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



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Abbreviations and acronyms

ADB	Asian Development Bank
AIC	Agrarian Science and Innovation Centre
AIF	Agrarian Insurance Fund
ARC	Agrarian Research Centre
ASA	Agrarian Services Agency
ASDC	Automated System for Data Collection
AWM	Amelioration and Water Management OJSC
AZN	Azerbaijani manat (new)
CCA	Caucasus and Central Asia
CoM	Cabinet of Ministers
DRR	Disaster risk reduction
EWS	Early warning systems
FAO	Food and Agriculture Organization of the United Nations
FSA	Food Safety Agency
GHG	Greenhouse gas
GIS	Geographical information systems
GIZ	German Agency for International Cooperation
IFAD	International Fund for Agricultural Development
IoT	Internet of Things
MoA	Ministry of Agriculture
MoE	Ministry of Economy
MoENR	Ministry of Ecology and Natural Resources
MoES	Ministry of Emergency Situations
NGO	Non-governmental organization
NHS	National Hydrometeorology Service
OJSC	Open Joint Stock Company
PISC	Property Issue State Committee
PPR	Peste des petits ruminants
SRIFGTG	Scientific Research Institute of Fruit-Growing and Tea-Growing
SRM	Strategic Road Map on agriculture and agricultural products processing sector in the Republic of Azerbaijan
SSC	State Statistical Committee of Azerbaijan Republic
UNDRR	United Nations Office for Disaster Risk Reduction
UNFCCC	United Nations Framework Convention on Climate Change
UNISDR	United Nations International Strategy for Disaster Reduction
WMO	World Meteorological Organization

Executive summary

Natural and biological hazards. Azerbaijan is exposed to many natural hazards, such as earthquakes, floods, landslides, drought, wildfires, and storms. In addition, it is expected that climate change will increase the frequency and severity of extreme weather events.

The agricultural sector is highly vulnerable to the impacts of extreme weather events, as it is highly climate-sensitive. Natural hazards, as well as biological hazards including animal and plant pests and diseases, can adversely impact the sector and lead to extensive damage and loss of crops, livestock, forestry, fisheries, and aquaculture. Annual economic losses caused by natural hazard-induced disasters were estimated to be between USD 10 million and USD 20 million in the early 2000s. Since then, these losses have increased to an annual average of USD 30 million to USD 50 million (Babakhanov, 2004; Babakhanov and Aliyev, 2014).

Agriculture and food security. In 2020, agriculture accounted for 6.9 percent of Azerbaijan's gross domestic product (GDP), and it is estimated to employ around 36 percent of the country's labour force. The sector's contribution to the economy is important in order to reduce poverty, rural to urban migration, and food insecurity. As a result of impressive economic growth over recent decades – due to the development of the oil sector – poverty rates have declined from 49 percent in 2001 to 4.8 percent in 2019. During the 2015–2018 period, the share of the population living below the international poverty line was zero percent (SSC, 2019e). Azerbaijan has achieved considerable progress in poverty reduction and shared prosperity, improved its standards of living, and expanded its middle class (World Bank, 2019). The government is currently giving priority to non-oil sectors, including agriculture, to diversify its economy and ensure food security.

Institutional structure for disaster risk reduction (DRR) in agriculture. The country has undertaken significant steps to shift from a reactive emergency response towards a proactive DRR approach. Therefore, Azerbaijan is strengthening its institutional capacities and enhancing the mainstreaming of DRR into its agricultural policy frameworks. For instance, the development and establishment of information and early warning systems (EWS) for agriculture are included in the country's 2016 Strategy Road Map for agriculture. These systems will help farmers and other agricultural partners to make well-informed decisions, which will reduce the adverse impacts of natural and biological hazards on the sector.

Disaster prevention, mitigation and preparedness for natural hazards are among the key issues for the government, despite the fact that a national strategy for DRR is yet to be developed. The Ministry of Emergency Situations (MoES) is responsible for the formulation and coordination of DRR measures. Its decision to publish the Emergency Atlas of the Republic of Azerbaijan is considered a positive development towards enhancing the protection of its population, settlements, industry, agriculture, and strategic infrastructure from disasters, and combining efforts to reduce the adverse impacts on its communities and economic sectors.

Early warning systems. The Strategic Road Map on agriculture stressed the need to develop a multi-hazard information and EWS by 2025. At present, the National Hydrometeorology Service (NHS) develops national weather forecasts in Azerbaijan. There are hydrometeorological stations that provide hydrometeorological data. The NHS provides short-term and monthly weather forecasts and flow forecasts for rivers and reservoirs, as well as early warnings of natural hazards (such as storms, hail, and drought). The forecasts are available on the Ministry of Ecology and Natural Resources (MoENR) website and also sent to government agencies and institutions. However, the EWS service and products for agriculture at national and local levels are not functioning fully at present.

Agrometeorology services. The NHS, under the MoENR, provides agrometeorology services to farmers in Azerbaijan and promotes sustainable agricultural development in order to increase productivity. Since March 2021, the Ministry of Agriculture (MoA) has provided agrometeorological advisory services in Guba, Gusar, Khachmaz, and Shamakhi districts within the framework of a pilot project. For this purpose, climate stations

are used. Climate stations are a modern innovative system that allows observing the development phase of diseases and pests in the process of plant development, and timely and correct prediction of field work. There is a need to integrate the use of IT and similar technologies, such as SMS, for enhancing the output of appropriate weather and climate products.

Disaster risk reduction in agriculture. Information on disaster risk assessments, preparedness plans, emergency action plans, post-disaster needs assessments, and damage and loss assessments, are currently not available for the agricultural sector in Azerbaijan. In addition, local authorities do not have the technical capacity to carry out flood risk assessments. However, in recent years, the focus on DRR in agriculture has increased and there are plans to establish a new unit on DRR in agriculture by 2022 that will be engaged in conducting post-disaster needs assessments for agriculture and food systems. At the same time, there are plans to establish a weather monitoring system by the end of 2021. Agriculture insurance is not widespread in Azerbaijan as it remains risky for insurance companies. At present, there is no compulsory agricultural insurance in the country, but efforts are being undertaken to improve voluntary agricultural insurance. Despite the fact that the government is providing subsidies to cover 50 percent of the premium of crop insurance, farmers are still reluctant to purchase it (CoM, 2019b).

Programmes and projects. There are a few programmes and projects related to DRR, EWS and agrometeorology services that are being implemented for the agricultural sector in Azerbaijan. For instance, the project Integrating Climate Change Risks into Water and Flood Management by Vulnerable Mountainous Communities in the Greater Caucasus Region of Azerbaijan – implemented by the United Nations Development Programme (UNDP) together with MoES – aims to reduce the vulnerability of communities to climate change-induced water stress and flooding-related hazards by improving water and flood management. In addition, the Institute of Hydrometeorology is planning to implement a project on DRR in agriculture – jointly with the Global Environment Facility (GEF) and United Nations Environment Programme (UNEP). The project will include an agroclimatic services component.

Conclusions and recommendations. At present, a national agricultural DRR platform is absent in Azerbaijan. There is a need to establish this platform as it will help to provide horizontal and vertical coordination across sectors and levels. Moreover, enhanced coordination is required between relevant state authorities for the development of relevant policies, strategies and plans that support the implementation of DRR, EWS, and agrometeorology services activities – in particular for the agricultural sector. This is also highly important for flooding, forest fires and drought events that are often transboundary. To adequately and efficiently address these risks requires regional cooperation for the harmonization of methodologies, the adoption of common standards, and the exchange of data and information related to hazard monitoring, forecasting and the issuing of timely warnings among river-basin countries.

Recommendations for improving agricultural DRR include the following:

Policy recommendations:

- Prepare National Strategy for Disaster Risk Reduction 2021–2030 and develop national and local disaster risk management plans, including preparedness activities and contingency planning specifically for the agricultural sector.
- Establish a national platform for DRR to support and strengthen the inter-institutional coordination, collaboration, and communication among relevant organizations at all levels. It is especially important to ensure the active participation of institutions responsible for the agricultural sector in this platform.
- Develop and adopt a new state programme for the development of hydrometeorology for 2021–2025.
- Adopt a new state programme for the development of forests in Azerbaijan for 2021–2030.
- Define the roles and responsibilities of all relevant partners within the DRR framework, sectoral laws, strategies, plans and policies, along with expected actions.
- Enhance capacities to undertake disaster risk assessments by the line ministries at local level.
- Increase communication and enhance coordination among all relevant authorities, such as line ministries, academic institutions, and municipalities.
- Speed up the printing of the Emergency Atlas of the Republic of Azerbaijan.
- Close the gap between policy making and research, including data collection and analysis on DRR in agriculture.

- Restore the important work of the State Commission on Climate Change.
- Re-approve the composition of the working group within the State Commission on Climate Change and continue its activity in the NHS.
- Revise the “regulations on the Azerbaijan state system for prevention of emergency situations and activities in such cases” and “functions of state bodies of the Republic of Azerbaijan for prevention and activities in such cases”.
- Revise the laws “on hydrometeorological activity” and “on melioration and irrigation” and adapt them to the requirements of the European Union.
- Accelerate the preparation of a long-term low-emissions development strategy in Azerbaijan.
- Discuss and agree the Adaptation Plan, which will be prepared with the support of UNDP in 2021.
- FAO to continue engaging MoA and MoENR on possible support for land-use issues, through the Office of Climate Change, Biodiversity and Environment (OCB) team at headquarters, and on agriculture and forestry sector development, integrating the DRR principles.
- Propose to MoA, MoES, and the State Statistical Committee, to institutionalise the damage and loss assessment methodology. This is a very concrete initiative that is part of the FAO agenda and that may support Azerbaijan to progress in meeting Sustainable Development Goals (SDG) targets by 2030.
- Encourage non-governmental organizations (NGOs) and the private sector to take a more active role in the DRR process, including their involvement in emergency and mitigation plans and programmes.

Recommendations for improving agrometeorological services:

- Enhance technical and human capacity to undertake GIS mapping.
- Increase the use of agrometeorological data and modern meteorological systems in agriculture, particularly by farmers. This will be critical for the enhancement of the forecasting potential of the country, and reduction in the adverse effects of disasters on the sector.
- Strengthen the capacity for collecting and analysing data and enhance the knowledge of EWS, agrometeorology services, including use of digital technologies.
- Improve access to information for farmers through extension services.

Recommendations for EWS:

- Establish EWS to cover crop and agricultural forecasts, as well as annual food balance, by major commodities. In addition, link EWS with climate early warning to support agriculture and food security.
- Participate in regional initiatives to exchange information on DRR and combine efforts regarding the monitoring, forecasting, and responding to disasters.
- Develop a feedback mechanism where end users are able to provide inputs on whether the forecasts and early-warning products are addressing their needs, including the dissemination of warnings to farmers’ organizations or forums, which will help to disseminate the alerts to local people and communities.
- Apply the newest technologies and best practices in forecasting and provide training on World Meteorological Organization (WMO) standards, methodologies and requirements.
- Secure funding for the weather monitoring system created by the Agrarian Research Centre (ARC).
- FAO to offer support on EWS, vulnerability mapping, contingency planning, and best practices to strengthen the resilience of the agricultural sector to disasters. In this regard, it is essential to focus on building national capacities, which is the only way to ensure sustainability.
- Increase the number of operational meteorological and hydrological stations, especially automatic stations with online transfer capabilities, and optimize the hydrometeorological observation network – support the establishment of stations in mountainous areas, including high-attitude stations; expand the actinometric observation network; and carry out biometeorological observations and research.

Recommendations for disaster risk assessment, vulnerability and hazard mapping:

- MoA, the Agency for Agrarian Services (ASA), and the Agrarian Science and Innovation Centre (AIC), to recognise the significant impact of drought on the agricultural sector.
- Systematically collect, consolidate and analyse damage and losses data by the Agrarian Insurance Fund (AIF), and the ARC, and ensure that assessments of damage and losses cover all agricultural subsectors.
- Conduct technical training courses focusing on risk assessment and decision making based on a countrywide standardization of risk-assessment methodologies.
- Strengthen forest management practices, such as the development of field-protective forest windbreaks around the edges of croplands and establish field, soil and water-protective forests.
- Update the existing methodology for post-disaster damage assessment for the agricultural sector.
- Promote research activities to assess the economic damage caused to agriculture by disasters.
- The FAO Country Office in Azerbaijan to continue exploring the possibility of integrating the DRR aspects in both ongoing and pipeline projects, or to develop dedicated projects if donors are interested.
- The FAO Country Office in Azerbaijan to explore how to concretely pursue the offer from UNDP, German Agency for International Cooperation (GIZ) and International Fund for Agricultural Development (IFAD) to coordinate and collaborate in the area of DRR.

Recommendations to improve agricultural insurance:

- Explore the possibilities to expand insurance coverage for crops and harvests (together with short-term loans).
- Further analyse the distribution of agricultural insurance products among large and small-scale farmers by the AIF and the ARC.
- Identify the need for an increase in the use of insurance across rural areas by the AIF.
- Develop insurance products that will help to reduce the adverse impacts of drought.
- Raise awareness among farmers of the benefits of agricultural insurance as a risk transfer tool, to mitigate the impact of natural hazards on agriculture.

Introduction

The Europe and Central Asia (ECA) region is prone to various natural hazards, including floods, drought, hail, avalanches, landslides, storms, and so on. 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 in many parts of the region, and impact food security, nutrition, and ecosystem services. The agricultural sector and in particular smallholders, herders, fishers, and foresters, are particularly vulnerable to the adverse impacts of climate change as the majority of these smallholder producers are dependent on the sector and its activities for their food and livelihoods.

This Comprehensive analysis of the disaster risk reduction system for the agricultural sector in Azerbaijan 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 (REU). The other countries included in the series are Armenia, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Republic of Moldova, Tajikistan, Turkey, Turkmenistan, Ukraine, and Uzbekistan. 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 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 secondary (literature review) as well as primary (interviews) data sources. Information on gaps, challenges, constraints, and opportunities was collected through semi-structured interviews with relevant national officials and experts, following the provided guidelines and the developed 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 between October 2019 and July 2021, and the list of interviewed experts is provided in Annex I.

This study was conducted under the REU Regional Initiative 3 that focuses on 'Managing natural resources sustainably and preserving biodiversity in a changing climate'.

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

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

Country background

The Republic of Azerbaijan is located on the west coast of the Caspian Sea. It borders the Russian Federation to the north, Georgia and Turkey to the northwest, Armenia to the west, and Iran to the south. The country is situated between 44° and 52° of east longitude, 38° and 42° of north latitude. Geographically, the country consists of three zones, including the mountainous areas located in the northern (Greater Caucasus mountain range) and the southwestern part (Lesser Caucasus) of the country. The Kura–Aras plains, named after the Aras and Kura rivers, are situated in the centre of the country and are partially below sea level. The landscape is sometimes very rugged and rocky due to the mountains; it is also hilly, with woodlands and meadows.

Azerbaijan has a total surface area of 86 600 km², of which around 12 percent is covered by forests, 4.6 percent is under water, 55.2 percent is agricultural land (28 percent of which is hay and pasture land), and the remaining 28.2 percent is other land (SSC, 2020a). At least since the 1990s, the area covered by forest has grown, and in 2020 it reached around 1.13 million ha. Almost 73 percent of it is naturally regenerating forest, the remaining is planted (FAO, 2020a). Azerbaijan has joined the Bonn challenge to restore the forest landscape in lands degraded by climate change and aims to restore 270 000 hectares of forest by 2030 (Republic of Azerbaijan, 2021).

The country is located in an arid zone with limited water resources. According to the last assessments conducted in the 1960s and 1970s,³ the maximum water resources of the country are 39 billion m³. Surface water resources amount to 32.3 billion m³, which falls to 22.6 million m³ during dry years. Seventy percent of Azerbaijan's surface water resources are generated outside of the country's borders. The volume of groundwater resources is 5.2 billion m³, and around 21 billion m³ of available water resources is stored in reservoirs, of which only 12 billion m³ is used. Agriculture uses up between 60 percent and 70 percent of the water. It is estimated that the country's water deficiency is 3.7 billion m³ during the years with normal precipitation, and 4.7 billion m³ to 5 billion m³ when there is insufficient precipitation (SRM, 2016).

³There has been no assessment of the surface water resources of Azerbaijan since the 1970s.

Natural hazard profile

Azerbaijan is prone to a number of natural hazards, including floods, landslides, earthquakes, and drought (ADRC, 2020). A total of 920 natural hazards were recorded in the country during the 2015–2020 period (Table 1). More detailed information on the main natural hazards is provided in the following sections.

Table 1. Natural hazards in Azerbaijan, 2015–2020

Natural hazards	2015	2016	2017	2018	2019	2020
Dangerous meteorological and agrometeorological events:	22	75	61	82	91	117
strong winds	13	27	30	41	69	74
precipitation	7	46	28	33	15	29
strong fog	–	2	3	6	5	1
snow avalanches					1	–
excessive heat			–	2	1	–
others						13
Dangerous geological events:	4	7	5	12	2	2
volcanic eruptions	–	–	–	4	–	–
landslides	–	2	1	3	2	2
floods	4	5	1	4	–	–
avalanches	–	–	3	1	–	–
Dangerous hydrological events:	–	8	8	1	2	–
fluvial	–	5	2	–	1	–
overflows	–	3	6	1	1	–
Dangerous geophysical events (earthquakes):	70	77	81	60	76	57
Total:	96	167	155	155	171	176

Source: MoES, 2020a and MoES, 2021b.

According to the 2020 INFORM Risk Index, the country has a medium risk, compared to the high risk of neighbouring countries Iran and Turkey. Azerbaijan is among the most exposed and most vulnerable of South Caucasian countries. It ranks 61 out of 191 countries on the 2020 INFORM Risk Index.

The risks are not equal across the entire territory and vary depending on the type of hazard, exposure, vulnerability, and coping capacity. As a result, different regions are prone to specific natural hazards. For instance, in mountainous regions, flooding, hail, (rock) avalanches, frost, snow storms, and landslides are quite common, whereas in the plains, dust storms, flooding, wind erosion, and drought are more frequent.

Damage and loss in agricultural sector caused by natural hazards

In general, the impact of natural hazards on Azerbaijan's economy has been increasing in recent years. It is estimated that in the early 2000s, the economic impact of natural hazards on the country was between USD 10 million and USD 20 million annually (Babakhanov, 2004). During the following decade, these figures increased. For instance, natural hazards caused USD 30 million to USD 50 million annually, while in some years, these losses were estimated at billions of dollars (Babakhanov and Aliyev, 2014).

Agriculture is among the sectors most impacted by natural hazards. It is calculated that every year, as a result of natural hazards, between 0.6 percent and 0.8 percent of the planted areas experience a production loss of between 3 percent and 4 percent (Babakhanov, 2004). Livestock breeding in Azerbaijan is less affected by

natural hazards than crop production. However, it is estimated that every year approximately 10 000 to 12 000 sheep and goats die as a result of natural hazards (Babakhanov, 2004).

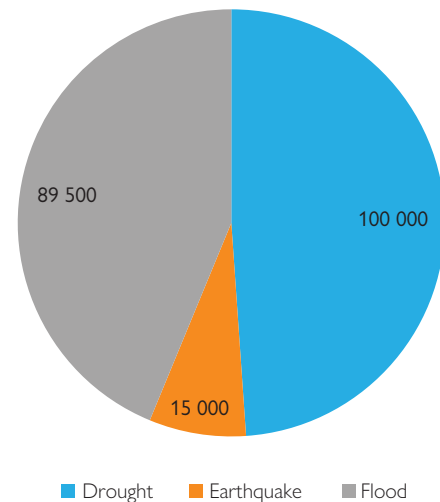
According to research conducted by the United Nations International Strategy for Disaster Reduction (UNISDR) and World Bank (2009), drought is considered the largest risk in Azerbaijan, with an average annual loss of USD 6 million, followed by floods (USD 5.7 million), earthquakes (USD 1.6 million), and landslides (USD 0.3 million). The 20-year return period loss for all hazards is USD 71 million (0.23 percent of GDP), while the 200-year return period loss is USD 179 million (0.57 percent of GDP).

As shown in Figure 1, drought has caused more economic loss than floods in Azerbaijan. Drought and wildfires are mainly triggered by high temperatures, but fires are also caused by humans and are quite widespread and frequent during the dry summer season. The high water level and flooding in the Kura river posed a substantial hazard to agriculture in 2010. However, in 2020 the opposite occurred, as the Kura river dried up and saline water along the river has adversely impacted agricultural production (N. Shalbuzov, personal communication, 2020).

The average annual economic losses caused by all natural hazards are estimated at nearly USD 50 million (Babakhanov and Aliyev, 2014). The agricultural sector in Azerbaijan is highly vulnerable to these impacts. Over the past 20 years, the damage caused by various natural hazards to the total sown areas in the country was 4 percent to 6 percent of total profits earned from crop production (Pashayev, 2017). On average, it has been estimated that 60 000 ha to 65 000 ha of grain, 120 000 ha to 130 000 ha of legumes, 2 800 ha to 3 000 ha of technical plants, 2 500 ha to 3 000 ha of vegetables, and 1 200 ha to 1 500 ha of melon plantations, are completely lost every year (Pashayev, 2017). Moreover, during the same period, an average of 75 000 to 80 000 cattle, 1.3 million to 1.5 million small horned cattle, 12 million to 14 million birds, and 25 000 to 30 000 bee colonies were killed, damage to livestock amounting to AZN 60 million (USD 35 million) (Pashayev, 2017).

The following sections will provide additional information on damage and loss per natural hazard and its impact on the country, in particular on agriculture.

Figure 1. INFORM Risk Index 2020 in South Caucasian countries



Source: EM-DAT, 2020

Floods

Azerbaijan is susceptible to heavy flooding, due to its topography and to water-related fluctuations in the Caspian Sea (Pusch, 2004). Floods and flash floods are common during spring. They occur frequently and are considered one of the most damaging types of disaster that substantially impacts the country's economy. It is calculated that flooding is likely to affect 60 percent of Azerbaijani territory, while the Kura–Araz lowlands and Absheron peninsula are less susceptible to this natural hazard (Babakhanov and Aliyev, 2014).

The number and frequency of floods is increasing progressively in the country. Between 1996 and 2014, 235 flooding and overflow events occurred, which accounted for 34.7 percent of the total number of such events since 1900. Over two recent decades (1995–2015), there was a three-fold increase in flooding, with the affected area and expansion of streams increasing by 50 percent to 100 percent. Flooding occurred on average ten times from 1990 to 2000, and 15 times during the 2000–2012 period (Pashayev, 2017).

