of agencies are responsible for the collection, assessment and reporting of agricultural data, including the State Committee on Statistics, the MoES, MoA, Ministry of Water Resources, Farmers' Council, and district *khokimiyat*. Currently, data on key indicators are collected through three annual forms, three semi-annual forms and three seasonal forms that are submitted by farming organizations, assemblies of citizens, enterprises engaged in agricultural activities. Twice a year, state statistics bodies carry out sample surveys in all types of farms. In addition, the State Committee on Land Resources annually submits information on arable land used by farms. Since 2013, all state statistical report forms can be submitted electronically. The State Committee on Statistics created the Automated Information System, which is designed to support legal entities in the preparation, completion and submission of reports to state statistical bodies in electronic format (Eralieva and Madreimov, 2019).

However, at the moment, no statistics on disaster damage and losses is collected regularly in the country, in any of the agricultural subsectors (crops, livestock, forestry, and fisheries). Data on disaster-related losses in agriculture can be collected only in the following cases: if farming organizations and *dehkan* farms submit a letter to the Cabinet of Ministers about the sector affected by a disaster, or if the forecasted targets were not met due to the disaster. In both cases, a working group is established urgently to identify losses and damage in the sector (Eralieva and Madreimov, 2019).

Central Asian countries, including Uzbekistan, are planning to implement the "DesInventar-Sendai" software system for the systematic collection, analysis and reporting of data related to disaster losses. This activity will be supported by United Nations Office for Disaster Risk Reduction's (UNDRR) regional initiative, Strengthening disaster resilience and accelerating implementation of Sendai Framework for Disaster Risk Reduction in Central Asia 2019–2022, funded by the European Union (UNDRR, 2020a). The "DesInventar-Sendai" system, among other aspects, covers direct economic loss by sector, including agriculture, and should report such losses as damage to crops and pastures in hectares, number of animals lost, and productive assets losses (UNDRR, 2019). The same regional project will help to strengthen urban resilience in five capital cities in Central Asia, including Tashkent (which is also Uzbekistan's largest city). The project will facilitate the assessment of the resilience of the city and the development of a comprehensive plan of action to reduce disaster risks (UNDRR, 2020b).

Agricultural insurance

Currently, 32 organizations work in the insurance market in Uzbekistan. Among them, three are insurance brokers, one is a special insurance agency, and 28 are insurance companies. In 1997, in order to create more favourable conditions for national agricultural producers and ensure effective development of insurance services in rural areas, the state created the specialized insurance company, state joint stock insurance company *Uzagrosugurta* (based on a decree of the president dated 25 February 1997, No. 1713 and the resolutions of the Cabinet of Ministers dated 6 March 1997, No. 125). *Uzagrosugurta*, Agroinvest, and Halq Sugurta are the only three insurance companies that provide drought insurance coverage in Uzbekistan. At present, insurance companies are playing an increasing role in providing natural-hazard insurance to clients. In 2019, *Uzagrosugurta* collected around USD 27.8 million of insurance premiums for agricultural insurance. In the same year, it paid out around USD 10.7 million to cover the losses of the insured from the damage caused by natural hazards (Akbarovich, 2020).

However, when it comes to agriculture, only 30 percent of crops were reported to be covered by any insurance against hazards such as drought, strong winds, and hail (Muradullayev, Bobojonov and Mustafaqulov, 2016). Existing crop insurance is indemnity-based and a lengthy verification procedure is required to trigger payments. The situation is also complicated by the fact that to even qualify for payments, farmers are supposed to follow strict agronomic and agrotechnical recommendations set out by MoA (which are different for each region and crop, not always easy to understand, and may not make economic sense to a farmer). This situation can lead to arbitrary interpretations of the requirements and a lack of transparency in the whole process (Nurbekov and Mirzabaev, 2017).

Muradullayev, Bobojonov and Mustafaqulov (2016) reported that financing of agricultural production is considered a highly risky business, therefore most banks demand crop insurance cover as security against natural hazards. Hence, the major condition for receiving access to credit for farmers is guaranteed insurance protection. This promotes growth in the financial stability of farms, and therefore increases the investment appeal of agricultural projects. The procedure of systematic monitoring of the condition of crops allows for a halt to credit provision if there is a risk of harvest failure. Thus, the state can ensure the efficiency of funds spent on agricultural production.

Cotton and wheat are the most important crops in Uzbekistan, covering between 50 and 60 percent of the total arable land. In this particular case, wheat and cotton are the most insured agricultural crops of all the crops in the country (Muradullayev, Bobojonov and Mustafaqulov, 2016). From 1998 to 2001, the total volume of budget assignments for insurance companies reached UZS 2.5 billion (USD 1.45 million, based on the 2001 exchange rate), or 33 percent of total indemnities paid under crop insurance contracts. Muradullayev, Bobojonov and Mustafaqulov (2016) reported that there is a high heterogeneity in terms of coverage of cotton fields with insurance, and that in 2012 only 3 percent of the cotton was insured in northern regions, while in central regions the figure was more than 60 percent of existing cotton fields. The situation with wheat was quite similar, with more than 30 percent of fields insured in central regions, and only around 2 percent in the north. Wheat production is important across the country, but insurance dispersion is very low in some regions.

The Government Decision No. 830 of 30 September 2019 approved the regulation on the procedure for insurance of livestock maintained in households and business entities engaged in livestock breeding. According to this regulation, it is voluntary. There are few cases of livestock insurance in the country – only some Karakaul sheep breeding farms have contracts with *Uzagrosugurta* to recover losses from natural hazards, including drought in pastures.

Some recommendations could be proposed to support the development of agricultural insurance in the country, including the introduction of smart insurance services in the agricultural sector, that would identify the most dangerous natural hazards; carrying out insurance liability in the agricultural sector at every step (from sowing to processing); a mechanism of state subsidies of insurance premiums paid by agricultural enterprises; and

digital insurance approaches (Akbarovich, 2020). An alternative index-based insurance approach in agriculture can provide new opportunities by reducing transaction costs (lowering insurance fees) and making the process of triggering the payments more transparent. The introduction of a well-functioning index-based insurance system would require very close cooperation between Uzhydromet, research institutes, and insurance companies, which is not currently in place. Opening the insurance market to new participants and increasing privatization of state-owned insurance companies can also boost the demand-driven and customer-oriented approaches in agricultural insurance (Nurbekov and Mirzabaev, 2017; Bobojonov, 2020). Crop insurance systems can be developed based on Earth observation data and agrometeorological information, supported by the integration of this model into national EWS.

Programmes and projects related to disaster risk reduction, early warning systems and agrometeorology services for the agricultural sector in Uzbekistan

Annex II provides information on relevant programmes and projects, as well as on funding and implementing agencies, implementation periods, and allocated budgets.

Since 2003, the European Commission's Civil Protection and Humanitarian Aid Operations (ECHO) has been supporting Uzbekistan, focusing on DRR under its Disaster Preparedness Programme (DIPECHO), working with the MoES, as well as partners from the United Nations family and the Red Cross and Crescent Societies. Examples of DIPECHO-funded projects were the support for the construction of the earthquake simulator in Tashkent (funded in 2012-2013), the Emergency Coordination Center in Kamchik Pass, which included an EWS, the permanent monitoring of severe weather and a mobile application to identify quickly the location of an incident or emergency (in 2013–2015). Through the 2016-2017 DIPECHO cycle, ECHO is funding two projects in Uzbekistan, implemented by the UNDP and the German Red Cross. The projects follow an integrated DRR resilience approach to strengthen DRR capacities of local and national authorities so the government can eventually take over such programmes, and mainstream DRR into local development planning.

Through DIPECHO, a project called Strengthening disaster risk management capacities in Uzbekistan, was implemented in 2011–2016. Under the United Nations Coordination Office in Uzbekistan, as part of the project, the UN Disaster Preparedness Group provided assistance to Uzbekistan in the event of a natural hazard-induced disaster. The project team included representatives from all United Nations agencies, the Red Crescent Organization of Uzbekistan, and other accredited humanitarian organizations, such as ACTED, and Doctors Without Borders. The project organized an earthquake simulation exercise with assistance from the Regional United Nations Office for the Coordination of Humanitarian Affairs that gave the UNDP a unique opportunity to test the humanitarian crisis mitigation and humanitarian aid mechanisms to support the government in disaster situations.