During the past 100 years, an estimated 675 floods have led to economic damage worth about AZN 1.3 billion to AZN 1.5 billion (USD 0.8 billion to USD 0.9 billion) (Pashayev, 2017).⁴ One of the most devastating flooding events occurred in 1995, affecting over 1.5 million people and causing about USD 30 million in damage (World Bank, 2015). The floods in 1998 and 2003 caused economic damage of USD 50 million and USD 70 million,

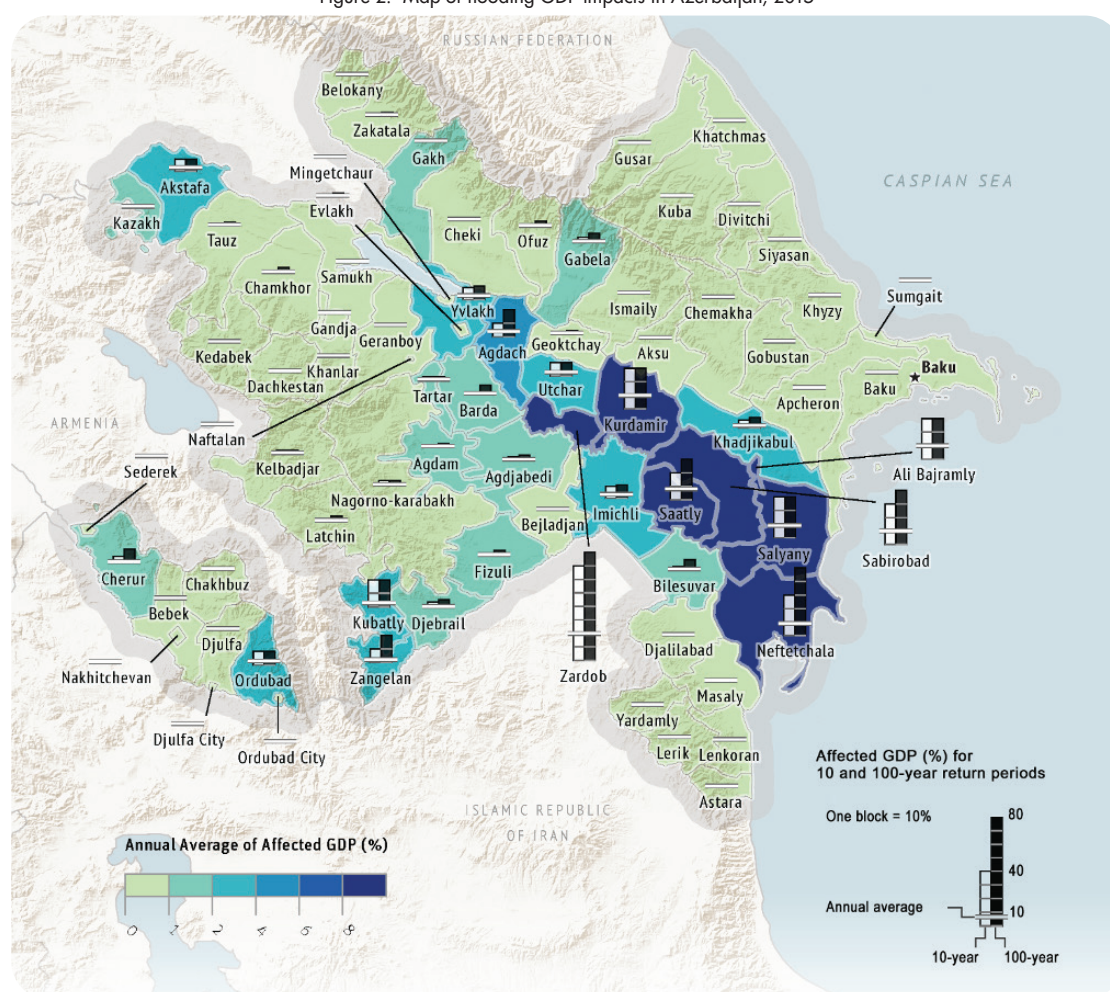
⁴Material losses are indexed.

respectively (Babakhanov and Aliyev, 2014). Before 1990, it was estimated that the economic damage caused by flooding was on average AZN 17 million to AZN 20 million (USD 10 million to USD 11.7 million) per year, while in 2017, this figure had increased to between AZN 25 million and AZN 30 million (USD 14.7 million and USD 17.6 million) (Pashayev, 2017).

Disaster data have shown that floods have affected a large number of people and caused significant economic losses over the past 20 years. For example, flooding that occurred in the Tovuz–Khanlar region in June 1997 affected 75 000 people and caused an economic loss of USD 25 million. The April 2003 flood in the Ismayilli–Gobustan region affected 31 500 people and resulted in an economic loss of USD 55 million (UNISDR and World Bank, 2009).

The map in Figure 2 depicts the impact of flooding on provinces' GDPs, represented as percentages of their annual average GDPs affected, with greater colour saturation indicating higher percentages. The bar graphs represent GDP affected by flooding with return periods of 10 years (white) and 100 years (black). The horizontal line across the bars also shows the annual average of GDP affected by flooding (World Bank, 2015). The agricultural districts at greatest risk of flooding are Zardab, Sabirabad, Kurdamir, Neftchala, Salyany, Saatly, Agdash, Ordubad, and Akstafa.

Figure 2. Map of flooding GDP impacts in Azerbaijan, 2015



Source: World Bank, 2015.

According to research conducted by the World Bank, the number of extreme weather events, such as heavy rainfall that may lead to substantial flooding, has increased in the past two decades. Climate change is likely to increase the frequency and magnitude of flooding and can adversely impact agricultural areas, vineyards, grasslands, and forests (World Bank, 2014a). Additionally, findings from studies show that over the past 12 years, 1.42 million ha, or 30 percent of the country's total agricultural land (of 4.76 million ha), has been affected

by flooding (Pashayev, 2017). The number of flooding events observed in the rivers of Azerbaijan were 3, 20 and 35, in the years 2000, 2010, and 2020, respectively (Tagiyeva, 2021).

Fluvial (river) flooding

River flooding in Azerbaijan makes soil and vegetation unusable and significantly damages farms. This hazard occurs due to the rising levels of the Caspian Sea and the inability to regulate and manage the downstream levels of the Kura and Araz rivers. Historical data shows that the overflow of the Kura river in 1897 completely destroyed 200 000 ha of cultivated land. The most recent severe flooding of the Kura and Araz rivers occurred in December 2002 and early 2003, when an area of 10 000 ha of farmland was devastated. During flooding in 2006, 28 000 heads of big and small cattle were killed (Musayeva, 2014). It has been estimated that during the 2003–2010 period, 29.8 percent of the total agricultural land was destroyed due to river flooding, which included 238 600 ha of harvested land, 187 000 ha of cotton fields, 772 000 ha of grain, 10 000 ha of garden vegetables, and 7 407 ha of pastures. Approximately 104 000 big and small cattle also died (Musayeva, 2014).

Drought

The length of drought events has increased since the twentieth century, when a drought lasted for two to three years, whereas during the 2012–2020 period there has been continuous drought. In particular, 2019 was the driest year in Azerbaijan, when the annual average precipitation was below average. The drought continued in 2020 and agriculture suffered, with grain production declining by 8 percent (A. Veliyev, personal communication, 2021). In 2020, due to the drought, 100 000 ha of grain fields in the Aran region of Azerbaijan were damaged (WMM, 2020), and grain producers lost more than AZN 20 million (USD 12 million) (E. Zeynalov, personal communication, 2021). Drought and water shortages had a negative impact on cotton, corn, and fruit production. Due to a lack of water and drought, the sowing area of rice was reduced by 1 000 ha and the sowing area of sugar beet by 2 700 ha in 2020. In addition, Azerbaijan reduced the replanting sowing area by 50 000 ha in the same year (WMM, 2020). Drought has a negative impact on livestock and on feed crops and natural forage sources. This could create obstacles to the development of animal husbandry. Furthermore, global warming is reducing the amount of snow and glaciers that feed the country's mountain rivers.

The amount of precipitation is decreasing in all regions of the country, apart from the Caspian region. It has decreased by an average of 8.7 times in the areas of the main mountain rivers during the ten years from 2010 to 2020. In 2019, precipitation was 17 percent lower than normal, while in 2020 it was 25 percent below average. At the same time, the water level in the Kura and Ganig rivers decreased by 29.2 percent in 2019 and by 45.8 percent in 2020 compared with the normal level. Given the inertia of the climate, we can expect another 8 percent decline in the amount of precipitation over the next decade (WMM, 2020).

Drought has caused the most economic losses of natural hazards in Azerbaijan, the average loss being USD 6 million every year. However, when a severe drought occurs, the losses can be much higher. In 2000, a severe drought caused an economic loss of USD 100 million (UNISDR and World Bank, 2009).

Landslides

Each year, landslides cause extensive damage to the Azerbaijani economy – these natural hazards lead to losses in the crop, livestock, and forestry sub-sectors, loss of agricultural land and damage and destruction to roads, communication systems, agricultural infrastructure, houses, and villages. It is estimated that 25 percent to 30 percent of the country's land area is prone to landslides that mainly occur in the mountainous areas of the Greater and Lesser Caucasus, the foothills of the Talysh mountains and the Absheron peninsula, particularly in the mountainous parts of Ismayilli and Aghsu districts, Shamakhi district and its northeastern slopes, and the districts of Khizi, Guba, and Gusar. Landslides occur more frequently in spring and summer with the increase in rainfall.

It is estimated that 150 settlements in Azerbaijan are subject to periodic or continuous landslides, with the majority of the landslides observed in 30 villages of the Ismayilli region (N. Shalbusov, personal communication,

2019). The only reported disaster related to a landslide was in April 2000, when 11 people were killed and there were economic losses of USD 4 million (UNISDR and World Bank, 2009). In 2017 and 2018, one and three landslides, respectively, were reported in Azerbaijan. At present, the number of landslides is yet not fully estimated and registered (MoES, 2020a).

Hail

Azerbaijan is highly exposed to hail. The likelihood of hail occurring in April, May or June is 86.3 percent in the southern part of the Lesser Caucasus, 78.2 percent in the northern part of the Lesser Caucasus, 76.5 percent in the Nakhchivan Autonomous Republic, 74.6 percent in the southern slopes of the Greater Caucasus, and 73.2 percent in the Lankaran region (MoENR, 2019b; CoM, 2019a). In contrast, hail events in the Central Aran region rarely occur (MoENR, 2019b).

Every year, especially in April, May, and June, hail occurs in 25 to 30 administrative districts in Azerbaijan (Azertac, 2019a). It often damages gardens, vineyards, and cultivated fields and sometimes kills poultry, small animals, and bee families. For example, in May 2019, hail damaged cherry gardens, grain fields, strawberries, potatoes, legumes, and tomato farms in the Khachmaz region. In June 2019, hail destroyed 40 ha of grain and 27 ha of vegetables in the Qusar region (Azertac, 2019a; Azertac, 2019b). It is estimated that more than 40 percent of damage caused by hail to agriculture occurs in Ganja–Gazakh region. During the 2000–2012 period, a total of over 100 hail incidents were recorded in this region, which resulted in economic damage of AZN 12.7 million (approximately USD 16.3 million) (Pashayev, 2017). The annual damage and losses caused by hail in Azerbaijan are estimated at USD 10 million to USD 12 million (Pashayev, 2017). At present, a comprehensive anti-hail protection system is not yet established; however, this issue is reflected in the country's Strategic Road Map (SRM), with the MoENR tasked to implement this activity.

Earthquakes

Azerbaijan is considered a 7-magnitude earthquake region. Within the country, the Absheron peninsula, the Mountainous Shirvan (especially Shamakhi district), the Sheki–Zagatala zone, Ganja city and its southern suburbs in the Lesser Caucasus, are classified as 8-magnitude earthquake areas. Devastating earthquakes have occurred in Azerbaijan in the past. For example, several earthquakes hit Shamakhi in 1667 (6.9 magnitude) and 1859 (5.9 magnitude), while an earthquake that occurred on 9 July 1998 in the Lankaran, Lerik, Yardimli, Astara, Masalli, Imishli and Bilasuvar areas affected people and destroyed and damaged hundreds of buildings and communication facilities (OoP, 1998a). More recently, a 6.5 magnitude earthquake hit Zagatala in the northeast of Azerbaijan on 7 May 2012, which caused significant damage and losses to the crop and livestock sub-sectors. In 2017, 2018, and 2019, 81, 60, and 76 earthquakes were recorded, respectively. In general, information on earthquakes is collected every year in Azerbaijan (MoES, 2020a).

Severe winds and storms

Storms have recently been observed in the Ganja, Dashkesan, Goygol, Shamkir, Samukh, and Gadabay districts, and on the Absheron peninsula, in the northwestern and eastern part of the country. Whirlwinds are primarily recorded in the western area, especially in the Ganja–Gazakh zone, as well as in the Aghdash, Goychay, and Zardab districts in the central areas of the country. The average number of days with wind speeds of 15 m/s and above is 100 to 145 days per year.⁵ In 2017 and 2018, wind speeds of 35 to 38 m/s were recorded on 30 days and 41 days, respectively. The Ganja–Gazakh plain, in particular, experiences strong winds on between 25 and 70 days a year. In other parts of Azerbaijan, strong winds are relatively rare (MoENR, 2019b). Severe winds have caused damage to orchards, vineyards and areas cultivated with grain, while thunderstorms, mainly observed in the mountains and foothills of Azerbaijan, have affected livestock. For instance, due to lightning strikes in June 2014, 13 cattle from the 'Yaylaq' farm in Kover village, Yevlakh region, were killed and the economic loss suffered around AZN 30 000 (USD 18 000). It is anticipated that, as a result of climate change, rain storms will increase in future. One of the main problems is that the damage caused by wind to agriculture is not

⁵metres per second.

accurately calculated. For example, on 17 June 2021, a strong wind seriously damaged cherry orchards in Guba and Khachmaz regions. However, the exact amount of damage has not been calculated. In general, there is still no accurate calculation of wind damage. Due to the underdevelopment of agricultural insurance, farmers are not given any payment or compensation. Farmers bear this loss themselves (A. Hagverdiyev, personal communication, 2021).

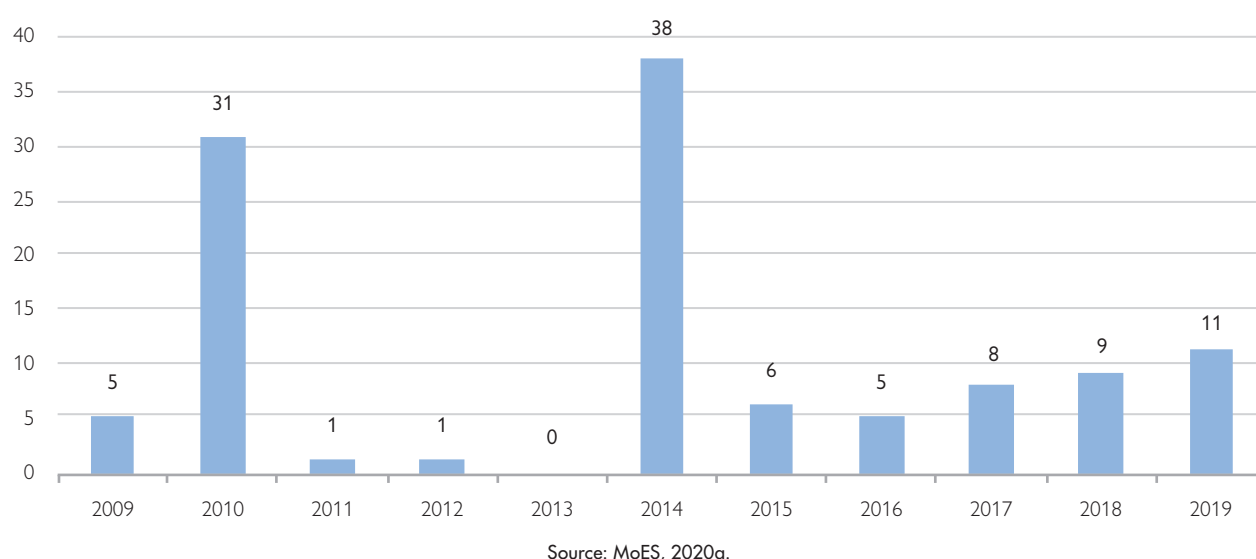
Mud volcanoes

Mud volcanoes are located in less populated areas of Azerbaijan. In 2018, four volcanic eruptions took place in the country, but there is no data regarding substantial damage and loss to agriculture.

Forest fires

There has been an upward trend in the number of forest fires in the country during the 2017–2019 period (Figure 3).

Figure 3. Number of forest fires in Azerbaijan, 2009–2019



Wildfires are common in Azerbaijan during the summer period. A total of 11 wildfires that affected Azerbaijani forests were recorded in 2019 (MoES, 2020). MoENR considers the occurrence of forest fires due to natural (heat) factors, but also to human-induced factors. Two anthropogenic factors that are causing fires in Azerbaijan include the careless handling of fire, and the burning of grass after the harvesting of grain. The country has a law that prevents farmers from burning anything on agricultural lands, and any violation leads to a substantial fine of between AZN 400 and AZN 600 (USD 235 and USD 355) for farmers, and between AZN 5 000 and AZN 6 000 (USD 2 950 and USD 3 530) for legal entities (Azernews, 2015).

In dry seasons and during the summer months in particular, fires cause substantial damage to forest land. Forest fires covered 0.7 ha in 2016, 372 ha in 2017, and 15.8 ha in 2018. As a result of these fires, the losses were AZN 140 (USD 82) in 2016, AZN 8 400 (USD 4 941) in 2017, and AZN 8 300 (USD 4 882) in 2018.⁶ Although forest fires were recorded in the country in 2019, they were extinguished before spreading extensively. During the past few years, the government has strengthened activities to prevent fires (SSC, 2019a).

⁶AZN 1.70 = 1 USD in 2017 and 2018.

Avalanche

As altitude increases, the likelihood of snow cover increases – generally between 1 200 meters and 1 400 meters above sea level. The annual number of snow-covered days is around 80 to 120 in the central part of the country, and about 250 days per year in the higher areas, such as in the highest peaks of the Greater Caucasus where snow never melts (MoENR, 2019b). Snow and rock avalanches are seen in a limited number of areas, and as these areas are less populated, significant damage has not been reported. During the past few years, three avalanches were reported in 2017, one avalanche in 2018, and one snow avalanche in 2019 (MoES, 2020a).

Biological hazards

Measures to prevent, control and manage plant pests, including locust, American white butterfly, Colorado beetle, and San Jose scale, are financed from the state budget. Azerbaijan is affected by the Moroccan and Italian locusts, and to a lesser extent by the migratory locust. The country participates very actively in the interregional and multi-funded Programme to improve national and regional locust management in Caucasus and Central Asia (CCA), implemented by FAO since 2011 to the benefit of ten countries. In this framework, the Automated System for Data Collection (ASDC) and the Geographical Information System (GIS) entitled 'Caucasus and Central Asia Locust Management System (CCALM)' have been introduced in CCA over recent years. Thanks to the active involvement of the ASA, during the 2020 campaign Azerbaijan became the first CCA country that almost entirely covered its locust survey and control operations with ASDC. These tools are expected to play a key role for data collection, analysis and forecast, thus early warning and timely reaction allowing to prevent locust-related damage to crops and rangelands. Locust control activities in Azerbaijan are increasingly implemented using ultra-low volume technology, which is the most efficient, economic and environmentally friendly spraying technology developed specifically for locust treatments.

The vaccination of livestock is also carried out and funded by the government to protect cattle from anthrax, foot-and-mouth disease, brucellosis, rabies, and other infectious diseases. Table 2 shows the list of animal diseases for which prophylaxis, diagnosis and control are financed by the state according to the decision No. 65 of the Cabinet of Ministers of the Republic of Azerbaijan of 7 March 2006 (latest amendments in 2015) (CoM, 2006).

Table 2. List of animal diseases financed by the state for veterinary prevention, diagnosis and control

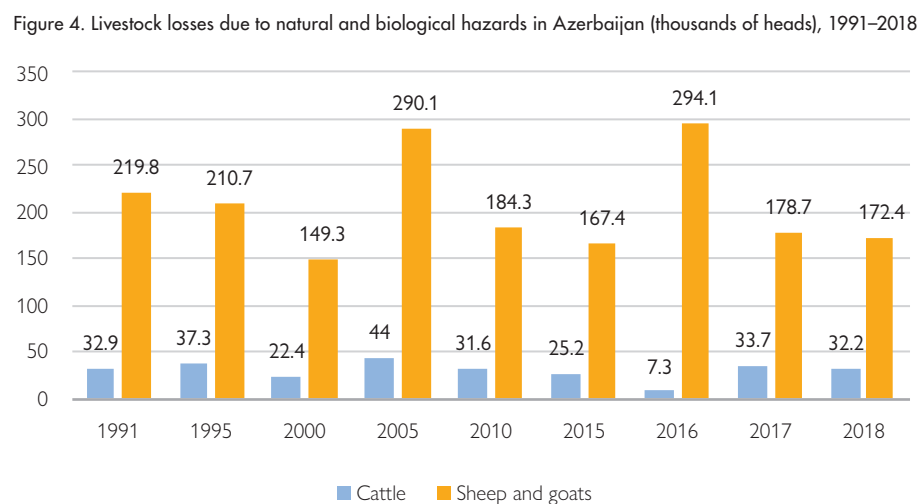
Animal diseases	Cattle	Small ruminants	Pig diseases	Horse diseases
vesicular diseases (all types of virus); anthrax (except skin); rabies; tuberculosis; brucellosis; leptospirosis; Q fever; trichinosis; schmallenberg virus; pasteurellosis.	Bovine spongiform encephalopathy (BSE); contagious bovine pleuropneumonia (CBPP); infectious nodular dermatitis (LSD).	Gat and sheep pox (GSP); infectious arthritis; Peste des petits ruminants (PPR); scrapie; bluetongue disease; braxy; Clostridial disease.	African swine fever (ASF); classic swine fever (CSF); foot and mouth disease (FMD); Teschen disease.	African swine fever (ASF); contagious equine metritis; encephalomyelitis; mango; glanders; equine influenza (horse flu); rhinopneumonitis.

Source: based on CoM, 2006.

Besides the above-mentioned diseases, the state also finances the removal of camel plague, avian influenza and Newcastle disease in birds, encephalopathy of fur-farming animals, rabbit and sea otter, rabbit haemorrhagic disease virus, haemorrhagic septicaemia of carp fish, and furunculosis of gold fish. In addition, when certain diseases with high economic impact appear, then the veterinary response is also funded by the government. In the case of the occurrence of previously unregistered and unnamed special dangerous diseases in the territory of Azerbaijan, all complex veterinary measures are carried out and paid for by the state budget (CoM, 2006).

Regarding economic loss in livestock due to natural hazards, the estimated numbers often vary. As a result, it is challenging to estimate the exact amount of damage and losses caused by natural hazards in agriculture. For example, research undertaken by Babakhanov (2004) estimates that in 2003 up to 70 000 cattle, sheep and goats, over 250 000 poultry, and thousands of bee colonies, were killed by natural hazards in the country.

However, according to official statistics, livestock losses due to natural and biological hazards reached 307 400 in 2003 (43 300 cattle and 264 100 goats and sheep). These figures were lower for cattle and higher for goats and sheep, namely 43 300 and 264 100, respectively, compared with the calculations of Babakhanov (SSC, 2020a). Official statistics provide general information about livestock losses. On the other hand, there is no detailed information on the number of cattle, sheep, and goats that are killed during natural disasters. Consequently, it is impossible to conduct detailed research and find the number of animal losses related to natural disasters. An overview of the livestock losses in Azerbaijan during the 1991–2019 period is shown in Figure 4.



Source: SSC, 2020a.

According to the ASA, which is under the Ministry of Agriculture (MoA), endemic infectious diseases, such as anthrax, are relatively stable in Azerbaijan (BBC, 2019). In 2014, there were ten cases of anthrax in animals, nine cases in 2015, ten in 2016, six in 2017, nine in 2018, and seven in 2019. Large-scale vaccination took place, for instance, during the first six months of 2019 – 2 530 204 cattle, 7 185 984 small ruminants, 81 363 whole-hoofed animals (e.g. horses), 4 105 pigs, and 320 camels, were vaccinated against anthrax (Trend, 2019).

One of the most common diseases in animal husbandry is brucellosis. According to the ASA, brucellosis was widespread in all regions of Azerbaijan in 2019 despite vaccination – a decrease in the number of infections has not been observed (Fed, 2019). Brucellosis vaccination is free and compulsory. It is currently being provided across the country by state veterinarians and is one of the priorities for the ASA in Azerbaijan. Other major diseases reported by herders include foot-and-mouth disease, and sheep pox (FAO, 2020b).

It should be noted that written and video materials about the protection of the plants, pests, and their control are published on the www.pest-atlas.az web portal, which was created by the MoA (AO, 2021). Furthermore, 'The Atlas of quarantine pests for the Republic of Azerbaijan' has also been published. The atlas includes information on pests that are dangerous for significant agricultural plants, and the microorganisms that are subject to internal and external quarantine measures (Atlas, 2018).

One of the gaps and challenges that should be addressed is the establishment of a concrete implementation mechanism regarding the legislative provision related to the financial compensation of damage incurred by individuals and legal entities as a result of animal culling during outbreaks. Another gap that needs to be bridged is the creation of an effective monitoring and animal and plant health control system in line with the World Organisation for Animal Health (OIE) standards, which was included in the action plan of the 2016 Strategic Road Map (SRM). According to the SRM, there is need to further the implementation of risk management, including enhancing preparedness for response with regard to animal and plant diseases and linking to the International Plant Protection Convention's international standards for phytosanitary measures. Azerbaijan participates in the Progressive Control Pathway for foot-and-mouth disease and Peste des petits ruminants (PPR) and is currently working on getting the country free of PPR.

Climate change

The country has eight climate patterns (Azerbaijan, 2020), although when temperatures, rainfall figures, and rainfall periods are compared, there are only slight variations. The largest difference can be observed in the extremes that occur in the mountains, where temperatures may drop to $-30\text{ }^{\circ}\text{C}$, with the lowest recorded temperature of $-42\text{ }^{\circ}\text{C}$. During the winter, the level of precipitation is relatively low; it varies from 15 mm to 30 mm per month, and in the interior a substantial amount falls in the form of snow. In January and February, rainfall mainly falls along the coast, while at the beginning of spring, rainfall increases inland. The wettest months are April, May, and June, with 40 mm to 100 mm of precipitation per month.

During the months of December to March, the average temperatures are $6\text{ }^{\circ}\text{C}$ to $10\text{ }^{\circ}\text{C}$ along the southern coast, and slightly below freezing in the mountains, with temperatures at night below $0\text{ }^{\circ}\text{C}$. Along the northern coast, the temperatures are around freezing, due to the influence of the Caspian Sea. Summers are generally dry, warm and sunny with average temperatures between $28\text{ }^{\circ}\text{C}$ and $32\text{ }^{\circ}\text{C}$. These temperatures, combined with temperatures at night of $20\text{ }^{\circ}\text{C}$ along the coast, low precipitation, and about 300 hours of sunshine per month (in summer), allow multiple cropping during the season.

Azerbaijan is vulnerable to the adverse effects of climate change. Data from Azerbaijan's National Hydrometeorology Department of the MoENR for the 1961–1990 period (baseline) showed that the mean temperature rose by $0.34\text{ }^{\circ}\text{C}$. The increase observed during the 1991–2000 period was $0.41\text{ }^{\circ}\text{C}$, showing three times faster increase in temperatures compared to the baseline (MoENR, 2010). Agricultural production and food systems are some of the main sources of greenhouse gas (GHG) emissions. These systems are particularly sensitive to climate and thus they should be a priority for climate-change adaptation and mitigation actions (FAO *et al.*, 2018).

Temperatures in Azerbaijan are projected to rise at a faster rate than the global average, with potential warming of $4.7\text{ }^{\circ}\text{C}$ by the 2090s over the 1986–2005 baseline, under a highest-level emissions scenario. The most significant warming is expected to occur during summer months, with average temperatures between July and September rising by almost $6\text{ }^{\circ}\text{C}$ by the 2090s (World Bank and ADB, 2021). The negative effects of climate change are already visible in Azerbaijan, with particularly severe implications for the water sector. Over recent years, drought and declining water resources have been observed, while many areas below sea level are getting flooded. All this reduces agricultural productivity in the country (UN, 2021). Over 10 years from 2000 to 2010, rainfall levels decreased by 9 percent across the country compared with 1990, with the highest decrease of 14.3 percent in the Kura–Araz lowlands (ADB, 2014). It is calculated that during the hottest period of the year, which are the months of June, July, and August, the amount of precipitation has decreased by 3 percent to 17 percent. The annual rate of temperature increase was $0.8\text{ }^{\circ}\text{C}$ to $1.4\text{ }^{\circ}\text{C}$ over the past 134 years, which translates to approximately $0.1\text{ }^{\circ}\text{C}$ per decade (IoG, 2020).

In Azerbaijan, the main glaciers are located in the Gusarchay Basin in the Greater Caucasus. Over the past 110 years, the glacier area has decreased from 4.9 km^2 to 2.4 km^2 . Natural water resources are also declining, with water shortages becoming more frequent (World Bank, 2014a). It is projected that the amount of water resources will decrease by 23 percent from 30.9 km^3 to 22.5 km^3 during the 2021–2050 period (Mammadov and Eyyubov, 2018). At the same time, the Institute of Geography has observed an average increase of 15 percent to 20 percent in the area of streams in river basins on the southern slope of the Greater Caucasus compared to 1961–1990 data (IoG, 2020).

Rising temperatures are projected to lead to significant changes in the altitudes at which winter wheat and vineyards may be planted in Azerbaijan by the end of the twenty-first century. In practice this will mean that vineyards, which are currently most productive at altitudes of 800 meters to 900 meters, will become productive at much higher altitudes, of 1 400 meters to 1 700 meters, whereas winter wheat production will become viable above its current range of 1 600 meters to 1 800 meters. This is likely to reduce Azerbaijan's productivity for winter wheat and vineyards, due to a shortage of suitable land at such altitudes relative to the area under cultivation at the current productive altitudes (World Bank and ADB, 2021). The adverse impact of climate change on agriculture is expected to result in a decrease in crop productivity by 15 percent to 20 percent per year. The anticipated increase in temperature will lead to an increase in the number of dry days (drought periods). At present, changes in temperature during the ripening period of fruit, the increase or decrease in temperatures, the increase in hot days and decrease in cold nights, increased rainfall and humidity, have negative impacts on

fruit production, such as the delay in the ripening of some fruit varieties. At the same time, with the increase in moisture and humidity, the outbreak of viral and fungal diseases may also increase. In general, these diseases emerge until early June, depending on soil-climatic characteristics, but due to the changes in climate, these diseases have become more prevalent, which in turn increases farmers' costs to adequately prevent, control and manage these pests and diseases (N. Nasirli, personal communication, 2020). For instance, there has been an increase in the number of locust attacks in the Zagatala rayon and the Shabran rayons. In addition, drought is one of the largest agricultural challenges in 2020. The ASA is helping farmers to reduce damage and losses to crops by using modern techniques to address these hazards (S. Mammedova, personal communication, 2020).

The air temperature rise is expected to double the recurrence of dry winds and increase the number of arid days per year to reach 50 to 60, which will be more prevalent in the warmest regions of the Kura–Araz lowlands during the cotton-growing season. Moisture deficiency is expected to increase by 350 mm to 450 mm during the vegetation period of cotton in the warmest and driest regions. In the traditional crop areas, the vegetation period of winter wheat is expected to fall by 13 to 40 days, while in the dry-farming zone, the yield of winter wheat is projected to decrease by 3 percent to 4 percent. The productivity of dry-farmed vines could decline by 10 percent (UNISDR and World Bank, 2009). According to a 2014 study conducted by the World Bank, it is expected that besides a gradual trend in rising temperatures, there will be an increase in water stress. It is expected that the yields of all key crops (for example, corn, cotton, grapes, potatoes, wheat) will decrease across the four agricultural regions and climate scenarios, except for pasture yields under rainfed conditions, which will substantially increase in all regions.

Farmers have observed an increase in the frequency of extreme heat events. Estimates of how precipitation will change in Azerbaijan are much more uncertain than those for temperature. However, it is likely that climate change will also increase the magnitude of biological hazards (World Bank, 2014b). Therefore, the development and implementation of climate-change adaptation and risk-reduction measures are needed to prevent and minimise the impacts on the sector (MoENR, 2015). With successful adaptation measures to climate change, it is possible to gain benefit from its negative consequences. Thus, the number of days when the average daily temperature is above ten degrees in spring has increased to 20 days and according to the region, consists of 170 to 245 days annually. The rise is observed mostly in mountainous terrain and as a result of this process, the boundaries of the hot zones have increased upwards by 150 meters to 200 meters. At the same time, this can lead to an expansion of the areas of hot and moderate climate zones, and a decrease in the area of cold zones in Azerbaijan and therefore, create opportunities for an increase in fields of heat-loving plants (Tagiyeva, 2021).

Agricultural and food security profile

Azerbaijan is a country with limited land resources – 55 percent (or 4.78 million ha) of Azerbaijan’s total area of 8.66 million ha are agriculture-oriented lands (utilized agricultural area). About 2.1 million ha of these lands are farmed; 1.45 million ha are irrigated. Specifically, per capita land area usable for agriculture is 0.46 ha, of which 0.19 ha is arable area, while the per capita area of pastures and hay fields is even less (SSC, 2020a). Permanent crops occupy an area of 260 300 ha, hay fields and pastures areas – 2.42 million ha (50.7 percent of utilized agricultural area). Furthermore, forest-covered areas were 1.04 million ha in 2019 (SSC, 2019d).

The agricultural sector in Azerbaijan is one of the most important economic sectors, and it will gain even more significance as a driver of economic growth in the regions. The government is promoting a policy of agriculture-led industrialization, which would be particularly focused on good governance, proximity to farmers, innovation and digitalisation (promoting e-agriculture and smart villages), value chain development, and export promotion (UN, 2021). During the 2000–2010 period, the share of the agricultural production and processing sectors as a proportion of GDP fell from 17.9 percent to 6.4 percent.

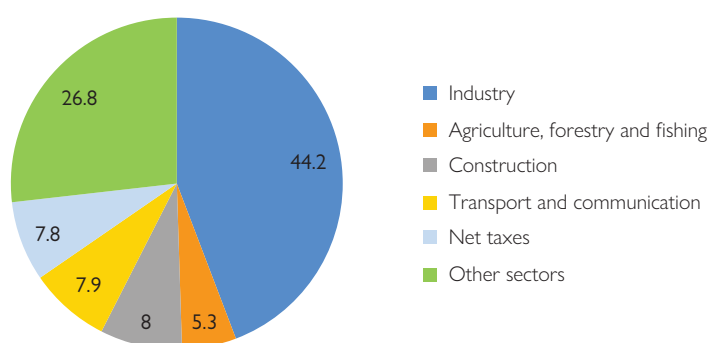
During the 2010–2015 period, the total share of the two sectors was 6.2 percent, of which agriculture contributed 5.2 percent and the agriculture processing industry 1.2 percent (SSC, 2019a). In 2018, agriculture accounted for about 5.3 percent of national GDP, as shown in Figure 5, but it also plays an important role regarding processing and other value-added related services connected to the industry.

Due to the effects of the COVID-19 pandemic, GDP decreased by 4.3 percent in 2020 in Azerbaijan. In the same period, non-oil and gas GDP decreased by 2.6 percent. The total volume of agricultural production increased by 2 percent. The total volume of agricultural products in actual prices was USD 4.96 billion, of which 52.2 percent was in the cattle-breeding and 47.8 percent in the plant-growing sector (SSC, 2020c). To mitigate the impact of COVID-19, the Government of Azerbaijan approved support programmes to provide direct financial assistance – of USD 1.5 billion overall in 2020 (Republic of Azerbaijan, 2021).

When analysing the gross output of agriculture, forestry and fisheries, the share of forestry and fisheries is relatively small in comparison to agriculture (which includes both crops and livestock). For instance, the gross output of agriculture was AZN 7.01 billion (USD 4.13 billion) in 2018, of which AZN 3.82 billion (USD 2.25 billion) was for livestock and AZN 3.19 billion (USD 1.88 billion) was for crops. At the same time, the value of gross output for the forestry, fisheries and hunting sub-sectors in 2018 was AZN 265 million or USD 156 million, of which 4.8 percent or AZN 13 million (USD 7.7 million) was for forestry, 95.1 percent for fisheries or AZN 252 million (USD 156 million), and a mere 0.1 percent or AZN 100 000 (USD 58 800) for hunting. Fisheries has been one of the fastest-growing agriculture sub-sectors in recent years. Compared with 2005, the total production of fisheries increased by 13.1 times in 2018 (SSC, 2019a). In general, the gross output of agriculture (livestock and crops) is 26.5 times higher than the gross output of forestry, fishing and hunting; thus 96.4 percent is covered by livestock and crop production, and 3.6 percent by the forestry and fisheries sub-sectors.

Azerbaijan has a total population of approximately 10 million people, with 44.8 percent under 30 years old. In 2019, 52.8 percent of the population lived in urban areas and 47.2 percent in rural areas. It is estimated that over 36 percent of the labour force (1.78 million people) is employed in the agriculture, forestry and fisheries

Figure 5. Gross domestic product by economic sector in Azerbaijan (%), 2018



Source: SSC, 2020a.

sub-sectors (SSC, 2020a). Fifty-seven percent of people in rural areas are self-employed (World Bank, 2019). More women (55.8 percent) than men (44.2 percent) were employed in agriculture, forestry and fishing in 2018 (SSC, 2019b). In 2018, the average monthly nominal wages of women and men in the agricultural sector were AZN 270.5 (USD 159) for women and AZN 284.1 (USD 167) for men. In 2019, the average monthly wage of women as a percentage of male average monthly wage in the agricultural sector was 85.4 percent. Furthermore, in Azerbaijan, female-headed farms account for about a quarter of the farms, and around 4 percent of the larger agribusiness enterprises are managed by female managers. Access to knowledge and technologies for female farmers is often limited due to their traditionally intensive family responsibilities at home (World Bank, 2018).

Since 1995, Azerbaijan's agricultural sector has experienced substantial structural changes, as a result of particular measures undertaken by the government, such as the upgrading of the agricultural sector to market principles, eliminating the collective farming system, and distributing lands, cattle and agricultural assets among farmers. With regard to agrarian reform, 2 239 collective and state farms, as well as other agricultural enterprises, were closed (SSC, 2011). The first stage of the reform process was completed in 2004, when agricultural land was privatized and 869 000 rural families received an average of 1.6 ha of land, generally divided into two to four parcels. This led to excessive land fragmentation and small farm sizes. Today, farm structures are characterised by a large number of small- and medium-sized family farms, which produce the majority of the agricultural products, and a relatively small number of corporate farms (there were 38 cooperatives in 2019). In 2019, 90.9 percent of gross output of agricultural production came from private owners, family peasant farms and households (SSC, 2021b). Pastures and forests have remained in state ownership.

Azerbaijan has climatic and physical conditions and characteristics that make it suitable for the production of a diverse range of agricultural products. Among the most important crops, in terms of volume, are cereals, potatoes, vegetables, and fruit. With regard to livestock products, milk, beef, sheep and goat meat, as well as poultry meat and eggs, prevail. Depending on the climatic conditions in the regions, crop and horticulture products are mainly produced through irrigation or are rainfed (Wageningen University & Research, 2017).

Factors that have a positive impact on agricultural development in the country include for instance the high number of sunny days and other favourable climate conditions. Irrigation plays an important role in agricultural production for the majority of agricultural lands, except in the foothills and southeastern part of the country. This is due to the arid and semi-arid climate and average annual rainfall that is between 200 mm and 300 mm, which means that agricultural production in these areas depend on irrigation. The agricultural sector has the potential to make significant contributions to growth and diversification of the economy, help to reduce poverty and create employment in the rural areas of Azerbaijan. Due to the agrarian reforms that have been implemented since 1995, agriculture has developed substantially. Recently, the government has made great efforts towards stimulating the growth of non-oil industries, including agriculture, by providing various agricultural subsidies – from oil-export revenues – to promote agricultural production. Due to these efforts, agricultural production in Azerbaijan has significantly increased during the past decade.

The most important food products produced in Azerbaijan for the internal market are: fruit (apples, peaches, kurma, pomegranates, grapes, apricot, and citrus); vegetables (tomatoes, cucumbers, cabbages, eggplants, sugar beet and onions); tubers (potatoes), and cereals (wheat). Azerbaijan exports fruit (apples, pomegranates, citrus), vegetables (tomatoes, cucumbers, cabbages), tubers (potatoes) and animal products (canned meat, eggs, wool and leather), and imports wheat, grapes (fresh and dry), maize, potato seeds, tobacco, strawberries, and citrus. Agricultural production is somewhat specialised by region. The northern region produces mainly apples, cucumbers, and tomatoes, and the southern region produces potatoes, tomatoes, cucumbers, and citrus, while the region around Baku specialises in livestock.

Upon Azerbaijan gaining independence as a state, and the transition towards a market economy, fundamental structural changes have occurred in agriculture. For instance, total farming areas were declining before 2000, but expanded again from 2000 as result of the development of the private sector and extensive production. The total farming area in 2019 increased by 17.4 percent compared with 1990, while the farming areas used to cultivate potatoes, vegetables and melon crops increased by 97.7 percent. The areas used for cereals and leguminous crops expanded by 83.8 percent in 2019 compared with 1990. However, the farming areas of

industrial crops and forage declined by nearly 53.8 percent and by over 29.8 percent, respectively, over the same period, as shown in Table 3.

Table 3. Farming area of different types of crops (thousands of ha and %), 1985–2019

Year	Total farming area	Cereals and leguminous crops		Industrial crops		Potato, vegetable and melon crops		Forage	
		Area, thousand ha	Share, %	Area, thousand ha	Share, %	Area, thousand ha	Share, %	Area, thousand ha	Share, %
1985	1 371.3	494.0	36.0	318.3	23.2	70.2	5.1	488.8	35.6
1990	1 462.5	583.4	39.9	282.1	19.3	74.7	5.1	522.3	35.7
1995	1 207.9	609.4	50.5	227.0	18.8	49.4	4.1	322.1	26.7
2000	1 041.5	648.2	62.2	118.2	11.3	136.1	13.1	139.0	13.3
2005	1 327.9	802.3	60.4	132.0	9.9	179.7	13.5	213.9	16.1
2010	1 583.9	968.0	61.1	52.6	3.3	178.8	11.3	384.5	24.3
2015	1 585.4	952.1	60.1	38.7	2.4	166.0	10.5	428.6	27.0
2016	1 628.3	997.5	61.3	73.6	4.5	163.1	10.0	394.1	24.2
2017	1 665.7	977.2	58.7	180.9	10.9	151.5	9.1	356.1	21.4
2018	1 738.0	1 083.1	62.3	159.0	9.2	149.7	8.6	346.2	19.9
2019	1 717.1	1 072.3	62.4	130.2	7.8	147.7	8.6	366.9	21.4
2019/2018, %	-1.2	-1	x	-18.1	x	-1.3	x	6	x
2019/1990, %	17.4	83.8	-	-53.8	-	97.7	-	-29.8	-

Source: SSC, 2020a.

It should be noted that the share of industrial crops started to increase after the state adopted support measures for the sector, as indicated by the share of these products amounting to only 2.4 percent in 2015 and increased to 10.9 percent in 2017. The trends observed in the farming areas of perennial plants are not different from those of annual plants. Specifically, the area of directly marketable (to consumer market) fruit and berry fields rapidly expanded after 2005. These areas had expanded by 54.7 percent in 2019 compared with 1990. In return, due to a sharp decline in both industry-oriented grape and tea plantations, their areas decreased by 91 percent compared with 1990.

After the decision of the leadership of the former USSR on “measures to combat alcoholism and drunkenness” in 1985, a major blow was dealt to viticulture and winemaking, one of the leading sectors in the Azerbaijani economy. Before long, the fruit-bearing vineyards were destroyed, productivity fell sharply, and the viticulture and winemaking complex fell into crisis (SPDV, 2011). Since 1988, as a result of the aggression from the neighbouring country, 43 000 ha of vineyards were destroyed in Azerbaijan. Restoration of grape plantations commenced after 2005, while the restoration of tea plantations initiated after 2011. In 2019, the total area of tea plantations decreased by 90.7 percent compared with 1990 (Table 4). The decrease in tea plantations was due to the privatization of a tea factory and the decision to import raw material from outside the country (R. Huseynov, personal communication, 2021).