An intensification of climate change and climate variability has resulted in an increase in drought frequency. The UNDP in Uzbekistan, within the Adaptation Fund project and jointly with Uzhydromet, has improved and strengthened the Drought Early Warning System's forecasting capacity to ensure that all end users are informed about the risk of drought and prepared well in advance.

Conclusions and recommendations

Legislation and policy

There is a strong legal basis for the protection of the population against natural hazards in the country. However, it does not directly address climate change, DRR or the agricultural sector. At the moment, Uzbekistan is in the process of developing a national climate-change adaptation plan. The Ministry of Agriculture (MoA) is responsible only for food security, as part of overall national safety. However, there is no clear regulatory framework on DRR in agriculture. There is legislation on monitoring and prevention on emergency situations related to flooding, mud flows, avalanches and landslides. Various ministries (including MoA) have procedures to prepare for and respond to any accidents and emergency situations and prevent or mitigate associated impacts. Uzhydromet works closely with local, provincial and national authorities to coordinate their emergency preparedness plans. The country has an Agriculture Development Strategy for 2020–2030 which mentions the need to address the effects of climate change on the productivity of agricultural crops, and also the need to allocate gradually an increasing share of available funds for disaster risk management. However, to date, DRR has attracted limited attention at political and institutional level, despite various programmes and government resolutions. There is little awareness of the importance of DRR in ensuring agricultural production, securing food supply, and adapting to climate change.

The main recommendations for improving existing regulations can be summarized as follows:

- Incorporate climate change, DRR and EWS considerations into the national regulatory system. In particular, integrate EWS into policies for disaster mitigation, including the drought management system.
- Introduce a comprehensive, nationwide policy for climate-change adaptation.
- Integrate DRR, climate-change adaptation, and EWS into sectoral agricultural development plans and socioeconomic development strategies.
- Seek possibilities for improving technological options in accordance with the overall national development framework of the country, since agricultural production, processing and marketing of produce is closely tied to overall national long-term strategic plans.
- Develop a joint climate-change adaptation and DRR strategy and action plan, which would ensure the safety and mitigation of effects as well as information on the occurrence of natural hazards, and specifically cover drought risk management. This strategy should be based on the latest research on the impacts of natural hazards, including drought (covering impacts on agricultural productivity, on incomes, poverty, and food security). The strategy should classify available knowledge on climate-change adaptation strategies and establish a framework for inter-agency coordination. Activities to be covered in the proposed strategy could include crop diversification, breeding drought-resistant crop varieties and production of their seeds, improving water use efficiency in agriculture, improving extension and rural advisory services, expanding drought insurance products, particularly index-based drought insurance approaches, improving monitoring and forecasting of drought (data collection, hydroeconomic modelling, and open access to data), and strengthening the coordination of drought response and risk mitigation activities.
- Government to remain committed to the implementation of the crop diversification policy (cotton and wheat-based cropping system) by promoting crop rotation and production of higher-value and export-oriented alternative crops, including horticulture crops and pulses.

Institutional framework

The Ministry of Emergency Situations (MoES) is responsible for the development and realization of state policy in the field of prevention of emergency situations, protection of life and health of the population. A large number of organizations (various ministries, agencies, companies, state inspections) participate in emergency management activities in the country. At local level, community leaders are responsible for disaster management. The Department of Emergency Situations under the Cabinet of Ministers coordinates all activities of the ministries and organizations involved in DRR. However, the existing system is still lacking an effective institutional coordination mechanism between these various actors and their roles. In case of agriculture-related disasters, the State System of Emergency Situations functional and territorial subsystems' action plans have been developed, approved and are systematically adjusted. The Ministry of Agriculture and Water Resources was recently split into MoA and the Ministry of Water Resources. The Ministry of Water Resources implements a unified policy on water-resources management and is developing state policy on water use and protection of water resources, prevention and elimination of harmful impacts of water. The MoA now deals with unified policy on agriculture and food security, including coordination of state bodies on research in different aspects (such as drought, disease, pest tolerance). At the same time, MoA does not perform any specific tasks related to DRR, apart from disease and pest control. The ministry used to be responsible for implementing the unified policy for plant protection including plant quarantine. However, now the Agency of Plant Protection and Quarantine is responsible for plant quarantine activities in the country.

Recommendations for the improvement of the institutional framework and coordination mechanisms include:

- Introduce an effective institutional mechanism for coordination between all actors involved in DRR and their roles. The development of a real functional DRR strategy could be a vital step for improving the coordination between stakeholders.
- Increase capacities of MoA and the Ministry of Water Resources to address natural hazards affecting agriculture.
- Provide opportunities for the capacity development of national agricultural research institutes, with a particular focus on young scientists – for example, through short-term specialist training in research methods and techniques, training for technical support staff, participation in international seminars, workshops and symposia.
- Establish a national platform for DRR in order to reduce the impact of disasters in the country.
- Strengthen the Network of Steering Committees for Floods Control (committee in each province of the country) at all levels (including infrastructure, equipment, operation, and management).
- Support potential cooperation with other Central Asian countries under the Sendai Framework. This might be done using the national platform for DRR.

Early warning systems

The MoES and Uzhydromet operate the National Center for DRR Monitoring, the major function of which is to provide early warning and propose measures to alleviate the impacts of natural hazards. The MoES is responsible for the distribution of warnings among the general population and taking measures for the reduction of disasters and liquidation of after-effects of possible catastrophes. The main early warning information comes from Uzhydromet for weather-related hazards, from State Quarantine inspection for diseases and pests outbreaks, and from MoA for crop forecasts. However, at the moment, there is no comprehensive EWS in place to guide water allocation and crop and pasture planning and management. Tailored forecast products are not readily available to potential users. Most of the observation stations are operated manually. Some other issues are related to inadequate linkages between research and education, farmers and other stakeholders, poor infrastructural development, and an insufficient number of early warning specialists to cater to diversified agricultural services. Food price monitoring and some related services can be easily accessible by farmers through the AgroMart web portal.

The following recommendations can be proposed to strengthen the existing EWS:

- Undertake regular disaster risk assessments, preferably before the flooding season, of plant and animal diseases, pest outbreaks, frost and earthquakes, to raise community awareness and promote dialogue between different ministries, state agencies, and communities, of DRR.
- Organize capacity-development activities in EWS and particularly in price/market information systems.

Agrometeorology services

Uzhydromet is the organization responsible for agricultural meteorology in the country. Its regional offices have agrometeorological departments that collect and provide agrometeorological information, including forecasts. There is a regular monitoring system in place. The agrometeorological bulletin, published every ten days, provides an overview of agrometeorological conditions by region and an assessment of their impact on the growth and development of major crops. The bulletin also contains information from observations of meteorological stations located in the agricultural zone. Uzhydromet provides agrometeorological data to farmers through MoA and agricultural departments in provinces and districts. Based on this data, MoA makes a decision on the crop rotation system. Farmers cannot decide which crops they should plant, nor do they have a say in the rotation. Farmers can get hydrometeorological information from district-level agricultural departments and water-resource departments. Some other challenges in this system include: a lack of automatic stations, old and outdated observation equipment, uneven distribution of stations across the country, lack of real-time data, lack of capacity-development activities for personnel, and an insufficient budget of Uzhydromet. No capacity-development activities are conducted for farmers.

Recommendations for the improvement of agrometeorology services include:

- Carry out capacity-development activities for Uzhydromet staff including technical officers, forecasters and middle-management officials. Specialists in the main office and regional field offices should also undergo training to enhance their knowledge and skills in the operation and maintenance of modern equipment.
- Explore the possibility of creating a task force gathering governmental institutions, the private sector, agricultural associations and research institutions for providing user-tailored agrometeorology services.
- Provide farmers with direct access to climate data.
- Scale up feedback mechanisms and regular assessments to understand better if farmers' needs and preferences, in terms of agrometeorology services, are met.
- Increase the frequency of meteorological observations including short-term and long-term forecasting of factors related to hazards through the development of the expected climate-change scenarios, in order to ensure early warning of dangerous weather and climate in advance.
- Improve the quality of monitoring and forecasts of yield and production of all agricultural crops, and to assess the impact of changing climatic conditions on crops, using known crop simulation models such as AquaCrop,[13] CropSyst, DSSAT, and Agricultural Production Systems SIMulator (APSIM).