The liberation of the occupied territories of Azerbaijan in 2020 will lead to an increase in agricultural land – 680 000 ha of the liberated territories are suitable for agriculture, of which 380 000 ha are hayfields and pastures, and 300 000 ha is arable land. This shows that there is great potential for increasing the sown area in Azerbaijan over the coming years (A. Veliyev, personal communication, 2020).

As mentioned earlier, the most important crops cultivated in Azerbaijan are cereals (wheat, barley, maize), potatoes and vegetables, and fruit, while livestock production includes milk, beef, sheep, goat and poultry meat, as well as eggs. In particular, the production of cereals and dried pulses, vegetables, fruit, grapes, cotton, tobacco, meat, and cocoons for silk production, increased in 2018. In comparison to 1990, the production of sunflower seeds, sugar beet, watermelons and melons, and potatoes, significantly increased in 2019 (Table 5).

Table 4. Farming area of perennial crops (thousands of ha and %), 1985–2019

Year	Fruit and berry fields		Grape fields		Tea plantations	
	total	of bearing age	total	of bearing age	total	of bearing age
1985	138.2	105.9	267.8	218.8	13.4	7.3
1990	136.0	113.5	181.4	156.1	13.3	7.9
1995	117.8	103.9	97.7	94.7	11.4	9.1
2000	83.1	76.7	14.2	13.9	5.4	5.4
2005	93.0	84.3	9.6	7.2	2.9	2.9
2010	127.7	102.5	15.4	11.2	0.6	0.6
2015	144.1	123.4	16.1	13.5	1.0	0.5
2016	171.8	133.1	16.0	13.9	1.0	0.7
2017	186.4	138.3	16.1	14.1	1.1	0.6
2018	199.7	147.5	16.1	14.4	1.1	0.7
2019	210.4	154.2	16.1	14.5	1.1	0.6
2019/2018, %	+5.4	+4.5	0	+0.7	0	-14.3
2019/1990, %	+54.7	+35.9	-91.1	-90.7	-91.7	-92.4

Source: SSC, 2020a.

Table 5. Production volumes of agricultural products (thousands of tonnes and %), 1990–2019

Year	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2019/2018, %	2019/1990, %
Cereals and dried pulses	1 413.6	921.4	1 540.2	2 126.7	2 000.5	2 999.4	3 065.1	2 928.8	3 309.2	3538.5	+6.9	+150.3
Potato	185.2	155.5	469.0	1 083.1	953.7	839.8	902.4	913.9	898.9	1004.2	+11.7	+442.2
Vegetable	856.2	424.1	780.8	1127.3	1 189.5	1 275.3	1 270.6	1 405.6	1 521.9	1714.7	+12.7	+100.3
Watermelons and melons	67.5	41.9	261.0	363.8	433.6	484.5	464.8	438.1	401.9	447.6	+11.4	+563.1
Fruit	367.4	324.4	477.0	625.7	729.5	888.4	882.8	954.8	1 010.8	1099.7	+8.8	+199.3
Grapes	1 196.4	308.7	76.9	79.7	129.5	157.1	136.5	152.8	167.6	201.8	+20.4	-83.1
Sugar beet	–	28.1	46.7	36.6	251.9	184.3	312.6	410.1	277.2	218.5	-21.2	+677.6 (2019/1995)
Cotton	542.9	274.1	91.5	196.6	38.2	35.2	89.4	207.5	233.6	295.3	+26.4	-45.6
Tobacco	52.9	11.7	17.3	7.1	3.2	3.5	3.6	5.3	6.3	6.0	-4.8	-88.7
Tea	30.7	9.41	1.08	0.74	0.54	0.58	1.02	0.78	0.87	0.93	+6.9	-34 times
Sunflower for seed	0.6	0.7	3.7	16.1	15.5	18.4	16.7	29.8	23.6	33.7	+42.8	+56 times
Meat (in slaughtered weight)	175.5	109.4	153.6	198.0	244.9	298.6	302.2	316.8	326.0	335.7	+3.0	+91.3
Milk	970.4	826.5	1 031.1	1 251.8	1 535.8	1 924.5	2 009.9	2 024.1	2 080.4	2150.8	+3.4	+121.6
Egg, million units	985.3	455.8	542.6	874.6	1 178.6	1 552.9	1 609.8	1 714.0	1 676.2	1827.1	+9.0	+85.4
Wool (in physical weight)	11.2	9.0	10.9	13.1	15.6	17.0	16.7	16.0	15.8	16.1	+1.9	+43.8
Cocoons, tonnes	4 902.0	1 100.0	66.6	78.0	6.0	0.236	70.8	245.2	513.9	643.7	+25.3	-86.9

Source: SSC, 2020a.

In general, agricultural productivity is relatively low in Azerbaijan. Climate-smart agriculture and precision technologies can increase agricultural productivity by mitigating and reducing production risks due to climate change and variability impacts, such as the increase in the frequency of drought and water shortages, sea-level rise, excessive soil salinity, rising temperatures, as well as the increase in pest and disease outbreaks (World Bank, 2018).

Due mostly to the extensive expansion of the livestock farming area, the number of both cattle and small ruminants showed a steady growth after 1995, and similarly with poultry after 2000. As a result, the number of cattle and small ruminants increased in 2020 by 44.5 percent and 45 percent, respectively, compared with 1991. There was also an increase of 10.9 percent in the number of poultry between 1991 and 2020, as shown in Table 6.

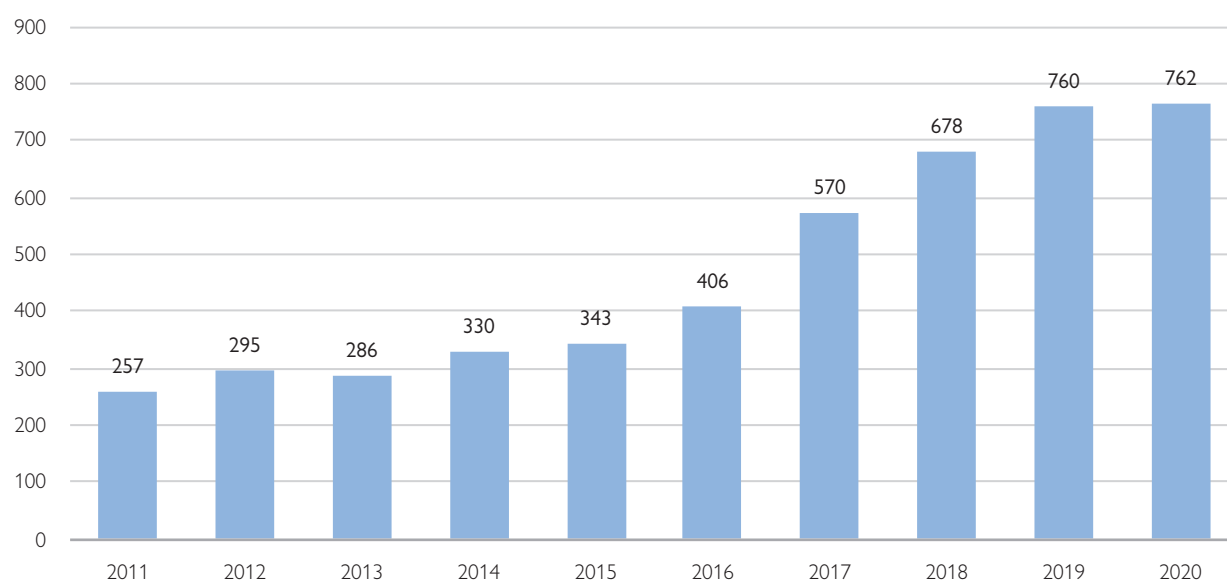
Table 6. Number of livestock by all categories of farms, 1 January 2020

Years	Beef cattle	including		Sheep and goats	including		Pigs	Poultry	Bee families
		Cattle	Buffaloes		Sheep	Goats			
1991	1831.6	1541.1	290.5	5418.7	5224.1	194.6	156.7	29050.8	73.8
1995	1632.8	1340.9	291.9	4557.6	4373.1	184.5	33.4	14417.8	53.5
2000	1961.4	1664.4	297.0	5773.8	5279.7	494.1	19.7	14711.1	54.0
2005	2315.8	2007.2	308.6	7488.8	6887.4	601.4	22.9	18253.3	95.7
2010	2582.4	2299.7	282.7	8331.2	7723.9	607.3	5.3	22041.6	164.0
2015	2697.5	2445.2	252.3	8645.4	7987.3	658.1	6.1	28851.7	243.0
2016	2708.3	2466.0	242.3	8677.1	8025.6	651.5	5.2	27559.4	251.2
2017	2698.5	2484.3	214.2	8614.8	7966.5	648.3	4.4	28009.5	260.1
2018	2673.0	2476.3	196.7	8454.3	7821.0	633.3	4.9	30473.4	271.7
2019	2658.8	2482.6	176.2	8304.1	7681.7	622.4	5.5	30498.4	501.0
2020	2646.6	2484.1	162.5	7990.6	7385.8	604.8	5.7	32230.2	542.8
2020/2019, %	-0.5	+0.1	-7.8	-1.4	-1.4	-1.3	+3.6	+5.7	+8.3
2020/1990, %	+44.5	+61.2	-44.1	+51.1	+45.0	+215.4	-27 times	+10.9	+635.5

Source: SSC, 2020a.

In terms of trade, the volume of agricultural products exported from Azerbaijan increased during the 2011–2020 period, as shown in Figure 6.

Figure 6. Export of agricultural products (in USD million), 2011–2020



Source: SSC, 2021a.

Agricultural products accounted for 41 percent of Azerbaijan's non-oil exports, and the export of these products increased by 0.3 percent in 2020. Table 7 provides information on the quantity and value of the main exported agricultural products in 2011 and 2020.

Table 7. Azerbaijan's agricultural exports in 2011 and 2020

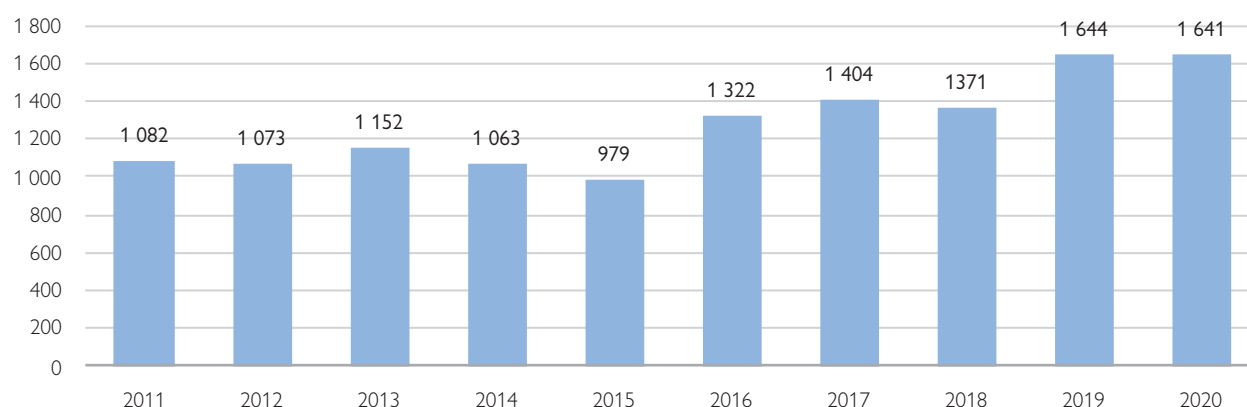
Name of the products	2011		2020		Percentage change comparison 2011–2020	
	Quantity (in thousand tonnes)	Value (in USD million)	Quantity (in thousand tonnes)	Value (in USD million)	Change in quantity (%)	Change in value (%)
	A	B	C	D	$C-A/A \times 100$	$D-B/B \times 100$
Vegetables	157.6	78.3	301	254.8	+91	+225.4
of which:						
Potato	91.7	29.7	81.4	33.8	-11.2	+13.8
Tomato	42.9	31.8	187.7	201.5	+337.5	+533.6
Fruit	177.2	153	305.8	352.9	+72.6	+130.7
Tobacco	2.8	9.3	4.8	11.9	+71.4	+28
Cotton yarn	2.6	4.9	97.6	131.9	37.5 times	26.9 times
Raw leather	x	11	x	8.3	x	-24.5
Livestock products ⁷	x	0.9	x	4.4	x	+388.9
Total	x	257.3	x	762.3	x	+196.3

Source: SSC, 2021a.

Azerbaijan is a net food importing country. Against the backdrop of integration into the global market, the import of various agriculture and food products increased in 2020 compared to 2011, due to increased consumer demand (Figure 7). The share of food products as a proportion of the total imports of Azerbaijan was 11.1 percent in 2011 and 15.3 percent in 2020. Wheat is the main imported food product of Azerbaijan and mainly comes from the Russian Federation. The share of wheat in Azerbaijan's total food imports was 26.1 percent in 2011 and 18 percent in 2020. Furthermore, the share of particular food products as a proportion of the total food imports of Azerbaijan in 2020 was as follows:

- fruit and vegetables – 12.4 percent;
- meat – 4.8 percent;
- butter – 5.1 percent;
- tea – 3.4 percent;
- rice – 2.4 percent.

Figure 7. Import of food products (in USD million), 2011–2021

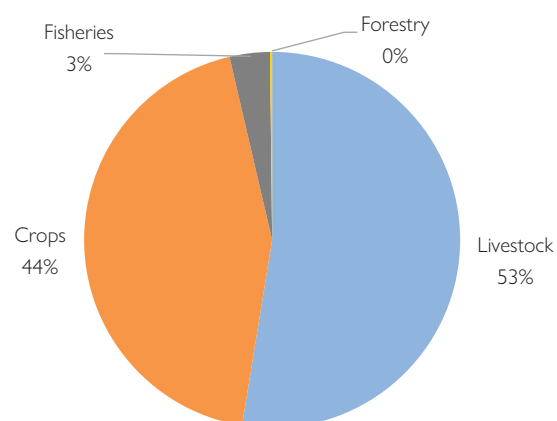


Source: SSC, 2021a.

⁷ Livestock products include the cost of meat, milk and cream, wool, natural honey, eggs, raw silk, and live animals.

In the coming years, the government's aim is to decrease the import of food products and to increase agricultural exports. However, in order to achieve this aim, the intensification of agricultural production should be considered because the country has limited land resources. After the agrarian reforms that have occurred since 1995, there has been a significant increase in livestock production. Crop production as a proportion of total agricultural production declined from 54 percent in 1995 to 44 percent in 2018, as shown in Figure 8, but this is explained by the higher growth rate of livestock production compared to crops, as well as the extensive expansion of cereal-growing areas, which has relatively lower added value and resulted in the production decline of other products with higher added value (SSC, 2019d). The Government of Azerbaijan is focusing its programmes on farmers who are involved in ensuring the food security of the country, thereby ensuring an uninterrupted food supply for the population (Republic of Azerbaijan, 2021).

Figure 8. Share of crops, livestock, forestry and fisheries in Azerbaijan, 2018



Source: SSC, 2020a.

Since the restoration of state independence and transition towards a market economy, the production of agricultural products has grown substantially, including a significant increase in the production of agricultural processing products. Despite that, the ratio of import volume to domestic production of some products is relatively high, due to the demand by consumers and the processing industry for raw materials. As a result, Azerbaijan has a relatively high level of self-sufficiency with respect to certain food products. For instance, it is close to meeting domestic demand for mutton, melon crops, as well as for potatoes and grapes, while it is producing more than the domestic demand for eggs, vegetables, fruit and berries, as shown in Table 8.

Table 8. Level of food self-sufficiency (%), 2010–2019

Products	2010	2015	2019
All types of meat and meat products	87.7	94.7	82.5
Beef and beef products	95.5	91.8	86.1
Mutton and goat meat and meat products	99.7	99.3	97.6
Pork and pork products	19.7	17.8	5.3
Poultry meat and poultry meat products	70.6	98.6	74.6
Milk and dairy products	70.4	84.3	86.3
Egg	97.9	99.7	101.8
Fish and fish products	76.6	77.6	82.2
Grains (excluding rice)	56.5	64.5	67.3
Wheat	48.9	54.8	57.2
Barley	87.7	95.1	100.2
Maize	64.5	54.1	80.0
Leguminous	65.8	69.3	76.1
Vegetables of all kinds	97.6	103.4	112.0
Tomato	106.0	113.7	132.5
Potato	100.5	89.1	87.8
Market garden crops	100.0	100.0	100.8
Fruit and berries	107.9	113.7	123.1
Walnut and hazelnut	121.6	132.5	138.2
Grapes	90.4	93.1	94.3

Source: SSC, 2019c; SSC, 2020d.

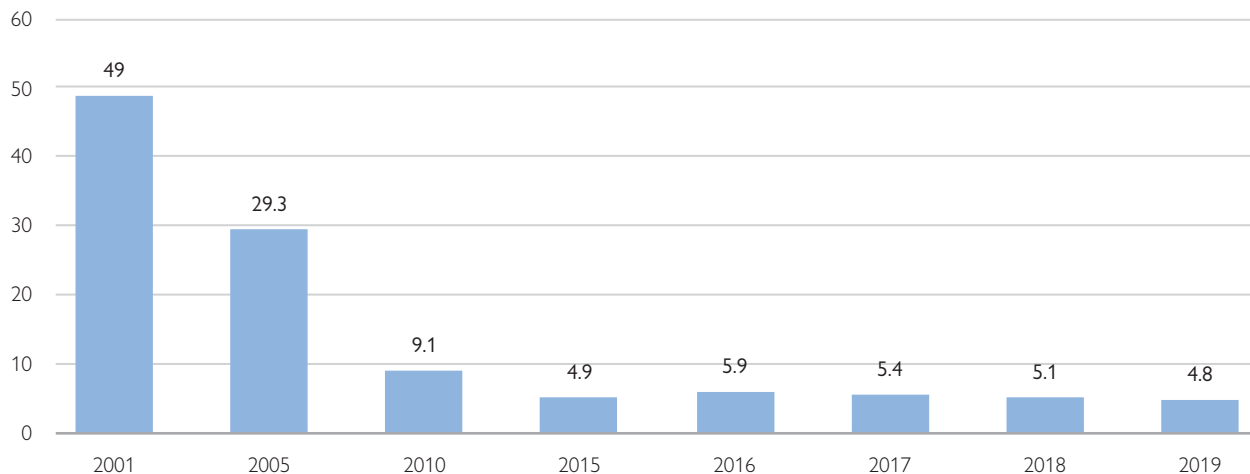
Food security

According to the State of Food Security and Nutrition in the World report by FAO, the major risk for food security in Azerbaijan is climate-sensitive production and yields (FAO *et al.*, 2018). To reduce this risk to Azerbaijan's food security, it is necessary to improve coordination between the MoA, the MoES, and the MoENR. For example, in 2020, due to the drought, 100 000 ha of grain fields in the Aran region of Azerbaijan were damaged, grain production declined by 8 percent and grain producers lost more than AZN 20 million. If there is good coordination between institutions, it would be possible to reduce the negative impact of natural disasters on food production. Of course, both climate variability and extremes have implications for agriculture and food production. As a result, all dimensions of food security and nutrition are likely to be affected, including food availability, access, utilization and stability (FAO *et al.*, 2018).

Over recent years, Azerbaijan has improved its position in the field of food security. Positive trends were observed between 2014 and 2019 with regard to the consumption of food products. Azerbaijan ranked 53 out of 113 countries (score 64.8/100) in the Global Food Security Index in 2019. Significant improvements were recorded in terms of food affordability and availability. However, Azerbaijan ranks 86th for the quality and safety of food, particularly due to indicators related to diet diversification, nutritional standards, and micronutrient availability (GFSI, 2019).

Azerbaijan's GDP grew by an annual average of 11 percent during the 2000–2015 period. This impressive growth was accompanied by poverty reduction through higher social transfers and a dramatic rise in real wages, although the welfare gaps across the regions were not completely narrowed (World Bank, 2019). In the 2000s, poverty was mainly a rural phenomenon, but the share of the population living in poverty decreased from 49 percent in 2001 to 4.8 percent in 2019 (4.7 percent for men, and 5 percent for women), as shown in Figure 9. In urban areas, the number was 4.5 percent, and in rural areas 5.2 percent (Republic of Azerbaijan, 2021). At the same time, the proportion of the population living below the international poverty line (USD 1.90/day) in Azerbaijan has been zero percent since 2015 (Republic of Azerbaijan, 2021).

Figure 9. Poverty rate in Azerbaijan (%), 2001–2019



Source: SSC, 2020c; SSC, 2020b.

Declining exports that were the result of a decrease in oil prices in 2015 had some impact on the economy. However, this did not lead to a significant rise in the country's poverty rate due to timely and appropriate preventive measures that were taken. The SRM mechanisms aim to achieve a reliable food supply for all sections of the population and will ensure poverty reduction (SRM, 2016). Within the context of the implementation of the SRM, the aim is to gradually eliminate poverty after 2025 and expand the access to quality education and health services. Poverty will be addressed through two approaches: increasing the number of decent jobs; and providing targeted social support through salary and other income forms for people who cannot afford to pay for the most basic needs. In addition, the aim is to increase gradually the minimum wage, towards 60 percent of the average wage, which will decrease the number of working poor.

In terms of malnutrition, children in Azerbaijan have relatively low levels of wasting and underweight, but stunting is more prevalent, especially in some regions. It is estimated that in 2006 the level of chronic malnutrition or stunting was 25.1 percent, while acute malnutrition or wasting was 6.8 percent, and 7.7 percent of children under five years of age were underweight. Overweight in the same age group was at 13 percent, which indicated that Azerbaijani children were both underweight and overweight – the so-called ‘double burden’ of malnutrition (AzNS, 2013). According to the 2020 Sustainable Development Report, the prevalence of stunting in children under five years of age had decreased somewhat to 18 percent, and the prevalence of wasting had declined to 3.1 percent in 2013 (Sachs *et al.*, 2020). Breastfeeding and complementary feeding practices were clearly sub-optimal and could potentially explain the stunting prevalence observed (AzNS, 2013). While significant progress has been made in the area of nutrition in recent years, high rates of anaemia are still present in the country – 38.2 percent among women of reproductive age, and 39.5 percent among children between the ages of 6 and 11 months (UNICEF, 2021).