Disaster risk reduction in the agricultural sector

In Uzbekistan, access to information on natural hazards, DRR and mitigation activities in agriculture is very limited. In this situation, it was not possible to identify clearly existing gaps and challenges for many aspects of the country's DRR system in agriculture. Data on natural hazards is available only for official use, for the preparation of governmental reports – it is not made available through open-access sources. This situation prevents more effective integration of disaster risk considerations into sustainable development policies, planning and programming at all levels. However, there is also a big challenge related to the timely prevention of all types of emergency situations and to delays in immediate response to arising emergencies. At the moment, no statistics on disaster damage and losses is collected regularly in the country, in any of the agricultural subsectors. Regarding insurance, only around 30 percent of crops were reported to be covered by any kind of insurance. At the same time, there were only a few cases of livestock insurance in the country.

[13] A multi-year, multi-crop, daily time step cropping systems simulation model.

Since insurance is indemnity-based, it requires lengthy verification procedures to trigger payments. In many cases, such insurance has high transaction costs. Moreover, insured farmers are required to follow complicated agrotechnical norms set out by MoA for each crop in order to qualify for drought payments.

The following recommendations are proposed for the improvement of the DRR system:

- Enhance international cooperation on DRR development and improvement to maintain and develop partnerships and collaborations among associations in which Uzbekistan is a member, such as the Association of Southeast Asian Nations (ASEAN), World Meteorological Organization (WMO), and Regional Integrated Multi-Hazard Early Warning System (RIMES).
- Create a database on the occurrence of natural hazards and DRR activities in the country to provide easier access to such information for specialists and researchers.
- Encourage the government to invest in DRR through the provision of more detailed information on costs and benefits of natural hazard mitigation activities.
- GPS zoning and mapping across the country should be carried out, to identify which areas are most exposed to disasters.
- Expand opportunities and the technical basis for index-based insurance options to spread coverage by reducing transaction costs. Alternative index-based approaches could provide new opportunities by not only reducing transaction costs (resulting in lower insurance fees), but also through more transparent ways of triggering payments. However, establishing a well-functioning index-based insurance system would require much closer cooperation and exchange between Uzhydromet, research institutes, and insurance companies than is currently practised. Furthermore, opening up the insurance market to new entrants and increased privatization of state-owned insurers could also provide a boost to the demand-driven and customer-oriented approaches in the work of insurance companies.
- Develop crop insurance systems based on Earth observation data and agrometeorological information across random districts with the guidance to integrate the model into national EWS.
- Implement crop diversification techniques that increase crop productivity, improve food security and nutrition, increase incomes, and contribute to adapting to climate change, thereby improving the livelihoods of the beneficiaries.
- Strengthen phytosanitary capacity by merging plant protection with quarantine functions to show better results. Uzbekistan has a strong capacity for integrated pest management, but in recent years climate change has induced cross-border movement of pests on a large scale. This has challenged public services and farmers to respond.

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Annexes

Annex I.
List of organizations interviewed

1. Ministry of Agriculture
2. Ministry of Water Resources
3. IWMI International Water Management Institute
4. ICARDA (International Centre for Agricultural Research in the Dry Areas)
5. United Nations Development Programme
6. Food and Agriculture Organization of the United Nations
7. Uzbekistan hydrometeorological service
8. Farmers Union
9. State Committee of the Republic of Uzbekistan on Land, Resources, Geodesy, Cartography and State Cadaster (Goskomzemgeodezkadastr)
10. Ministry of Emergency Situations
11. Ministry of Finance and the State Committee of the Republic of Uzbekistan on Statistics

Annex II. Programmes and projects related to disaster risk reduction, early warning systems and agrometeorology services for the agricultural sector

Title of programme / project	Targeted countries	Funding agency/ies	Implementing agency/ies	Implement. period	Allocated budget (USD)	Main components/project aim
Agriculture Modernization Project	Uzbekistan	IBRD, IDA	UzAIFSA	2020–2026	500 million	The objectives of the project are to (i) enhance productivity-supporting agricultural services, and (ii) promote market-led, high-value horticulture value chains. The project will help the country modernize institutions and upgrade agricultural research and development capabilities. Local farmers and agribusinesses will benefit from more modern technologies, advisory and extension services, capacity development, long-term financing and agro-logistical services. As a result, they will gain better access to internal and external markets. This project also promotes the use of climate-smart agriculture practices, increasing farmers' awareness of biohazards, strengthening plant protection and quarantine capacity. https://projects.worldbank.org/en/projects-operations/project-detail/P158372
Livestock Sector Development Project	Uzbekistan	IBRD, IDA	UzAIFSA	2017–2022	150 million	The objective is to improve livestock productivity and access to market in selected regions. The project includes three components: 1) Livestock Sector Public Investment Framework and Public Services; 2) Livestock Value Chain Modernization (have a strong emphasis on supporting the integration of small producers into value chains); 3) Project Coordination, Management, and Monitoring and Evaluation (includes training of project beneficiaries on safeguards requirements and awareness raising campaigns on labour practices in agriculture). https://projects.worldbank.org/en/projects-operations/project-detail/P153613

Title of programme / project	Targeted countries	Funding agency/ies	Implementing agency/ies	Implement. period	Allocated budget (USD)	Main components/project aim
Ferghana Valley Water Resources Management – Phase II	Uzbekistan	IDA	Agency for Implementation of Projects in Water Sector under Ministry of Water Resources	2017–2024	144.9 million	The objective is to improve the quality of irrigation and drainage service delivery to agricultural users within the project area. The project includes three main components: (i) Irrigation Modernization – aims to increase water supply both from surface and groundwater sources and to reduce wastage through investments in the modernization of the water distribution system (one of indicators focuses on flood control and bank protection); (ii) Support for Agricultural Modernization – promote intensification and diversification of agriculture and improved water management; (iii) Project Management – support strengthening the capacity of Ministry of Agriculture and Ministry of Water Resources. https://projects.worldbank.org/en/projects-operations/project-detail/P149610
Preparedness and response to resource related strengthened	Uzbekistan	UN Development Assistance Framework (UNDAF)	Ministry of Emergency Situations and UNDP Uzbekistan	2010–2015	1 480 000	1) Strengthen the capacities of the Ministry of Emergency Situations and other DRR stakeholders in Uzbekistan to mitigate, reduce the disaster risks and respond in a timely and strategic manner to any major catastrophic life threatening event in Tashkent, and at a later phase, in other high-risk locations. 2) Expand community-based DRR activities accordance with national guidelines on preparedness, mitigation and response activities to disasters caused by natural hazards; 3) Enhance the capacity of the United Nations Country Team to create a unified disaster preparedness and response strategy to support the Republic Uzbekistan in the event of a catastrophic disaster.
Reducing Pressures on Natural Resources from Competing Land Use in Non-Irrigated Arid Mountain, Semi-Desert and Desert Landscapes of Uzbekistan	Uzbekistan	GEF	State Committee on Land Resources, Geodesy, Cartography and State Cadaster and UNDP Uzbekistan	2014–2018	2 513 600	Component 1: Field level investment to transform the baseline approach – promising best practices on sustainable rangeland and forestry management and Integrated Natural Resource Management (INRM) planning up-scaled in target districts of Uzbekistan. Component 2: Policy, legal and institutional mechanisms – enabling cross-sector environment and in-country capacity (at system, institutional and individual levels) for applying integrated landscape management in arid mountain, semi-desert and desert areas of Uzbekistan.
Green Climate Fund (GCF) Readiness Programme in Uzbekistan	Uzbekistan	Federal Ministry for the Environment, Nature Conservation, and Nuclear Safety of the Federal Republic of Germany	Centre of Hydro-meteorological Services under the Cabinet of Ministers and UNDP Uzbekistan	2016–2020	1 589 458	The objective of the project was to develop the capacity of stakeholders in Uzbekistan to plan for, access, manage, and monitor climate change finance at the national and subnational levels. Component 1: Awareness and understanding on GCF and its priorities and processes, and coordination of climate finance at national level. Component 2: Capacities to develop a pipeline of bankable climate projects to access climate finance. Component 3: Investment frameworks for adaptation and mitigation detailing financial needs to address climate change, and sources of funding. Component 4: Training of Uzbekistan local financial institutions, including national, subnational, and private sector institutions, to effectively identify and evaluate proposals for climate finance from national stakeholders seeking funding.