The prevalence of undernourishment was 2.5 percent among adults in 2017 in Azerbaijan (Sachs *et al.*, 2020). Obesity is an emerging challenge in Azerbaijan, especially since it constitutes a major risk factor for non-communicable diseases. Under-nutrition was apparent in pregnant women, but in non-pregnant (especially older) women, the prevalence of overweight and obesity was higher than for men (AzNS, 2013). In 2016, World Health Organization (WHO) data showed that 53.6 percent of the adult population were overweight, and 19.9 percent were obese. The prevalence of overweight was 52.9 percent for males and 54.1 percent for females, while the proportions of men and women with obesity were 15.6 percent and 23.6 percent (WHO, 2020).

Institutional structure of disaster risk reduction in agriculture

International conventions

In the area of disaster risk reduction (DRR), Azerbaijan carries out its work within the international frameworks of the 2030 Agenda for Sustainable Development Goals (SDGs), the Paris Agreement under the United Nations Framework Convention on Climate Change (UNFCCC), and the Sendai Framework for Disaster Risk Reduction 2015–2030 (PMoRAUNOIO, 2018).

Azerbaijan joined the UNFCCC in 1995 and ratified the Kyoto Protocol in 2000. The Doha amendment adopted for the second phase of the implementation of the Kyoto Protocol obligations was approved by the parliament of Azerbaijan on 14 April 2015 and signed into law by the president. The Paris Agreement was signed in April 2016 and ratified by the parliament on 28 October 2016. According to the agreement, Azerbaijan presented its support to the Secretariat of the National Stability Convention, and as a contribution to global climate change mitigation initiatives, the country aims to reduce its GHG emissions by 35 percent by 2030 (AO, 2021).

In addition, it is important to recognise the Global Platform for Disaster Risk Reduction, of which Azerbaijan is part of, as a platform for viewing and analysing the progress that Azerbaijan has made since 2015 regarding the Sendai Framework for Disaster Risk Reduction 2015–2030, which was adopted on 18 March, 2015 at the World Conference on Disaster Risk Reduction held in Sendai, Japan. Azerbaijan adopted the Sendai Framework in 2015 but has not ratified it. The Government of Azerbaijan attaches great importance to the high-level relations with the United Nations Office for Disaster Risk Reduction (UNDRR, formerly UNISDR) to implement the Sendai Framework. For that reason, starting in 2016, the Government of Azerbaijan began more active cooperation with UNDRR (then UNISDR) in order to expand its group of partners in the field of DRR. The Ministry of Emergency Situations (MoES) of Azerbaijan is the focal point to deal with issues of DRR in the country. Within this context, the Permanent Mission of Azerbaijan in Geneva has been successfully coordinating activities between UNDRR and the MoES to further carry out DRR and management measures in the country. Azerbaijan works closely with the UNDRR Support Group and participates in all of the meetings organized by UNDRR in order to assist the country in the process of implementation, follow-up, and review of the Sendai Framework.

National legal framework

The following laws constitute the specific legal framework in relation to DRR in the agricultural sector in Azerbaijan:

Article 112 of the Constitution of the Republic of Azerbaijan (1995) states that “In the event of natural disasters or epidemic, epizootic, severe ecological and other disasters; the commission of acts directed at violating the territorial integrity of the Republic of Azerbaijan, insurrections or *coups d'état*; mass disorders accompanied by violence; other conflicts threatening the lives and security of citizens, or the normal activities of state bodies, the President of the Republic of Azerbaijan shall declare a state of emergency in separate regions of the Republic of Azerbaijan and shall, within 24 hours, submit the appropriate decree to the Milli Majlis of the Republic of Azerbaijan for approval”⁸ (CoA, 1995).

The Law of the Republic of Azerbaijan on Emergency Situation (LoES, 2004) aims to implement the state law to protect the rights and freedoms of citizens, foreigners and non-citizens within the context of an emergency, and to create an enabling environment in which the local government and self-governing bodies are able to adequately execute their roles and responsibilities as part of the constitutional structure of Azerbaijan. There is no mentioning of the specific types of emergencies, nor the various sectors that may be impacted.

The Water Code of the Republic of Azerbaijan (WCoAR, 1997) states that measures should be prepared to reduce the adverse impacts of flooding. It is the state’s responsibility to identify and implement these flood prevention and mitigation measures. It does not include specific institutions, their roles, or specific responsibilities or activities; it is under the president’s responsibility.

The Forest Code of Azerbaijan Republic (FCoAR, 1997) defines the legal basis for the regulation of forest relations in the territory of the country, the use, protection, restoration and increase of the ecological and conservation potential of forests. In the code, it states that forests must be protected from fire, illegal destruction, pests and diseases. In Azerbaijan, the Forest Fund can be used for the implementation of DRR activities, such as re/afforestation, wild fire management, and so on.

The Land Code of the Republic of Azerbaijan (LCoAR, 1999) regulates land relations in the country based on the different implementation of land ownership practices, fulfilment of obligations of landowners, users and tenants, protection of land rights, efficient use and protection of land, increase and restoration of land fertility, and environmental and sustainable preservation. The code states that landowners must take action in the areas of protection of soils from water and wind erosion, flooding, drought, salinisation, desertification, among others. It does not, however, include land use and land-use planning within the context of natural hazards, such as flooding and landslides.

The Law of the Republic of Azerbaijan on Hydrometeorological Activity (LoHA, 1998) defines the legal basis for conducting surveys, research and active work on the atmospheric processes, data preparation, use and protection of hydrometeorology and environmental monitoring of the country. It also outlines the specific institution responsible for these activities, which is the National Hydrometeorology Service (NHS). The hydrometeorological responsibilities, in particular those relevant for agriculture, include, for example, the following:

- Undertake observations and conduct studies as well as prepare and transfer information to the relevant authorities in case of natural hazard-induced disasters and man-made disasters.
- Prepare forecasts and notify relevant authorities about the onset, frequency and severity of (re) occurring hydrometeorological hazards.

⁸The Milli Majlis is the National Assembly, which is the legislative branch of government in Azerbaijan.

- Provide to relevant state authorities, private sector, mass media and public real-time information and forecasts on potential natural hazards that may occur.
- Carry out active work on atmospheric processes and protection of state observation network.
- Determine the condition and development of natural hazards, man-made hazards, and to study the impact of these processes on the soil, water, organisms and the environment.
- Undertake actinometric and agrometeorological observations to research the radiation balance of the surface, to determine the degree of atmospheric transparency, aerological and ozonometric measurements, as well as assess the impact of meteorological conditions on the development of agricultural crops.
- Collect, analyse and store meteorological, agrometeorological and solar radiation data.
- Conduct studies on the status of the Caspian Sea (lake), rivers, lakes, water reservoirs and other water bodies and provide to state authorities, mass media, private sector and public information and warnings about natural hazards related to the country's water resources, such as flooding, high waves, etc.
- Undertake observations and conduct research on the physical and chemical composition of air, water and soil.

The Law of the Republic of Azerbaijan on Melioration and Irrigation (LoMI, 1996) establishes the legal basis for activities in the areas of melioration and irrigation. The executive bodies of Azerbaijan have the authority to organize the restoration of melioration and irrigation systems that are damaged or destroyed by a natural hazard. However, the different types of natural hazards are not mentioned, nor the relevant institutions involved in this or their specific roles and responsibilities, except for the state company Amelioration and Water Management OJSC.

The Law of the Republic of Azerbaijan on Environmental Protection (LoEP, 1999) defines the legal, economic and social basis of environmental protection. The aim of the law is to prevent the negative effects of economic and other activities on biodiversity and ecosystems and preserve these systems. This law regulates the interaction of nature with society in order to improve the quality of the environment, ensure rational use and restoration of natural resources, strengthening the legislation and legal regulations in the area of environmental protection. Disasters can result in the destruction of the ecological balance and can adversely affect environment for humans, flora and fauna. In accordance with the relevant legislation, the state of emergency is applied when natural hazard-induced disasters or major environmental and other accidents occur. However, the specific types of these hazards and the different institutions that would be involved, as well as their specific roles and responsibilities, are not included in the law.

The Law of the Republic of Azerbaijan on Ecological Security (LoES, 1999) regulates relations in the field of ecological safety while legal entities and individuals, state and local authorities, and their officials, execute their activities. The objective of this law is to determine the legal basis for the protection of the environment, including air, space, water, soil, flora and fauna, as well as humans and society against natural and anthropogenic hazards. However, the different types of hazards, including the link to climate change and the potential impact of these external shocks and stresses to the various sectors, including agriculture, are not mentioned.

The Regulations on the Azerbaijan State System for Prevention of Emergency Situations and Activities in Such Cases (CoM, 1992), approved by the Resolution of the Cabinet of Ministers of the Republic of Azerbaijan No. 239 of 30 April 1992, defines the main tasks, organization and rules of operation of the Azerbaijan state system for the prevention of emergencies and activities in such cases. The state system was established to prevent emergencies, to ensure the safety of the population and reduce the damage to the national economy (CoM, 1992). However, this regulation does not meet modern realities and needs to be revised.

Concepts and strategies on disaster risk reduction

Azerbaijan is currently in the process of establishing its national DRR strategy until 2030, aimed at increasing the country's resilience to disasters. The MoES organized the first online meeting of the coordination group 'Development of the National Strategy in connection with the Sendai Framework for Disaster Risk Reduction' on 24 June 2020 (MoES, 2021a). Representatives of 18 organizations (MoE, MoENR, MoA, Food Safety Agency, etc.) are members of the coordination group. During its first meeting, the group discussed and made proposals for the development and implementation of unified disaster risk management at all levels in accordance with the Sendai Disaster Risk Reduction Program for 2020–2030, as well as the adoption of a unified disaster resilience policy and plan (ANAS, 2021). The MoES in Azerbaijan is currently setting up a National Strategy Coordination Group which will compile the necessary information for the national strategy (Republic of Azerbaijan, 2021). The Government of Azerbaijan has strengthened national capacities for disaster preparedness and risk reduction. Efforts are underway to ensure a systematic approach in identifying and assessing the risks and minimising the socioeconomic impacts of disasters (Huseynov, 2019b). As disaster risks need to be managed at local, national and international levels in order to reduce the likelihood and severity of the potential impacts of disasters, it is therefore necessary to make changes in the development of strategies and planning processes at these levels. The national strategy for DRR that is currently being developed (the draft will be ready by the end of 2021) will include activities in line with the four priority areas outlined in the Sendai Framework. It will help to coordinate DRR activities horizontally and vertically across sectors and across the various levels, and support the mainstreaming in different government areas and in the country's relevant national development and sectoral policies, plans and strategies. The national strategy will help to enhance the country's continuing work towards achieving the global targets that have been set out in the Sendai Framework (Huseynov, 2019b). The strategy will include, among other elements, components such as a risk assessment to quantify and understand the risks associated with natural hazards and their impacts; and an EWS, which will enable national and local governments and communities to take appropriate prevention, mitigation and preparedness measures towards building community resilience to disasters. In this respect, national meteorological and hydrological services provide vital contributions so that the adverse impacts of disasters can be reduced (WMO, 2012).

DRR strategies are essential to ensure that increasingly frequent hazardous events do not push countries and communities into poverty loops (FAO, 2017). Even though Azerbaijan does not yet have a national DRR strategy, it has the National Security Concept of the Republic of Azerbaijan, which was approved by Instruction No. 2198 of the President of the Republic of Azerbaijan on 23 May 2007. One chapter of the concept is titled 'Emergency management, protection of environment and public safety', which covers the emergency management of environment-related disasters caused by natural hazards and human-induced technological accidents, which may endanger domestic security through impacting humans, property and infrastructure, etc. Within this context, Azerbaijan has established a special Ministry of Emergency Situations (MoES), which is responsible for the formulation and coordination of DRR measures, including for early warning and for emergency response and recovery activities. Disaster prevention, mitigation and preparedness to natural hazards are among the key issues for the government, including the safeguarding and preservation of the country's rich flora and fauna. Particular focus is on tackling environmental pollution as well as controlling the use of plant-protection measures, such as chemical pesticides and conducting timely quarantine inspections for early pest identification and treatments to ensure food security.

Policy makers in Azerbaijan have made a strong commitment to diversify the economy away from oil, and thus promote non-oil sectors. The government has launched a number of state programmes to address some of the non-oil sectors' challenges. For the agricultural and rural sector, the current overarching strategic documents are presented below.

The State Program on the socio-economic development of the regions of the Republic of Azerbaijan for 2019–2023 is a fourth in a series of state programmes for socioeconomic development.⁹ The ongoing programme includes measures for the development of agriculture and protection from flooding in each district of Azerbaijan from 2019 to 2023. According to Huseynov (2019c), all four state programmes for socioeconomic development have given priority to ensuring sustainable health and resilience of the natural environment in order to support local communities that depend on natural resources for their livelihood and survival. In addition, many efforts have been made to maintain ecological harmony, adapt to climate change, ensure clean air and water for local communities, and continue protection of the natural environment. Furthermore, implementation of green activities has increased since the beginning of the first programme in 2004. For example, more than 133 000 ha of land was used for tree farming and forestation, and irrigation systems in rural areas have been improved. Land and water resources are also used more rationally (Huseynov, 2019c).

State Program on reliable food provision of the Republic of Azerbaijan for 2008–2015. The following tasks are established within the programme:

- increase food production in the country;
- provide population with safe and qualitative food products;
- provide risk management in the field of food supply;
- develop institutional food supply system and improve entrepreneurship.

As a result of the purposeful measures implemented in the framework of the state programme, a legislative framework on the establishment of food reserves to prepare for emergency cases was developed. A flexible mechanism to prevent emergency cases was also established. Modern irrigation systems have been installed on farms. As a result of the implementation of the programme until 1 January 2016, the food provision of the population has improved (MoE, 2021a). Information on the targets of the programme and their achievement are provided in Annex II.

The Strategic Road Map of production and processing of agricultural products in Azerbaijan Republic (SRM, 2016) consists of nine strategic objectives and 36 priority implementation areas. The SRM stresses that people’s food security will be ensured by developing the agrarian sector of the country until 2025 (SRM, 2016). The long-term capacity of self-reliance of the country will be strengthened by increasing the possibilities for local production, trade turnover and product storage, as well as establishing an institutional and operational management system, for example, information and EWS. In addition, the management of adverse impacts of natural hazards on agriculture as well as the creation of a weather control system for agriculture will be important and is identified under the seventh strategic target, titled ‘environmental protection, sustainable use of natural resources and management of effects of natural factors on agriculture’.

The first priority of the SRM is to “develop mechanisms for reduction of negative impact of climate change and other natural factors on agriculture”, which includes an action plan that will assess the effects of climate change and promote the application of climate-smart agriculture practices, such as the development of crop varieties resistant to biotic and abiotic stresses. In addition, a modern system of agrometeorological support to agriculture will be established, which will be used for cooperation with farms, insurance companies, and scientific research organizations working in agriculture. Under this priority, required measures will be taken to reduce the negative effects of climate change on agriculture and the application of climate-smart agriculture principles will be promoted for sustainable development of the agricultural sector in the country. The following actions are being carried out (implementation period 2017–2018) (CAERC, 2020):¹⁰

⁹The previous state programmes for socioeconomic development covered the periods 2004–2008, 2009–2013, and 2014–2018. The first programme focused on support to industries in non-oil sectors by creating sustainable development strategies, advancing social infrastructure and services and providing better living standards to locals by increasing opportunities for employment. The second programme continued the support to the non-oil sector and, in addition, aimed to diversify the economy in order to create sustainable and balanced regional development and sustainable social and economic resilience (Huseynov, 2019c). According to Huseynov (2019c), the two programmes were considered to be successful and thus the third programme was launched to accelerate further the policy reforms as well as to construct stronger all-encompassing development strategies.

¹⁰The final monitoring and evaluation report of the Strategic Road Map will be published in January 2022.

- Action 1: Assessment of climate-change effects on agriculture and the preparation of an adequate adaptation plan. The main executor of this action is MoENR, with the support of MoA. The action has been partially executed.
- Action 2: Improvement of the agrometeorological database. The main executor of this action is MoENR, with the support of MoA. It has been partially executed.
- Action 3: Creation of a weather control and hail protection system for agriculture, such as the use of anti-hail nets. The main executor of this action is MoENR, with the support of the Ministry of Finance and MoA. It has been fully executed.
- Action 4: Improvement of a legislative framework and the strengthening of coordination between relevant institutions. Within the context of this action, a working group will be created to coordinate the activities between relevant agencies, which will also take into account the actions that will help to help minimise the impact of climate change on agriculture. The main executor of this action is MoENR, with the support of MoA and the Property Issue State Committee (PISC). The action has not been executed.

The second priority of the SRM is to “improve mechanisms for environmental protection in the agricultural sector”, which focuses on environmental protection, including research on the reduction of carbon dioxide emissions in crop and animal husbandry, the introduction of non-waste production technologies in agricultural processing, and the minimisation of other harmful effects of agricultural production on the environment. The establishment of field-protective forest windbreaks will be supported under this priority, where economically advantageous plant species (for example almonds, pistachio, pomegranate, mulberry, figs, and apricots) will be considered for green belts. The development of proposals is planned for the implementation of appropriate measures to preserve agrobiodiversity, protect biodiversity and create a gene bank. There is also a need to develop greenhouses and to explore the possibility of using alternative energy sources for their heat generation and provision. The following actions are being carried out under this priority (CAERC, 2020):

- Action 1: Development of up-to-date indicators on conformity of agricultural production to environmental standards and conduct assessment. The main executor of this action is MoA, with the support of MoENR. The implementation period covers 2017–2018 and the action has been fully executed and the indicators are in use.
- Action 2: Reduction of carbon dioxide emissions in the agricultural sector. The main executor of this action is MoENR, with the support of MoA. The implementation period covers 2017–2018. The action had not been executed in 2019.
- Action 3: Development of field-protective forest windbreaks. The main executor of this action is MoENR, with the support of MoA. The implementation period covers 2017–2020 and the action has been executed.
- Action 4: Application of an economic/cost-benefit approach to environmental protection. The main executor of this action is MoENR, with the support of MoA. The implementation period covers 2017–2020 and the action has been partially executed.
- Action 5: Preservation of agrobiodiversity. The main executor of this action is MoENR, with the support of MoA. The implementation period covers 2017–2020 and the action has been partially executed.
- Action 6: Assessment of the capacity to transition towards a ‘green economy’ in the agricultural sector and use of alternative energy sources to heat greenhouses. The main executor of this action is the State Agency for Alternative and Renewable Energy Sources (SAARES), with the support of MoA and MoENR. The implementation period covers 2018–2020. The execution status of the activity has not yet been evaluated.

The third priority of the SRM is to “improve mechanisms for sustainable use of agricultural lands and water resources”, which focuses on intensifying measures to improve the efficiency of the use of agricultural land, the use of salinised lands, to preserve the vegetation cover of pastures and hayfields, and improve the availability of grasses for feed. In addition, it also focuses on the expansion of activities such as the regular and comprehensive monitoring of land resources, the preparation of agrochemical soil maps to provide a detailed overview of the chemical makeup of croplands, and the promotion of the use of technology and methods that reduce land degradation for the development of agriculture. The SRM highlights the importance of carrying out melioration and reclamation of salinised, submerged and contaminated lands to ensure their rehabilitation. Achieving the sustainable use of water resources, along with land resources, is also highly relevant because in dry years, the amount of water per person is less than 1 000 m³.

Moreover, the extent of mineralization of the Kura and Araz rivers – Azerbaijan’s main waterways – has increased and the rivers have been contaminated with heavy metals and other toxic substances. The flow of rivers has significantly changed due to anthropogenic influences, and some of the rivers dry up in summer, which leads to flooding in spring and winter when their flows are restored. The irrigation canals, collector-drainage networks and their hydraulic structures, which were constructed between the 1950s and 1980s, have been exposed to physical wear and tear and have become obsolescent. At present, 6.06 billion m³ of water is used in Azerbaijan for the supply of irrigation water for agriculture.

In order to achieve the sustainable use of agricultural lands and water resources, a feasibility study, as part of the road map, has been conducted for the actions listed below. The study has been completed by the Amelioration and Water Management Open Joint Stock Company (AWM), MoA and MoENR. The result of the study is positive, a number of envisaged actions are implemented under this priority, such as (CAERC, 2020):

- Action 1: Establishment of a mechanism for the assessment of environmental impacts of land (use) changes. The main executor of this action is MoENR with the support of MoA and the PISC. The implementation period covers 2017–2018 and it has been partially executed.
- Action 2: Ensure efficient land use and implementation of measures for land reclamation. The main executor of this action is the AWM with the support of MoA, MoENR and PISC. The implementation period covers 2017–2020. The execution status of the activity has not yet been evaluated.
- Action 3: Conduct agrochemical analysis of soil. The main executor of this action is MoA with the support of PISC. The implementation period covers 2017–2020 and the action has been partially executed.
- Action 4: Improvement of pasture management. The main executor of this action is MoA with the support of MoENR and PISC. The implementation period covers 2017–2020 and the action has been partially executed.
- Action 5: Reduction of water losses in the supply to consumers. The main executor of this action is the AWM with the support of MoA. The implementation period covers 2017–2020. The action had been partially executed in 2019.
- Action 6: Improvement of ameliorative condition of irrigated lands and prevention of re-salinisation. The main executor of this action is AWM with the support of MoA and PISC. The implementation period covers 2017–2020 and it has been partially executed.
- Action 7: Assessment of water resources and dissemination of information. The main executor is AWM with the support of MoA and MoENR. The implementation period covers 2017–2018, but the action has not been executed.
- Action 8: Improvement of water use in arid regions. AWM is the main executor of this action, with the support of MoENR and MoA. The implementation period covers 2017–2020 and it has been partially executed.
- Action 9: Management of mountain streams. Measures will be taken for effective management of flood waters of mountain streams and minimising the devastating effects on rural areas and the environment. Due to the importance of the annual increase in irrigated croplands, additional ponds and lakes will be created to ensure the efficient use of flood waters. The main executor of this action is AWM with the support of MoENR and MoA. The implementation period covers 2017–2020 and the action has been partially executed.

One of the main objectives of the Azerbaijan 2020: Look Into The Future development concept (2012) is to achieve sustainable socioeconomic development from an ecological point of view (CoD, 2012). This concept has been adopted by the president, while the Ministry of Economy is responsible for its accomplishment. The measures will be implemented to protect the country’s biodiversity, particularly within the context of the negative impact of oil extraction on the environment and to protect effectively its existing natural resources. In addition, the contamination with chemical, radioactive and other harmful substances of a large amount of Azerbaijan’s freshwater reserves in neighbouring countries are causing issues in the supply of drinking water to the country’s population.

Azerbaijan 2030: National Priorities for Socioeconomic Development (NP, 2021). This document was approved by a Decree of the President of the Republic of Azerbaijan dated 2 February 2021. It aims to achieve the country’s goals in the new strategic period, and to form an appropriate policy and reform framework. National priorities stressed that global economic realities, in addition to the goals set for the new stage of development, require definitions of the country’s long-term development perspective, of the main pathways to socioeconomic

development, and of corresponding national priorities (NP, 2021). According to this document, over the next decade, the following five national priorities for country's socioeconomic development should be implemented:

1. a steadily growing, competitive economy;
2. a dynamic, inclusive society based on social justice;
3. areas of modern innovations and competitive human capital;
4. the great return to the territories liberated from occupation;
5. a clean environment and country of green growth (NP, 2021).

The above-mentioned national priorities are of particular importance for the fulfilment of the country's commitments arising from Transforming our world: the 2030 Agenda for Sustainable Development of the United Nations. They stressed that in the coming years, it will be necessary to reduce the environmental risks brought on by economic and demographic growth. For this purpose, it is necessary to increase the number of green spaces throughout the country (NP, 2021). The Cabinet of Ministers has to prepare and submit to the president by October 2021 the draft Strategy of Socioeconomic Development in 2021–2025, in accordance with the national priorities.

Action Plan to Ensure Efficient Use of Water Resources (APEEUWR) in 2020–2022. This action plan was approved by a Decree of the President of the Republic of Azerbaijan dated 27 July 2020. According to the action plan, the MoENR will identify, increase the risk of desertification-sensitive areas with signs of desertification, create a database, map and integrate them into an “electronic agriculture” information system in 2020–2022. The MoA is also to implement measures to prevent desertification (construction of amelioration and irrigation systems, preference for adapted plant species and planting subsidies, application of innovative solutions, etc.) (APEEUWR, 2020).

The Hydrometeorological Improvement Program in the Republic of Azerbaijan 2004–2010 includes the MoENR and among the achieved goals of the programme were:¹¹

- increase in the quality of hydrometeorological services;
- improvement in hydrometeorological management projects regarding the efficient and optimal use of water resources and adequate assessment of water resources;
- improvement of the forecasting system and development of EWS for hydrometeorological events (for example whirlwind, fluvial, hail, flooding, rainstorms);
- enhancement of hydrometeorological data dissemination to population and expansion of the scope of hydrometeorological data collection;
- advancement of the climate monitoring and assessment system, integration of that system into the Global Climate Monitoring System and the Global Surface Hydrological Network;
- development and modernization of the hydrometeorological network;
- develop a large-scale map (1:50 000) using GIS that covers important water bodies, as well as a hydrometeorological model for each river basin.

The State Food Safety Program in the Republic of Azerbaijan for 2019–2025 aims to provide the country's population with safe and high-quality food products, increase the transparency and efficiency of the food safety system and bring it in line with international requirements. This state programme outlines that in 2020, the Food Safety Agency and MoA will develop mechanisms for managing animal and plant health risks in Azerbaijan. International experience in this area will be studied and considered by the Food Safety Agency. According to the state programme, the Food Safety Agency, MoES, the Ministry of Internal Affairs, the Ministry of Health, and MoA will together with the State Customs Committee prepare a plan to conduct food safety assessments in crisis situations as well as to outline the administration, warning procedures for emergency situations, and crisis management in 2020. 84 percent of the measures envisaged in this programme were implemented in 2019 (CAERC, 2021).

¹¹Final monitoring and evaluation of the implementation of the programme has not been carried out.

The State Program on Poverty Reduction and Sustainable Development in the Republic of Azerbaijan for 2008–2015 aims to achieve targets set for sustainable environmental management, with activities to be implemented under the following priorities:

- sustainable management of forest resources;
- sustainable management of water resources;
- management of land resources and prevention of desertification;
- sustainable management of biodiversity;
- sustainable management of the atmosphere;
- expansion in the use of alternative energy sources;
- comprehensive waste management;
- overall management of mountainous and coastal ecosystems;
- enhancement of the legal and regulatory framework, monitoring systems and resources for environmental management;
- increasing environmental education and awareness-raising.

Under this programme, the Government of Azerbaijan planned to create a relevant insurance system to mitigate the effect of natural hazard-induced disasters on manufacturers of agricultural products and financing part of insurance activities through the budget. The successful implementation of the measures in the fields of education, health, environmental protection, and other fields considered in the programme plays an important role in decreasing poverty. As a result of the implementation of the programme, by 1 January 2016 the Government of Azerbaijan had achieved the following goals: the poverty rate in the country decreased by 4.9 percent, improvement in the environmental situation and ensuring sustainable management of the environment, promoting and protecting gender equality, continuing institutional reforms and improving good governance (MoE, 2021b).

According to the state programme on poverty reduction and sustainable development, flood prone areas were defined and mapped, and regular forecasts are prepared and submitted to the relevant authorities (SPPRSD, 2008). Under ‘sustainable management of the atmosphere’, an action plan will be designed and implemented to reduce the amount of GHG emitted into the atmosphere and to reduce adverse impacts of climate change on the country’s ecosystems and the economy.

Moreover, climate change and global warming are increasing the frequency and severity of climate-related hazards, including flooding of rivers that inundate entire villages and cities, and avalanches, etc. As all of these factors are directly affecting the country’s economy and society, in the design, planning and implementation of infrastructure projects, these factors should be taken into account and ensure that risk-proofed and climate-resilient infrastructure is established. This document does not include specific prevention and management activities to reduce the impact of disasters on the population and economic sectors of the country. It does emphasize that flood-prone areas will be identified and monitored, and regular forecasts issued by the relevant organizations.

MoA has prepared the 2021–2024 Sectoral Strategic Plan on the agricultural section of the state budget of the Republic of Azerbaijan. One of the key areas of the strategic plan is “environmental protection, sustainable use of natural resources and climate change impact management on agriculture” (Republic of Azerbaijan, 2021). The following measures will be implemented:

- Create mechanisms to reduce the negative impact of climate change and other natural factors on agriculture.
- Improve mechanisms to reduce the negative impact of agriculture on the environment.
- Improve mechanisms for the sustainable use of agricultural lands and water resources.
- Develop environmentally clean agricultural production.

At the same time, MoENR and MoA developed and approved the Joint Action Plan to Support Green Agriculture (2020–2023).

Institutional disaster risk reduction framework for agriculture

The following sections describe the institutional DRR framework in Azerbaijan. It includes the State Commission of Emergency, which was initially approved with the Resolution of the Cabinet of Ministers of the Republic of Azerbaijan in 1992, established in 1995 and eventually abolished in 2006.

The main function of the commission subordinated to the Cabinet of Ministers included planning, development and implementation of activities in order to prevent emergency situations, to reduce the damage caused by severe accidents, disasters caused by natural hazards, epidemics, epizootics and epiphytotics, to increase the reliability of business in potentially dangerous production areas, and to ensure the sustainability of potential emergency situations in national economic and social areas. At the time of its establishment, the Department of Emergency Situations in the Cabinet of Ministers of the Republic Azerbaijan was the secretariat of this commission.

The chair of the commission was the deputy prime minister of Azerbaijan. The following members were represented in the commission: chairman of the Committee on Amelioration and Water Management, the minister of communications, the minister of agriculture, the minister of health, the minister of finance, head of Executive Power of Baku, head of the department of Territorial Development of the Cabinet of Ministers, first deputy minister of internal affairs, deputy defence minister, chairman of the State Hydrometeorology Committee, chairman of the State Committee for the Control of Safe Works in State Industry and Mining, chairman of the State Geology and Mineral Resources Committee, president of "Azərenerji" State Company, head of State Railway Department, first vice-president of "Azəravtoyol" State Company, chairman of the State Veterinary Committee, president of State Insurance and Commerce Company, chief of the Civil Defence Headquarters, chairman of the Executive Committee of the Azerbaijan Red Crescent Society. At present, a national DRR platform is absent in Azerbaijan.

The institutions that are responsible for the management and implementation of different components of DRR are:

- Cabinet of Ministers;
- Ministry of Emergency Situations;
- Ministry of Ecology and Natural Resources;
- National Hydrometeorological Department under the Ministry of Ecology and Natural Resources;
- Ministry of Agriculture;
- Amelioration and Water Management OJSC;
- Food Safety Agency;
- Local executive authorities.

The functions of the Cabinet of Ministers of the Republic of Azerbaijan on prevention of emergencies and actions in such cases are as follows: to increase the industrial safety of ministries and departments, government agencies, companies, associations, and other organizational and production structures; to prevent accidents and tragedies, epidemics and epizootics of natural and environmental disasters; to coordinate activities aimed at acquiring, mitigating and eliminating their consequences. The Cabinet of Ministers is also responsible for organizing international cooperation on mutual assistance in preventing and mitigating the consequences of emergencies.

The Ministry of Emergency Situations was established in 2006 to strengthen coordination in the country to prevent emergencies and which was the result of merging several agencies into a single ministry. At present, MoES includes the following agencies, services and departments:

- State Fire Protection Service
- State Fire Control Service
- Civil Defence Troops
- State Material Reserves Agency
- State Agency for Control over Construction Safety
- State Agency for Safe Working in Industry and Mountain-Mine Control
- State Water Reserves Agency
- State Agency for Regulation of Nuclear and Radiological Activity
- State Service for Control on Small Capacity Vessels and Rescue in Water Basins
- Special Risky Rescue Service
- Caspian Basin Accident-Rescue Service
- Crisis Management Centre
- 'Isotop' Special complex
- Operation-Investigation Department
- Capital Construction Department
- Material-Technical Supply Department
- Aviation Detachment
- Academy of the Ministry of Emergency Situations
- Sport-health club
- Medical service.

MoES is a central executive body, which has responsibilities in the following areas:

- civil defence;
- protection of the population from natural (geophysical, geological, meteorological, hydrological, maritime hydrological contingencies, natural fires) and man-made (arson, explosions, collapse of buildings and constructions, chemical, biological and radiological hazards, accidents in electric power supply system, vital utilities, waste treatment facilities, breakdowns in hydrodynamic installations, oil and gas production units, main pipelines, transportation and traffic accidents) disasters;
- prevention of emergency situations and elimination of their consequences;
- fire security;
- safety of people in water basins;
- security of smaller vessels' operations;
- technical safety in industry and mountain-mine works;
- safety in construction;
- drafting of government policy and regulations on the state material reserves funds;
- management, coordination and supervision on the areas mentioned above;
- protection of strategic facilities, objects and installations in cases of occurrence of emergency situations;
- formation of the state reserve funds, such as the state grain fund (stocks) (MoES, 2019).

Within the framework of a solid national emergency management system, MoES is responsible for arranging and implementing civil defence functions and coordinating with national and local executive authorities in order to protect the population and property in the case of emergency situations such as fires, including wild and forest fires, safeguard human lives in water bodies, as well as prevent and manage emergency situations. Furthermore, the Ministry is involved in the monitoring of safety of industrial activities, mining and construction works, establishing the state reserve stocks (funds), securing strategic facilities affected by natural and anthropogenic disasters or terrorist attacks, as well as providing prompt response and humanitarian assistance in case of emergency situations. The Ministry also implements normative regulations and exercises control and inspections within the scope of its authority as specified in the relevant legislation (MoES, 2020b). In addition, MoES is responsible for publishing the Emergency Atlas of the Republic of Azerbaijan. The purpose of publishing the atlas is to address rationally the issues of efficient exploitation of natural resources, protection of the population, settlements, industrial and agricultural enterprises, other infrastructure facilities from emergencies, and solving the development of productive forces (human labour and means of labour) in a reasonable way. Additionally, this atlas will contribute to a systematic scientific study of natural and destructive events that have occurred and may occur in the territory of Azerbaijan, and a comprehensive assessment of the damage and risks which these events can cause (OoP, 2016).

The State Grain Fund is under MoES. Grain from this fund is used to meet the needs of consumers in the event of an emergency as well as to meet international commitments. The decision to use grain from the fund is made by the Cabinet of Ministers based on the agreed proposals of MoES, MoE and MoA (CoM, 2009). The release (sale) of the grain from the fund is based on market prices. At the same time, the government aims to keep the price of grain at an acceptable level to ensure that grain in the domestic market is not sold at lower prices. If the use of grain from the fund is to prevent a sharp rise in prices on the domestic market, grain may be traded at lower prices. In this case, the selling price should be determined by a decision of the Cabinet of Ministers.

The Ministry of Ecology and Natural Resources (MoENR) of Azerbaijan, established in 2001, is a government agency within the Cabinet of Ministers of Azerbaijan in charge of regulation of the activities with regard to ecology, environmental protection and use of natural resources in Azerbaijan (MoENR, 2020). The subordinate agencies under the Ministry include the following:

- Forest Development Service
- Biodiversity Conservation Service
- National Hydrometeorological Service
- State Environmental Security Service
- National Environmental Monitoring Department
- Department of the Caspian Integrated Environmental Monitoring
- State Environmental Expertise Agency
- National Geological Survey
- Azerbaijan Landscaping and Landscape Construction Open Joint Stock Company
- Geodesy and Cartography LLC
- Hazardous waste LLC
- Transport and Complex Mechanical Supply Department
- Regional bodies and local departments of the Ministry of Ecology and Natural Resources.

The National Hydrometeorology Service (NHS), under the MoENR, was established in 2001 (DoP, 2001). The basis of the national hydrometeorological system is the observation network, which consists of 11 regional hydrometeorological enterprises operating in the country to carry out hydrometeorological observations and implement operative hydrometeorological activities in the regions. In 2019, MoENR carried out structural reforms, which led to the setting up of the NHS on the basis of the National Monitoring Department, the National Hydrometeorology Department, the Scientific Research Institute of Hydrometeorology, the Centre for Metrology and Standardization and the Centre for Environmental Laboratory (DoP, 2019). Moreover, the Emergency Response Centre, which was under the MoENR and mainly focused on controlling and managing forest fires, was abolished in 2018.

The Ministry of Agriculture has undergone various changes since it was established in 1918. It has been re-arranged according to the Order of the President of the Republic of Azerbaijan dated 3 October 2014 (MoA, 2020). MoA is a central executive body that implements state policy in the agrarian sector, including the production and processing of agricultural products, the provision of essential services to producers, veterinary and plant protection and quarantine, as well as the efficient use of land. There are various agencies that are serving under MoA, which include the Agency for Agrarian Services (ASA), Agro Credit and Development Agency, Agro Research Centre, Agrarian Science and Innovation Centre, State Seed Fund, Republican Artificial Insemination Centre, Agrarian Procurement and Supply OJSC, Azeragrar State Production and Processing Union LLC, State Agro Trade Company LLC, Green Park Azerbaijan LLC, and the Regional Agricultural Development Centres. The Ministry coordinates and oversees the activities of these services (MoA, 2020). In 2021, the structure of MoA was improved. The Agrarian Training Center was established on the basis of Beylagan, Ganja, Kurdamir, Guba, Lankaran, Salyan, Sheki and Tartar regional agrarian science and innovation centres (CoM, 2021). The Center for Animal Health and Veterinary Services was established on the basis of the Republican Expedition against Epizootics and Zoonotic Diseases, the State Veterinary Department of the Railway, and district (city) veterinary departments. The Center for Plant Protection and Fumigation (neutralization) was established on the basis of the Republican Center for Plant Protection, Fumigation (neutralization) Center, and Jangi pesticide landfill, which is not included in the structure of MoA. In order to enlighten the farms, it was decided to publish the Agroinfo newspaper under the auspices of the Agrarian Research Centre (ARC). The Center for Agrarian Science and Innovation was renamed the Agrarian Innovation Center (CoM, 2021).

The Agency for Agrarian Services (ASA) under the Ministry of Agriculture is responsible for implementing veterinary and phytosanitary services, while extension services from MoA are largely non-existent. Most of the extension and advisory support institutions in Azerbaijan were established under various donor-driven projects (FAO, 2020b). The MoA has focused on risk management and with the aim to develop a risk management system, a Risk Management Committee within the Ministry was established in 2019. The main function of the committee is to coordinate the operational risk management activities of the structural units of the Ministry and to implement a unified risk management policy. Part of the risk management system that is currently being developed includes the work undertaken by the Centre of Agrarian Research, which will help enable the system to coordinate effectively various emergency response activities and measures in the agricultural sector that this centre will support and focus on.

The main mission of the state company Azerbaijan Amelioration and Water Management OJSC is to manage the country's water resources and to provide various sectors of the country's economy, especially agriculture, with irrigation water. It oversees the distribution of irrigation water and monitors its efficient use. In addition, it aims to improve land reclamation, carry out relevant activities to reduce the impact of flooding, through the discharge of water from rivers and filling and discharging of the water reservoirs, and ensure scientific and technical development in these above-mentioned areas. The Azerbaijan Amelioration and Water Management OJSC cooperates with other relevant state bodies to implement the management, use and protection of the country's water resources.

The Ministry of Economy has prepared proposals for the establishment of the Food Safety Commission in Azerbaijan, which is currently still under discussion. The main aim of the commission is to identify immediate response measures in the event of emergency situations and establish a monitoring and evaluation food safety system. The commission would operate in the Cabinet of Ministers and is expected to include representatives from MoES, MoA, MoENR, Ministry of Labour and Social Policy, MoE, Ministry of Finance, Ministry of Health, State Customs Committee, and Food Safety Agency.

The Food Safety Agency of the Republic of Azerbaijan is a central executive authority which executes the following functions: legal regulation of food safety standards (preparation and adoption of sanitation norms and hygiene standards), assessment of risks, official registration of food products and their packaging materials, issuance of food safety certificates for export of food products, state control over food safety and protection of rights of consumers at all stages of the food supply chain, including food production, supply, packaging, storage, transportation and trading (including import and export operations), and the implementation and regulation of state policy in the above-mentioned areas (FSA, 2019).

The Agrarian Research Centre (ARC) under MoA was established in 1962 on the basis of the Research Institute for Agricultural Economics. It has the status of a public legal entity according to a 2018 decree (DoP, 2018) and is planning to focus on the implementation of DRR related measures, including disaster risk assessments, preparedness plans, post-disaster needs assessments, and damage and loss assessments (ARC, 2020).

The State Commission on Climate Change was established by the Order of the President of the Republic of Azerbaijan dated 30 April 1997 (OoP, 1997b). This commission is headed by the deputy prime minister (OoP, 1997b). A working group was also created within the commission. However, there is no active action of the commission and the working group. There is no report of any meetings of the commission or working group over the past five years (2015–2019). Many ministers and chairmen of the committee appointed to the commission have already been dismissed. The president of Azerbaijan appointed new members of the commission on 11 March 2020 (OoP, 2020).

The 2012 regulations on the Local Executive Authorities (DoP, 2012) indicate that one of the duties of the heads of these local governments is to monitor and ensure the safety of the population, animals, etc., and protection of state, municipal and private property in the event of natural and man-made disasters and to provide assistance to those affected. It also coordinates the emergency activities implemented by the relevant state bodies to ensure uninterrupted operation of these agencies. In addition, the head of the local executive authority develops and establishes a training and material base for civil defence, natural and human-induced emergencies in enterprises and organizations, regardless of ownership and subordination. It should be noted that the Commission of Emergency Situations is currently operating in the regions and is headed by one of the deputy chief of the Local Executive Authorities.

Early warning systems

Early warning systems (EWS) are highly important to enhance the ability to prevent, mitigate and be better prepared for the adverse impacts of natural hazards on many things, including agriculture. Effective EWS are typically comprised of four main elements: risk knowledge, monitoring and warning service, dissemination and communication, and response capacity (FAO, 2018). The following types of observations are carried out by the NHS – meteorological, hydrological, hydrometeorological, agrometeorological, marine, aviation meteorological, radiometeorological, ozonometric, aerological, actinometry and thermal balance as well as for specific natural hazards, including for flooding and snow avalanches.

One of the primary missions of the NHS and the World Meteorological Organization (WMO) is to contribute to the protection of people's lives and livelihoods by providing early warnings for climate-related hazards and disseminating related information to reduce risks (WMO, 2012). The NHS at the MoENR develops national weather forecasts in Azerbaijan. The country became a member of WMO in 1993 (RoMM, 1993), and it has established hydrometeorological stations, which are equipped with modern devices and equipment. Automated exchange of hydrometeorological data at national, regional and international level is provided. The quality of hydrometeorological service provided to various sectors of the economy has also been improved.

The activities of the NHS are as follows:

- ensure the organization, conduct of hydrometeorological observations, preparation and distribution of forecasts and warnings;
- define the hydrometeorological regime and climatic features of the territory of Azerbaijan, including the Caspian Sea;
- study, analyse and forecast hydrometeorological events and processes in Azerbaijan, including high atmospheric layers;
- prepare programmes and projects to develop hydrometeorology;
- carry out active work on the hydrometeorological and geophysical processes with the aim to reduce and regulate the damage to the population and economy.

The NHS prepares the following hydrometeorological forecasts:

- short-term (daily) and medium-term (48, 72 hours) forecasts for the seven regions of the country and Baku;
- monthly weather forecast for seven regions of the country;
- six short-term (half-day, 24-hour) and medium-term (48, 72 hours) hydrometeorological estimates for the Caspian Sea;
- information on natural hazards such as storms, whirlwinds, hail, drought;
- medical meteorological forecasts;
- daily forecast about the flow of large reservoirs (Mingachevir, Shamkir);
- two to three-day weather forecast for Kur-Surra, Shirvan and Salyan settlements that are located below the Kura river;
- ten-day forecast for river water levels;
- monthly forecast for rivers;
- seasonal flow forecast for large reservoirs;
- spring-to-summer (April–June) forecasts about the excess of water.

Daily and expected weather forecasts as well as flooding, fluvial and actual wetland data are regularly published on the MoENR website (www.eco.gov.az). The two and three-day weather forecasts, as well as alerts on sudden weather changes and warnings about expected fluvial-related hazards, are sent to government agencies, relevant institutions, and in particular to MoES. Since 2001, the National Hydrometeorology Department of

MoENR has established radiological meteorological stations and in 2012, the Center of Radiometeorology and Aerology was established at MoENR. The stations of the centre carry out radiometric observations of hydrometeorological processes, for example lightning and thunderstorms and hazards related to extreme weather events. This information then is used for short-term weather and flood forecasting.

Four automated radar control systems operate in Azerbaijan. They allow high-quality and reliable monitoring of hydrometeorological hazards and the development of short-term forecasts for these hazards (MoENR, 2019a). The radiometric weather conditions are analysed and reported by the Bureau of Hydrometeorological Forecasts in real time and for several hour forecasts for torrential rains, hail storms, lightning and related floods (MoENR, 2019a). The EWS service and products for agriculture at national and local levels are currently not available, but MoA is currently working on it – in particular, information about atmospheric precipitation, including torrential downpours expected during the day, will be posted on the appropriate site.