Title of programme / project	Targeted countries	Funding agency/ies	Implementing agency/ies	Implement. period	Allocated budget (USD)	Main components/project aim
Strengthening Capacity in Price and Market Information Systems and Policy Monitoring in Response to COVID-19 and Other Shocks	Armenia, Albania, Belarus, Kyrgyzstan, North Macedonia, Tajikistan, Uzbekistan	FAO		2020–2022	420 000	Objective: Strengthened institutional capacities to address the countries' needs in developing and maintaining market information systems for commodity and value chain development and in developing robust and flexible policy strategies to deal with short-term risks and long-term market uncertainties.
Sustainable Management of Water Resources in rural areas in Uzbekistan	Uzbekistan	European Union	Ministry of Agriculture and Water Resources; involved ministries and agencies in water management; Farmers' Council, basin irrigation system authorities, water users associations, farmers; local municipalities and others and UNDP Uzbekistan	2016–2019	5 678 755	The project aimed at strengthening institutional frameworks and technical capacities for water management at basin, water user association and farm levels while increasing the awareness on effective rational water use. Component 1 was on "National Policy Framework for Water Governance and Integrated Water Resources Management (IWRM)", and Component 2 on "Technical Capacity Building". Component 3 was on "Awareness Raising".
Developing climate resilience of farming communities in the drought prone parts of Uzbekistan	Uzbekistan	Adaptation fund	Centre of Hydro-meteorological Service under the Cabinet of Ministers and UNDP Uzbekistan	2014–2020	5 190 878	The overall objective of the proposed project of the government of Uzbekistan is to develop climate resilience of farming and pastoral communities in the drought prone parts of Uzbekistan, specifically Karakalpakstan. 1. Institutional capacity and mechanisms for drought risk management and early warning. 2. Climate resilient agricultural and pastoral production systems. 3. Landscape level approach to adaptation to climate change risks of increased aridity. 4. Knowledge management and awareness raising.
Sustainable natural resource and forest management in key mountainous areas important for globally significant biodiversity	Uzbekistan	GEF	State Committee on Nature Protection and UNDP Uzbekistan	2017–2022	6 509 863	Component 1: enhance the quality of information on key ecosystems, habitats and species of the high altitude mountains that are home to snow leopard and prey populations. Component 2: seek to expand and build the management capacity of the core conservation zones and high conservation value forests located within the two targeted snow leopard landscapes. Component 3: seek to encourage more sustainable levels of use of the high altitude pastures and indigenous forests located within the two targeted snow leopard landscapes. Component 4: promote improved cooperation and collaboration in the conservation of snow leopard and their ecosystems.