Azerbaijan's current hydrometeorological network has gaps in its coverage, partially lacks automation and the timely generation of hydrometeorological-related warnings. The radar network is degraded and lacks a continued maintenance programme (GCF, 2019). Azerbaijan does not possess a national numerical weather prediction model, an operational impact-based flood forecasting model, surface water modelling software packages, which will become especially important as water resources become more strained. Moreover, Azerbaijan's current weather forecasting and production processes do not allow efficient and timely dissemination of information and EWS are insufficient in scale and scope to ensure adequate risk knowledge, disaster preparedness, and response capability of its population for safeguarding lives, infrastructure, and assets (GCF, 2019).

As a pilot project of the Scientific Research Institute of Fruit-Growing and Tea-Growing (SRIFGTG) under MoA, an EWS was established and appropriate equipment was installed. The device installed in the gardens belonging to SRIFGTG collects the relevant data and transmits it to the main station, where the data is processed. Through this system it is possible to obtain climate monitoring (temperature, humidity, wind speed and direction, solar intensity, precipitation, frost warning) and a 14-day weather forecast. Disease and pest warnings can be obtained in advance through the EWS based on leaf moisture sensors. Based on medium-range weather forecasts, it is also possible to determine the optimal times for ploughing, cultivating, fertilizing and spraying with pesticides. It has already been implemented in SRIFGTG's 'Smart Gardens' project. This system serves to increase productivity by 25 percent and minimise economic losses. SRIFGTG plans to implement this system in the Guba region at the next stage. If the issue of funding is resolved, the EWS will be applied in the Guba region, and then the whole country. In this way, SRIFGTG will provide an EWS service (I. Gurbanov, personal communication, 2021).

In March 2021, MoA launched a new project called Digital Agriculture. The pilot project on the transfer of data from climate stations to farmers was first implemented in Guba, Gusar, Khachmaz, and Shamakhi districts in Azerbaijan. Five stations covering about 60 villages have started to operate in these districts. At the initial stage, apple, cherry, nectarine, peach, and grape plants were identified as target plants (MoA, 2021). In March, SMS notifications (which included weather forecasts, information on the suitability of the weather for spraying, etc.) were sent to more than 5 800 farmers registered based on the Electronic Agricultural Information System (EAIS) on risks in the areas of apple, cherry, nectarine, and peach in the villages covered by climate stations. At the same time, for the aim of more detailed and flexible transmission of risk data, the Telegram channel "digital agriculture" (<https://t.me/ktnsmart>) was created, and regular work is carried out to attract farmers to this channel (MoA, 2021). Thanks to this system, the risk of water shortage, which has become a global problem in recent years, is also eliminated. Farmers know where and how much water they should use thanks to this method and do not waste it.

The Food Safety Agency (FSA) is planning to establish an EWS for veterinary and phytosanitary matters. For this purpose, FSA has prepared proposals for legislation on the establishment of the corresponding EWS (E. Mikayilov, personal communication, 2021). The FSA will be responsible for this area and will work with MoA. FSA also developed a plan for rapid assessment of food safety in crisis situations, management, warning procedures and emergencies, crisis management.

In 2019 and 2020, the inspections, monitoring, and investigations into poisoning incidents, certification, analysis of import–export operations and of laboratory tests, revealed key problems relating to food safety,

animal and plant health in Azerbaijan. In response to the identified problems, nine risk profiles were developed for food safety, animal health and plant health, and scientific risk assessments carried out for each (Republic of Azerbaijan, 2021).

The main gaps with regard to EWS include the lack of coordination, collaboration and communication among MoA, MoENR, MoES and other relevant institutions, and the need to improve the quality of hydrometeorological observations. In addition, the salary levels are relatively low in this sector and as a result, it is challenging to hire highly qualified staff. There is a need to increase the number of staff with academic degrees in meteorology and hydrology; and experts in data management, computing and IT are also needed. Moreover, meteorological and hydrological networks need to be upgraded and modernized by upgrading the calibration and maintenance systems per WMO standards, and automatic analysing and editing tools improved, so that these modernized surveillance and EWS can help to reduce the adverse impacts of disasters, in particular on agriculture.

Market information systems

In 2015, MoA together with FAO, created an information portal on agricultural prices, which was subsequently updated by MoA as the electronic price information portal *Agrarbazar* on agriculture.¹² At present, the operator of this portal is the ARC. The portal is publicly available and it is in the Azerbaijani language (N. Shalbuzov, personal communication, 2020).

The price information system is a complete functioning web application and the information currently provided by *Agrarbazar* (Agrarbazar, 2020) includes:

- supply prices of fruit, vegetable, potato and watermelon and melon products from the trade, wholesale, retail and processing enterprises;
- retail prices of animal-breeding products (meat, milk, eggs, honey);
- prices purchased by milk reception centres;
- wholesale and retail of meat prices;
- sales prices of wool and leather for population or meat cutting stations;
- prices of crops within seasonal sales and after seasonal wholesale;
- prices for technical plants and other products of industrial raw material purchased by organizations;
- retail sale prices (grass, fertilizer, animal breeding).

Prices for all types of products or assortments are aggregated daily, weekly and monthly depending on the products, taking into account low, medium and high levels (ARC, 2020b). For the rest of the products (fruit, vegetables, potatoes), there is a daily procedure, whereby ARC employees collect the wholesale and retail prices and upload them onto the system. ARC has an employee at each market and the data are automatically uploaded and published to the *Agrarbazar* (N. Shalbuzov, personal communication, 2020). A challenge that ARC has is to get prices for specific products (farm gate price) from the local offices of the ministry, which they only get twice per week. At present, ARC plans to improve their market information systems within the context of the European Union project, Support to Development of a Rural Business Information System.

¹²The website of the Electronic Price Information Portal on Agriculture can be accessed at <http://www.aqarbazar.az>

Agrometeorology services


The National Hydrometeorology Service (NHS) under MoENR provides weather and climate services to farmers via its website (<https://meteo.az/>) and promotes sustainable agricultural development in order to increase productivity. There are no extension services in Azerbaijan, but MoA is trying to establish them. It uses social media to involve farmers in the process, for instance through the Telegram channel “digital agriculture” (<https://t.me/ktnsmart>).

There are 72 operational meteorological stations (of which 60 are automatic) and 75 operational meteorological posts (all manual) in Azerbaijan. The meteorological stations observe the variables every two to three hours, whereas the posts observe precipitation twice daily and temperature once. Azerbaijan possesses 101 hydrological stations which are manual and are measured at a maximum of twice a day. The number of operational meteorological and hydrological stations needs to be improved (in terms of both technological and capacity-development aspects), together with the observation frequency. More automatic stations with online transfer capabilities are needed as the current frequency is inadequate. Automation of the hydrological network is a current priority in order to produce timely data which is particularly important for flash flood warnings. The number of sensors in existing stations needs to be increased, for instance for agriculture (R. Verdiyev, personal communication, 2020).


Agrometeorological observations are performed in 37 stations in the regions, which is important for agriculture in Azerbaijan. With the purpose of expanding the activities on an agrometeorological database, the Agrometeorological Center has been created in the new structure of the NHS (AO, 2021). As a result of agrometeorological observations, data is prepared on a daily, monthly and annual basis. In addition, an agrometeorological bulletin is prepared every ten days (NHS, 2020). This bulletin covers monthly and decadal data on agrometeorological conditions for crop development, as well as air and soil temperature, amount of precipitation, percentage of humidity and other meteorological parameters for (citrus) fruit, vegetables, tea, and so on (an example of a bulletin is given in Figure 10). Agrometeorological bulletins and reviews are prepared for agricultural organizations and farmers (NHS, 2021).

The annual agrometeorological bulletin includes information on thermal reserves of vegetation period, dates of average daily air temperature exceeding 0 °C, 5 °C, 10 °C, 15 °C in spring, total average daily temperature above 0 °C, 5 °C, 10 °C, 15 °C, the beginning and termination of the frost-free period, the average air temperature in the hottest month (July), the number of dry days, the average quantity of absolute minimum air temperatures, minimum and maximum average air temperatures, temperatures of soil surface (minimum, maximum) and different depths (5 cm, 10 cm, 15 cm), average relative humidity, lack of humidity, maximum wind speed and number of windy days above 15 m/s wind speed, amount of precipitation and daily maximum, number of rainy days over 1 mm and 5 mm, and some phenological data. Agrometeorological bulletins are sent to relevant agencies by the NHS. Since 2021, the online version of the agrometeorological bulletin (decadal) and monthly agrometeorological review are accessible to everyone. Real-time information can be accessed by farmers via <https://meteo.az/>, where the decadal agrometeorological bulletin and short agrometeorological forecasts are also published.

Figure 10. Sample of an agrometeorological bulletin



AZƏRBAYCAN RESPUBLİKASI
EKOLOGİYA VƏ TƏBİİ SƏRVƏTLƏR NAZİRLİYİ
MİLLİ HİDROMETEOROLOGİYA DEPARTAMENTİ



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GÜNDƏLİK HİDROMETEOROLOJİ BÜLLETEN

DEKADANIN ƏSAS AQROMETEOROLOJİ XÜSUSİYYƏTLƏRİ

İyul ayının birinci on günlüyü isti və yağıntısız hava şəraiti ilə səciyyələnmişdir.

Havanın orta temperaturu aran rayonlarında 28-31°, dağlıq və dağətəyi rayonlarda 19-29° təşkil etmişdir ki, bu da əsasən normadan 1-4°, ötən ilin göstəricisindən isə 1-2° yüksək olmuşdur. Dekada ərzində havanın maksimum temperaturu əksər rayonlarda 35-40° təşkil etmişdir. Havanın minimum temperaturu aran və dağətəyi rayonlarda 19-24°, dağlıq rayonlarda isə 13-15° olmuşdur. 10 sm dərinlikdə torpaq səthinin dekada üzrə orta temperaturu aran və dağətəyi rayonlarda 28-36° təşkil etmişdir.

Keçən dekada əsasən yağıntısız isti hava şəraitində keçsə də Şəki-Zaqatala bölgəsində və dağlıq rayonlarında 1-3 gün ərzində zəif yağışlar yağmışdır. Dekada ərzində qeydə alınan yağıntının miqdarı Sarıbaşda 17 mm, Gədəbəyda 5 mm, Balakəndə 3 mm, Zaqatalada, Şəkiddə və Şəmkirdə 2 mm, Gəncədə isə 1 mm təşkil etmişdir.

Aran və dağətəyi rayonlarda havanın dekadalıq orta nisbi rütubətliyi 45-57%, orta rütubət çatışmazlığı 19-24 hPa, dağlıq ərazilərdə isə orta nisbi rütubətlik 63-85 %, orta rütubət çatışmazlığı isə 4-7 hPa arasında dəyişmişdir.

Dekada ərzində Respublika ərazisində 7 gün Maştağada, 6 gün Goranboyda, 4 gün Biləsuvar və Neftçalada, 3 gün Tərtərdə, 2 gün Gəncə, Tovuzda güclü küləklər əsmiş və küləyin sürəti 15-28 m/san-ya çatmışdır.

Stansiya	Havanın temperaturu, (C°)			Torpaq səthində minimum temperatur, (C°)	Yağıntının miqdarı, (mm)	1 mm-dən çox yağıntılı günlərin sayı	5mm-dən çox yağıntılı günlərin sayı	01.10.2017-11.07.2018 ilədək yağıntı miqdarı, (mm)	01.10.2017-11.07.2018 ilədək yağıntı norması (mm)	Sürəti 15 m/san və ondan çox olan küləkli günlərin sayı
	orta	maks	min							
1	2	3	4	5	6	7	8	9	10	11
Maştağa	27.2	34	24	25	0,3	-	-	255.3	246	7
Lənkəran	27.4	34	21	23	0	-	-	1384	950	-
Astara	27.9	36	22	23	0	-	-	1062	984	-
Göytəpə	29.0	36	22	22	0	-	-	671	527	-
Göyçay	29.9	38	24	25	0	-	-	357	350	-
Kürdəmir	31.0	39	24	24	-	-	-	292.3	287	-
İmişli	29.6	36	23	24	-	-	-	233	251	-
Cəfər xan	28.9	37	23	23	-	-	-	345	260	-
Biləsuvar	28.7	37	23	24	0	-	-	332	298	4
Salyan	29.0	36	23	24	0	-	-	304	249	-
Gəncə	28.3	37	22	23	1	-	-	222	222	2
Gədəbəy	19.1	31	13	14	5	1	1	453	574	-
Daşkəsən	19.6	31	13	14	0	-	-	449	544	-
Bərdə	28.6	37	22	22	0	-	-	215	266	-
Tərtər	28.4	36	21	22	-	-	-	259	266	3
Şəki	27.1	36	21	21	2	-	-	528	625	-
Oğuz	27.3	37	20	21	0	-	-	605	703	-
Qəbələ	26.2	35	20	21	-	-	-	718	819	-
Şamaxı	26.5	35	20	21	-	-	-	366	509	-
Quba	25.0	32	20	21	0	-	-	370	403	-
Xaçmaz	25.2	33	19	20	0	-	-	549	247	1

Source: MoENR, 2019b.

Types of agrometeorological information and services provided by the NHS are as follows (NHS, 2021):

- minimum, average and maximum air temperature (daily, decade, monthly);
- forecast of agricultural crop yield;
- forecast of the date of flowering of fruit trees;
- forecast of the date of ripening of cereals;
- information on dry windy days;
- information on land drought;
- information on air drought;
- information on frosty days;
- maximum speed of wind (daily, decade, monthly);
- duration of sunny hours (daily, decade, monthly);
- the amount of precipitation (daily, decade, monthly);
- maximum daily amount of precipitation;
- number of rainy days during the growing season (March–October);
- the number of days when the amount of precipitation is 1 mm or more;
- the number of days when the amount of precipitation is 5 mm or more;
- the height of snow cover by the end of the decade;
- maximum and minimum soil surface temperature (daily, decade, monthly);
- the average daily temperature of the soil at depths of 5 cm, 10 cm, 15 cm, 20 cm, 40 cm;
- the average temperature of the soil surface at a depth of 10 cm per decade;
- humidity data at different depths of the soil;
- calculation of humidity and drought ratios for the area;
- calculation of the effective temperature sum;
- relative humidity (daily, decade, monthly);
- lack of humidity (daily, decade, monthly);
- preparation of agrometeorological bulletins.

Phenological observations are carried out on cotton in the lowland regions, for lemon, feijoa and tea plants in the Lankaran–Astara zone, and for grapes in the Ganja, Shamkir, and Gazakh regions. Productive moisture reserves are calculated at depths of 10 cm, 20 cm, 50 cm and 100 cm on the basis of soil samples taken from the areas planted with grapes, cotton, and alfalfa. Records are also kept on agrotechnical measures taken during the growing season.

During the vegetation period, a number of agricultural crops, including autumn cereals, are identified and observed in the lowlands and foothills. Based on these observations, the actual development phase of wheat and barley, plant height, number of plants per square metre, number of stems per square metre and one plant, plant density, general condition of planting and root system, size of damaged or destroyed crop areas, and plant damage or the causes of destruction, are investigated (NHS, 2020).

The MoENR is the responsible body for the implementation of the second action under the first priority of the SRM on production and processing of agricultural products in Azerbaijan, which focuses on the improvement of the agrometeorological database. The SRM activities are connected to, among other things, the expansion of the use of agrometeorological data in the agricultural sector, compilation of agrometeorological data in the format of a bulletin or summary in line with modern standards, dissemination of agrometeorological commentary and reviews in the media, inspections of croplands and pastures, and the organization of expeditions for studying agrohydrological features of the land. In addition, agrometeorological forecasting methods will be improved, including the strengthening of monitoring of soil moisture in croplands and pastures as well as evaporation from the soil surface. This information will be accessible to relevant agricultural institutions.

The MoENR is responsible for the implementation of the third action under the first priority of the SRM, which aims to establish a proper intervention and protection system for agricultural purposes. In order to prevent or minimise the negative impacts of hail, increase or reduce the amount of precipitation in relevant area(s), rain seeding for the benefit of agriculture, forestry and communal farms, and a weather control and hail protection system for agriculture, needs to be created.

The main gaps related to agrometeorology services include the lack of coordination between MoA, MoES and MoENR, which are responsible for specific components of flooding or drought risk assessment. No relevant coordination or information-sharing mechanisms currently exist in the country. There is infrastructure available for agrometeorology services, but it needs to be improved. In addition, in order to conduct high-quality agrometeorological observations, modern software and new sensors for automatic weather stations are required. If this equipment is purchased, it will allow the assessment and monitoring of agrometeorological soil moisture, evaporation from the soil surface, as well as the removal of snow. Moreover, there is a need to establish a systematic agrometeorology training programme for NHS staff. The MoENR plans to modernize and automate the hydrometeorological observation network using innovative and cost-effective technologies where possible. This would include automatising of meteorological and hydrological stations, posts and transmissions (for example, for water level in rivers, snow, glaciers and the Caspian Sea ecosystem); upgrade of the radar systems to ensure adequate coverage; increase in the number of sensors in existing stations (for instance, for agrometeorology); establishment of the Internet of Things (IoT) and wireless communications infrastructure (integrate with IoT networks), including opportunities for mobile sources (for example, smart sensors in mobile phones or vehicles) as emerging sources of meteorological data; modernization and calibration of equipment; digitisation of records; and acquirement of necessary software, accompanied by a training and capacity-development programme for NHS staff.

Other gaps include the following:

- While individual warnings for some climate-related hazards (such as floods, heatwaves) are issued via conventional channels such as newspapers and television, there is no comprehensive, systematic, nationwide EWS in place covering multiple climate-related hazards.
- Limited tailored or downscaled climate information products are available for response actions by the public and sectors such as agriculture and livestock, water management, and industry. Warnings and forecasts tend to be generic and not impact-based, while more accurate, timely and location-specific climate information is needed for planning, decision-making, and response actions.
- A few recent projects have addressed aspects of climate information services in Azerbaijan, such as Azerbaijan: Preparing irrigation and drainage system development in Nakhchivan Autonomous Republic (Annex III).

It is also desirable and beneficial to establish an agrometeorological advisory service in Azerbaijan, which would help farmers apply relevant meteorological information and make the most efficient use of natural resources, with the aim of improving both the quantity and quality of agricultural production. In agrometeorological advisories in Europe and the United States of America, there is a strong trend towards commercialization, which in developing countries will only be possible for wealthy and highly educated farmers (WMO, 2011). There is a high potential for the engagement of the local private sector, IT companies, telecom and radio companies, to use private-sector capacity to reach farmers and build relationships with the public sector. There is a need to integrate the use of IT and similar technologies, such as SMS, for enhancing the output of appropriate weather and climate products.

Climate stations are a modern innovative system that allow observation of the development phase of diseases and pests in the process of plant development, and therefore timely and correct prediction of fieldwork. The sensors collect data on air temperature, humidity level, amount of rain, leaf moisture and time of precipitation, wind speed, and are analysed by MoA employees. Farmers plan their work against plant diseases and pests with this information in mind. As a result, the effectiveness of the fight against diseases and pests increases, the production of products increases, and farmers can optimize their efforts (MoA, 2021). The first pilot project on the transfer of data from climate stations to farmers has already been successfully implemented in Azerbaijan. In March 2021, MoA started providing an agrometeorological advisory service in Guba, Gusar, Khachmaz, and Shamakhi districts within the framework of this pilot project.

Disaster risk reduction in the agricultural sector

During USSR times, the state took measures to reduce disaster risks in agriculture. Then, mainly large state-owned farms were engaged in agricultural activities in Azerbaijan. As a result of 1995 agrarian reforms, collective farms, state farms and other agricultural enterprises were closed (SSC, 2011). Land was distributed to farmers and currently Azerbaijan's agriculture is highly fragmented, mostly based on small family-owned farms. A total of 1 191 collective farms (kolkhoz), 156 agricultural production cooperatives, 2 651 family rural economies and other private entities were created, which led to around 842 100 families to start individual farming activities on privatized land and properties of state farms, collective farms and inter-economy enterprises, which in turn discontinued their activities as a result of the reforms (SPRFSPAR, 2008).

At present, the majority of agricultural products are produced by small and medium-sized farms. It is estimated that currently 88.9 percent of subsidised farms in the country own up to 5 ha of land each (Huseyn, 2019). Due to the relatively small size of these farms, it seems that it is highly challenging for them to shift towards more proactive DRR in agriculture, especially as these small farms are reluctant to implement preventive measures. The main DRR activities implemented correspond to the strategic goals and priorities of the Sendai Framework, which involve the following:

- Develop and coordinate a national strategy and implement best practices to protect humans against natural hazards.
- Develop annual work programmes that include objectives, priorities and actions in line with the strategic objectives regarding disaster risk reduction and management.
- Organize the preparation of reports that capture the progress on the achievement of the Sendai Framework goals and include these reports in the Sendai Framework Monitor portal.
- Support stakeholders in the development and integration of monitoring systems.
- Support the development of methodologies for disaster risk analysis and assessment as well as the establishment of disaster risk maps.
- Coordinate with the relevant structures of the Cabinet of Ministers in planning further actions on the national strategy that will be in line with the Sendai Framework.
- Analyse and evaluate international disaster risk reduction and management documents.
- Organize and maintain information campaigns on various types of risks and disaster response (Huseynov, 2019a).

However, in recent years, the focus on DRR in agriculture has increased. The ARC is planning to implement a study in this area. It plans to establish a new unit on DRR in agriculture based on monitoring, evaluation, and risk analysis, by 2022. This unit will be engaged in conducting post-disaster needs assessments for agriculture and food systems. At the same time, the ARC plans to establish a weather monitoring system by the end of 2021. It plans to do these activities in the near future as they currently do not have sufficient financial resources (F. Fikrekzade, personal communication, 2021). In addition, the Institute of Hydrometeorology is planning to implement a project on DRR in agriculture.¹³ The Institute aims to implement the project, which will include an agroclimatic services component, jointly with the Global Environment Fund (GEF) and the United Nations Environment Programme (UNEP) (R. Verdiyev, personal communication, 2020). All these initiatives are at the initial stage and the results can only be obtained in the coming years. However, there is a need to clearly define the roles and responsibilities of the various agencies within the DRR framework and to improve cooperation among the NHS and other agencies, particularly for data exchange, risk assessment and EWS.