Title of programme / project	Targeted countries	Funding agency/ies	Implementing agency/ies	Implement. period	Allocated budget (USD)	Main components/project aim
Building the resilience of communities affected by the Aral Sea disaster through the Multi-partner Human Security Fund for the Aral Sea	Uzbekistan	UNTFHS, UNDP, UNFPA, UNESCO, UNV and Adaptation Fund	United Nations Trust Fund for Human Security (UNTFHS)	2016–2019	4 154 000	Building the resilience of communities affected by the Aral Sea disaster through a Multi-Partner Human Security Fund for the Aral Sea.
Climate Adaptation and Mitigation Program for Aral Sea Basin (CAMP4ASB)	Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan	World Bank; Executive Committee of the International Fund for Saving the Aral Sea (EC IFAS)	Centre of Hydro-meteorological Service under the Cabinet of Ministers	2016–2021	15 million	Component 1 – Regional Services in the Area of Climate Knowledge. Implementation of this component will include provision of technical assistance in establishing a unified regional analytical platform to ensure sustainable climatic development in Central Asia. This approach involves development of a number of tools for data visualization, receipt of new knowledge and capacity buildup to ensure efficient decision making in the area of climate change. Component 2 – Regional Fund of Climate Investment. Component 3 – Coordination at the Regional and National Level. As the Regional Coordination Unit, CAREC will be implementing the project at the regional level, including: assessment of national climate investment implementation in participant countries, on a semi-annual basis; dissemination of the best practices and programme deliverables for better planning of activities in participant countries. Coordination at the national level will include funding of operational costs of the unit responsible for supervision of investment implementation at the national level in each participant country.
Strengthening Disaster Risk Management Capacities in Uzbekistan	Uzbekistan	European Union Humanitarian Aid	Ministry of Emergency Situations and UNDP Uzbekistan	2011–2016	1 715 000	The project aimed at strengthening the country's capacity to prepare for and respond to natural and human-induced disasters. The objective was to build upon and expand the UNDP Uzbekistan assistance to create sustainable mechanism for DRR as per the Hyogo Framework for Action (2005–2015). This project is directed to increase the DRR capacities of the Ministry of Emergency Situations and other stakeholders to mitigate, reduce disaster and climate risks and respond in a timely and strategic manner to any major catastrophic life threatening events in Tashkent, and at a later phase, in other high-risk locations. Expand community-based disaster and climate risk reduction activities in accordance with national guidelines on preparedness, mitigation and response activities to natural hazards. Strengthening the capacity of the United Nations Country Team to create a DRR strategy to support the Republic of Uzbekistan in the event of a catastrophic disaster.

Title of programme / project	Targeted countries	Funding agency/ies	Implementing agency/ies	Implement. period	Allocated budget (USD)	Main components/project aim
Project for Improvement of Locust Management (Phase 2)	Central Asia (including Uzbekistan) and Afghanistan	Japan/Japan International Cooperation Agency (JICA)	Locust and Mullberry Pyralid Control Service, Uzagrokimyohimoya Joint Stock Company	2020–2025	7 227 723	The overall objective of the project is to contribute to food security and livelihoods of the rural populations in Central Asia by preventing and limiting the threats posed by locusts and damage to crops and rangelands in the respect of human health and the environment. The expected outcome of the project will be that national and regional locust management is improved through development of increased national capacities and more efficient regional cooperation. www.fao.org/3/cb1302en/cb1302en.pdf
Locust disaster risk reduction in Caucasus and Central Asia (CCA)	Central Asia (including Uzbekistan), Afghanistan, Armenia, Azerbaijan, Georgia, the Russian Federation	USAID	Republican Center of Plant Protection and Agricultural Chemistry, MoA	2018–2021	480 000	The overall objective of the project is to contribute to food security and livelihoods of rural populations in climate-change adaptation by anticipating, preventing and limiting the threat posed by locusts, i.e. reducing occurrence and intensity of locust crises as well as of their potential impacts on crops and rangelands and on human health and the environment in case they occur. www.fao.org/3/CA3377EN/ca3377en.pdf
Towards better national and regional locust management in Caucasus and Central Asia	Central Asia (including Uzbekistan) and Azerbaijan	Government of Türkiye	MoA	2014–2019	600 000	The objective of the project is 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. www.fao.org/3/BU325en/bu325en.pdf
Enhancing locust management and prevention	Central Asia (including Uzbekistan), Caucasus, Russian Federation, Afghanistan	USAID	MoA and National Locust Control Unit	2011–2017	1 660 000	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. www.fao.org/3/bu326e/bu326e.pdf
Strengthening Regional Collaboration and National Capacities for Management of Wheat Rust Diseases (CAC-Rust)	Central Asia (including Uzbekistan) and Türkiye	FAO-Türkiye Partnership Programme	FAO	2020–2024	1 067 000	Improve the productivity and resilience of wheat production against emerging wheat rust epidemics and races by strengthening national capacities and regional collaboration.

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