¹³Project title: Strengthening climate services and impact-based multi-hazard early warning to increase resilience to climate change threats and enhance livelihoods of the population in Azerbaijan.

Information on disaster risk assessments, preparedness plans, emergency action plans, post-disaster needs assessments, and damage and loss assessments, are currently not available, in particular for the agricultural sector in Azerbaijan. In addition, local authorities currently do not have the technical capacity to carry out flooding risk assessments.

DRR and management must become an integral part of modern agriculture (FAO, 2017). Strengthening disaster risk management strategies beyond agricultural measures is crucial in Azerbaijan. During the past five years, clear improvements have been made regarding the implementation of DRR in agriculture in Azerbaijan – there is an interest in the topic at decision-making level, and in addition, a DRR unit was established under the Ministry of Agriculture in 2018. However, this unit is no longer functional, and a new unit will be established under the ARC by 2021. Despite the improvements, there is still a long way to go in order for DRR to be adequately mainstreamed and implemented in the agricultural sector.

Agricultural insurance

Agricultural insurance has been considered a risk-management tool for farmers in both developing and developed economies, which enables farmers to transfer and mitigate risks and help to contribute to their food security in the event of natural or biological hazards. Compared to other types of insurance, agricultural insurance remains risky for insurance companies and it is therefore not common in Azerbaijan. There is another issue that is directly linked to the insurance-market players. Due to the small scale of the Azeri agri-insurance portfolio and lack of quality data, international reinsurance companies pay less attention to this sector, which results in a higher reinsurance price and builds barriers for insurance-market players (World Bank, 2017).

With climate change, the frequency and severity of extreme weather events, such as thunderstorms, flooding, whirlwinds and other hydrometeorological hazards in Azerbaijan, is increasing. The agricultural sector is highly exposed to the increased climate variability, which can result in partial and total agricultural damage and losses due to the country's limited application of climate-resilient agricultural practices and technologies, and shortage of water resources for irrigation (World Bank, 2018). At present, there is no compulsory agricultural insurance in Azerbaijan, but efforts are being undertaken to improve voluntary agricultural insurance by the Agrarian Insurance Fund (AIF).

On 27 June 2019, the Agricultural Insurance Law was adopted and the AIF – which is a non-commercial legal entity – was created in order to achieve significant developments in this area. A new agricultural insurance mechanism is operational since autumn 2020 (F. Agashirinov, personal communication, 2020). According to the requirements of this law, the following will be subject to agricultural insurance:

- crops and vegetables, including long-lasting plants;
- livestock and animals that are raised for agricultural purposes;
- seafood products.

The following crops will be covered by insurance in 2020 and 50 percent will be paid by the AIF: wheat, barley, corn, potato, sugar beet, orange, lemon, tangerine, tea, tobacco, rice, grapes, hazel, and cotton. With regard to livestock, the following are covered: milk cows and buffaloes from one to seven years old.

The following hazards are covered by agricultural insurance:

- natural hazards (earthquakes, landslides, whirlwind, storm, hail);
- fires;
- plant diseases and pests: rust disease in cereals, mildew disease in grapes, rodents resembling mouse, locusts, Mediterranean fruit fly, brown marmorated stink bug;
- infectious diseases and poisonings: death from other infectious diseases, except for diseases included in the list of special dangerous infectious (exotic) diseases, death from a snake or an insect bite, death from poisonous herbs and forage, death as a result of mass poisonings;
- death by attack of wild animals (wolf, jackal, fox, bear, etc.) (CoM, 2019a).

Despite the government providing subsidies to cover 50 percent of the premium of crop insurance, under the Agricultural Insurance Law, farmers are still reluctant to purchase it (CoM, 2019b). This is due to a lack of trust between farmers and insurance companies regarding their expertise to assess agricultural damage and losses, limited farmer awareness of insurance benefits, and farmers' view of the premiums as too costly. The analysis of insurance premiums collected in Azerbaijan (Table 9) shows that the situation with regards to the insurance of crops and livestock is inadequate. Livestock premiums in 2020 have increased compared with 2015. But crop premiums in 2020 have decreased compared with 2015. In 2020, the collected share of agricultural insurance fees in the country was 0.39 percent (livestock insurance) and 0.0013 percent (crop insurance) in insurance payments.

Table 9. Agricultural insurance premiums and payments (in AZN thousands), 2015–2020

		2015 ¹⁴	2016 ¹⁵	2017 ¹⁶	2018	2019	2020	In comparison to 2015, %
Crop insurance	Premiums	239	601	1 326	639.8	183.8	9.2	-96.2
	Claims paid	50.7	3.8	1 419	180.3	0	0	0
Livestock insurance	Premiums	1 182	1 223	3 009	2 040.3	1438.8	2842	+140.4
	Claims paid	379	758	95	574.7	936.7	613	+61.7

Source: FIMSA, 2019 and CBAR, 2021.

In Azerbaijan, a policy of subsidising agricultural insurance is also being implemented, but there is an expectation that any damage and losses incurred due to a disaster will be compensated by the government. Improved risk management will reduce volatility in the agricultural sector, resulting in improved productivity and reduced farm risks, and lead to more efficient public spending. According to a World Bank assessment of current risks, appropriate risk-management strategies will reduce production losses at the farm level, improve the resilience of the agricultural sector, create incentives for the private sector to invest in the sector, make insurance products more affordable, and eventually, contribute to a more productive and competitive sector by improving the incentives for and returns to agricultural investment (World Bank, 2018).

State support to the agricultural insurance mechanism established in Azerbaijan officially started in 2020. It should be noted that the first agrarian insurance contract with state support in the country was signed on 3 November 2020, between the AIF and a local farmer in Bayimsarov village, Tartar district. According to this agreement, 50 heads of cattle owned by the farmer are insured against current risks. Fifty percent of the insurance amount will be paid by the state, and the farmer will pay the remaining amount in instalments. Within the framework of agricultural insurance, the United Agricultural Insurance Company (OJSC) will be engaged in concluding contracts with policy holders, receiving their requests and overseeing procedures (ARC, 2020c).

¹⁴USD 1= AZN 1.0512 in 2015.

¹⁵USD 1= AZN 1.5973 in 2016.

¹⁶USD 1 = AZN 1.7000 in 2017, 2018, 2019 and 2020.

Projects and programmes

Existing and recent projects and programmes related to DRR, EWS and agrometeorology services in the agricultural sector, implemented by the government, NGOs, international organizations, and the private sector, are presented in Annex III.

There are few programmes and projects related to DRR, EWS and agrometeorology services that are being implemented for the agricultural sector in Azerbaijan. For instance, the project titled Integrating Climate Change Risks into Water and Flood Management by Vulnerable Mountainous Communities in the Greater Caucasus Region of Azerbaijan, implemented by UNDP together with MoES, aims to reduce the vulnerability of the communities in this region to climate change-induced water stress and flood-related hazards by improving their water and flood management (Annex III). This will be accomplished through addressing the legislative and policy frameworks, strengthening institutions, and empowering local communities to participate actively in water and flood management (UNDP, 2020).

Conclusions and recommendations

Azerbaijan has undertaken significant steps to shift from a reactive emergency response to a proactive DRR approach. Disaster prevention, mitigation and preparedness to natural hazards are among the key issues for the government, despite the fact that a national strategy for DRR is not yet developed. The MoES is responsible for the formulation and coordination of DRR measures. Its decision to publish the Emergency Atlas of the Republic of Azerbaijan (OoP, 2016) is considered a positive development towards enhancing the protection of its population, settlements, industry, agriculture, and strategic infrastructure from disasters, and combining efforts to reduce the adverse impacts on its communities and economic sectors.

The SRM of 2016 for agriculture and the processing sector focuses specifically on the reduction of disaster risks in agriculture and includes an action plan for reducing the adverse impacts of climate change and extreme weather events on agriculture. This action plan includes the establishment of a multi-hazard information and EWS by 2025, and the creation of an effective monitoring and control system regarding pests and diseases of animals and plants in line with the World Organisation for Animal Health standards, and the implementation of risk management related to the International Plant Protection Convention and its International Standards for Phytosanitary Measures. The EWS service and products for agriculture at national and local levels are currently not available.

At present, a national agricultural DRR platform is absent in Azerbaijan. There is a need to establish this platform as it will help to provide horizontal and vertical coordination across sectors and levels. Moreover, enhanced coordination is required between relevant state authorities for the development of relevant policies, strategies and plans that support the implementation of DRR, EWS, and agrometeorology services activities, in particular for the agricultural sector. This is also highly important for flooding, forest fires, and drought that are often transboundary, and in order to adequately and efficiently address these risks requires regional cooperation for the harmonisation of methodologies, the adoption of common standards and the exchange of data and information related to hazard monitoring, forecasting, and the issuing of timely warnings among river-basin countries.

There are various challenges and constraints related to agricultural insurance, including the existing limitation of the database, the insufficient level of methodology for calculating tariffs in the field of agrarian insurance, the experience in assessing insurance risks and damage, operations with external and internal reinsurers in the field, and the high damage rate for agricultural insurance. Azerbaijan provides state support to insurance of agricultural producers. However, the list of natural hazards for which relevant support by the state is provided is currently limited. For instance, insurance against some natural and biological hazards, such as drought in rainfed lands and plant pests and disease, are not covered. Other challenges and constraints include the lack of trust between farmers and insurance companies regarding their expertise to adequately and accurately assess agricultural damage and losses, as well as farmers' limited awareness of the insurance benefits, and their view of premiums as high. In this regard, it is highly important for the government to conduct comprehensive assessments of disaster and climate related risks, which will also provide data that can be used to improve early warning and forecasting systems so as to enhance informed decision-making.

Recommendations for improving the legal, policy, and institutional environment include the following:

- Prepare a national strategy for DRR 2021–2030 and develop national and local disaster risk management plans, including preparedness activities and contingency planning specifically for the agricultural sector.
- Establish a national platform for DRR to support and strengthen the inter-institutional coordination, collaboration, and communication among the relevant organizations at all levels – national, regional and local. It is especially important to ensure active participation of institutions responsible for the agricultural sector in this platform.
- Develop and adopt a state programme for the development of hydrometeorology for 2021–2025.
- Adopt a state programme for the development of forests in Azerbaijan in 2021–2030, which would include the establishing of multi-layered protective forest belts along the crop fields, and protective forest, field and water belts. The respective action plan should be developed by 2025, and this will involve international donors.
- Define the roles and responsibilities of all relevant partners within the DRR framework, sectoral laws, strategies, plans and policies, along with expected actions.
- Enhance capacities to undertake disaster risk assessments by the line ministries at local level.
- Increase communication and enhance coordination among all relevant authorities, such as line ministries (MoES, MoENR, MoA), academic institutions, and municipalities.
- Speed up the printing of the Emergency Atlas of the Republic of Azerbaijan.
- Close the gap between policy-making and research, including data collection and analysis on DRR in agriculture.
- Restore the important work of the State Commission on Climate Change.
- Re-approve the composition of the working group within the State Commission on Climate Change and continue its activity in the NHS.
- Revise the “regulations on the Azerbaijan State System for Prevention of Emergency Situations and Activities in Such Cases” and “functions of State Bodies of the Republic of Azerbaijan for Prevention and Activities in Such Cases” since they do not meet modern requirements. In particular, the functions of MoA should be more clearly defined in these documents.
- Revise the laws “on hydrometeorological activity”, and “on melioration and Irrigation”, and adapt them to the requirements of the European Union.
- Accelerate the preparation of a long-term low-emission development strategy in Azerbaijan.
- Discuss and agree upon the Adaptation Plan, which will be prepared with the support of UNDP in 2021.
- FAO to continue engaging MoA and MoENR on possible support on land-use issues (with the OCB team at the headquarters), but also on agriculture and forestry-sector development integrating the DRR principles.
- Propose to MoA, MoES and to the State Statistical Committee to institutionalise the damage and loss assessment methodology. This is a very concrete initiative that is on the FAO agenda and that may support Azerbaijan to advance in meeting SDG targets by 2030.
- Encourage NGOs and the private sector to take a more active role in the DRR process, including their involvement in emergency and mitigation plans and programmes.

Recommendations for improving agrometeorological services include the following:

- Enhance technical and human capacity to undertake GIS mapping.
- Increase the use of agrometeorological data and modern meteorological systems in agriculture, particularly by farmers. This will be critical for the enhancement of the forecasting potential of the country in terms of climate-related hazards and reduction of the adverse effects of disasters on the agricultural sector.
- Strengthen the capacity for collecting and analysing data and enhance the knowledge of EWS, agrometeorology services, and including the use of digital technologies.
- Improve access to information for farmers through extension services.

Recommendations concerning the early warning systems (EWS):

- Establish EWS to cover crop and agricultural forecasts, as well as annual food balance by major commodities. This system will provide detailed information about food stocks to decision makers. In addition, link climate early warning to agriculture and food security, for example, price information and the weather monitoring system operated by the ARC.
- Participate in regional initiatives to exchange information on DRR and combine efforts regarding the monitoring, forecasting, and response to disasters.
- Develop a feedback mechanism where end users are able to provide inputs on whether the forecast and early warning products are addressing their needs, including the dissemination of warnings to farmer organizations or forums, which will help to disseminate the alerts to local people and communities.
- Apply the newest technologies and best practices in forecasting and provide of training on WMO standards, methodologies, and requirements.
- Secure funding for the weather monitoring system created by the ARC.
- FAO to offer support on EWS, vulnerability mapping, contingency planning, and best practices to strengthen the resilience of the agricultural sector to disasters. In this regard, it is essential to focus on building national capacities, which is the only way to ensure sustainability.
- Increase the number of operational meteorological and hydrological stations, especially automatic stations with online transfer capabilities, in order to increase observation frequency. In addition, optimize the hydrometeorological observation network: support the establishment of stations in mountainous areas, including high-attitude stations; expand the actinometric observation network; and carry out biometeorological observations and research.

The following recommendations are proposed for disaster risk assessment, vulnerability, and hazard mapping:

- MoA, the ASA, and the AIC to recognise the significant impacts of drought on the agricultural sector. One of the related measures could be government subsidies for drought-affected farms.
- Systematically collect, consolidate and analyse damage and loss data by the AIF and the ARC and ensure that assessments of damage and losses cover all agriculture sub-sectors.
- Conduct technical training courses focusing on risk assessment and decision-making based on a countrywide standardization of risk-assessment methodologies.
- Strengthen forest-management practices such as the development of field-protective forest windbreaks around the edges of croplands and establish field, soil, and water-protective forests.
- Update the existing methodology for post-disaster damage assessment, which is currently outdated, to bring it in line with international standards and guidelines, particularly for the agricultural sector.
- Promote research activities to assess the economic damage caused to agriculture by disasters. Providing relevant research topics on these subjects to the doctoral students of the ARC and Azerbaijan State Agrarian University (ASAU) could be very beneficial.
- The FAO Country Office in Azerbaijan to continue exploring the possibility of integrating DRR aspects into both ongoing and pipeline projects, or to develop dedicated projects if the interest of donors is detected. The DRR issue shall be addressed at different levels (namely, central and decentralized ministries, advisory services, education curricula, communities and farmers).
- The FAO Country Office in Azerbaijan to explore how to pursue concretely the offer to coordinate and collaborate in the area of DRR received from UNDP, German Agency for International Cooperation (GIZ) and International Fund for Agricultural Development (IFAD).

Recommendations to improve agricultural insurance are as follows:

- Explore the potential expansion of insurance coverage for crops and harvests (together with short-term loans), which is currently not common.
- Further analyse the distribution of agricultural insurance products among large and small-scale farmers by the AIF and the ARC.
- Identify the need for an increase in the use of insurance across rural areas by the AIF.
- Develop insurance products that will help to reduce the adverse impacts of drought.
- Raise awareness among farmers of the benefits of agricultural insurance as a risk transfer tool, to mitigate the impact of natural hazards on agriculture.

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Annex I.

List of people and agencies interviewed

Name	Agency	Date of interview
Firdovsi Fikretzade	Director of the ARC under MoA	12.11.2019 19.05.2020 15.03.2021 18.05.2021
Rafiq Verdiyev	Acting Director of Institute of Hydrometeorology under MoENR	17.05.2020
Nurlan Babayev	Former head Risk Management Sector of MoA	02.10.2019
Firdovsi Agashirinov	Deputy Director of the Agrarian Insurance Fund (AIF)	17.06.2020
Namig Shalbusov	Deputy Director of the ARC under MoA	04.10.2019 07.07.2020 17.03.2021 19.05.2021
Ramiz Isgenderov	Chairman of Centre for Economic, Social and Environmental Research	17.10.2019
Hamza Khalilov	Azerbaijan Architecture and Construction University	24.10.2019 and 15.03.2021
Akif Veliyev	Former First Deputy Chairman of the State Land and Cartography Committee of Azerbaijan	21.12.2020 and 18.03.2021
Nijat Nasirli	Head of department at the Agrarian Science and Innovation Centre (ASIC)	25.10.2019 and 16.05.2020
Eltekin Omerov	Project Manager of Clima East project	24.10.2019
Ruslan Salmanov	MoENR	03.10.2019
Firudin Tagiyev	MoA Head of the department	24.10.2019 17.05.2021
Zaur Gardashov	Head of Azexport portal	23.10.2019
Rashad Huseynov	Head of department at the Centre for Analysis of Economic Reforms and Communication	23.10.2019 15.03.2021
Mehdi Mehdiyev	Senior researcher at Azerbaijan Research Institute of Crop Husbandry	13.06.2020
Solmaz Mammadova	Agronomist at the Agency for Agrarian Services (ASA)	14.07.2020
Ilham Gurbanov	Director of Scientific Research Institute of Fruit-Growing and Tea-Growing	18.01.2021
Elshen Zeynalov	Director of "Zeynalli-33" LLC	17.03.2021
Zaur Aliyev	UNDP, Representative of National Adaptation Plan (NAP) Support Project	19.05.2021
Issa Aliyev	Independent expert	20.05.2021
Elchin Atababayev	Representative of the project, Preparing Irrigation and Drainage System Development in Nakhchivan Autonomous Republic	21.05.2021
Fuad Humbetov	NHS Head of department	24.05.2021
Sevinc Ahmedova	Head of Agrometeorology Center	25.05.2021
Azer Hagverdiyev	Head of Khachmaz State Agrarian Development Center	18.06.2021
Elkhan Mikayilov	Head of Administration of FSA	15.07.2021

Annex II.

Information on the targets of the state programme on reliable food provision of the Republic of Azerbaijan for 2008–2015, and their achievement

No	INDICATORS	Target of the State Program for 2015	The actual figure for 2015	
			Absolute quantity	Percentage compared to 2015 target
1.	On cereals:			
	– sown areas, thousand hectares	900	952,1	+5.7
	– productivity, 100 kg/ha	32	31,5	–2.8
	– total production, million tonnes	2.8	2.99	+6
2.	Meat production, thousand tonnes	340	298.6	–12.2
3.	Production of milk and dairy products, million tonnes	2.4	1.92	–23
4.	Annual production of poultry meat by industrial methods, thousand tonnes	80	97.2	+21.5
5.	Eggs, billion units	1.3	1.55	+15.4
6.	Potato production, million tonnes	1.12	0.839	–25.1
7.	Production of vegetables and melons, million tonnes	1.72	1.75	+1.7
8.	Fruit production, thousand tonnes	800	888	+11
9.	Sown areas of oilseeds, thousand hectares	135	10.7	–91.3
10.	Sowing area of sugar beet, thousand hectares	20	4.9	75.5
11.	Tea leaf production, thousand tonnes	3	0.58	–81
12.	Sowing areas of feed crops, thousand hectares	500	428.6	–85.7
13.	Production of mixed forage, million tonnes	2	0.007	–99.65

Source: SPRFSPAR, 2008; SSC, 2019d; and own calculation of author.

Annex III.

Projects and programmes related to DRR in agricultural sector in Azerbaijan

Title of programme / project	Funding agency/ies	Implementing agency/ies	Implementation period	Allocated budget	Project aim/main components
Integrating climate change risks into water and flood management by vulnerable mountainous communities in the Greater Caucasus region of Azerbaijan	Funded by GEF, UNDP core funds and the government	UNDP Implementing partner: Ministry of Emergency Situations, Azerbaijan	2012–2016	USD 31.8 million	The project aims to address both sides of the water crisis. Firstly, it helps shift the focus of flood management from the short-term tactic of constructing floodwalls to long-term solutions such as flood zoning, watershed management, and early warning systems. Secondly, it promotes new water management techniques where groundwater complements the traditional reliance on surface water, fostering a more sustainable response to water scarcity. Towards both aims, the project assists in filling gaps in the Water Code, including a lack of attention to climate change. Pilot projects in three river basins demonstrate ways forward. The project assisted in enhancing the hydrometeorological observation network, flood risk modelling and forecasting, and capacities of the new water management agency. A community-based flooding early warning system was piloted in one community. New flood and water management techniques will reduce flood damage and water stress and will be scaled up through a more supportive Water Code and associated legislation (UNDP, 2018).
Water users' association development support project	International Bank For Reconstruction and Development, International Development Association	AELIATI	2011–2018	USD 114.30 million	The objective of the water users' association development support project for Azerbaijan is to improve the effectiveness and financial viability of on-farm irrigation water distribution and management in the project area. There are three project components, of which the first component focuses on institutional strengthening and capacity development. The component will finance the following activities: capacity development of Amelioration and Water Management OJSC; training and capacity building of Water User Association (WUA); and institutional capacity-development studies, and pilots. The second component is the rehabilitation of on-farm irrigation and drainage (I&D) systems. This component will finance the rehabilitation of 85 000 ha of on-farm systems managed by about 34 eligible WUAs located in 15 core project rayons with a total irrigated area of 518 000 ha. The concept is to strengthen WUAs into mature and sustainable entities, able to manage, operate and maintain their systems. The WUAs will be selected according to agreed upon criteria and procedures to be eligible for rehabilitation. The third component is project management, including monitoring and evaluation (M&E). (World Bank, 2020a)

Title of programme / project	Funding agency/ies	Implementing agency/ies	Implementation period	Allocated budget	Project aim/main components
Rural environment project	International Development Association, Japanese Ministry of Finance - Phrd Grants	World Bank	2005–2009	USD 12.10 million	<p>The Rural environment project for Azerbaijan aims to improve biodiversity conservation and introduce more sustainable natural resources management and economic activities in two mountainous areas of Azerbaijan, so as to restore the ecological health and productivity of their natural forests and pastures. The project consists of the following four components: Component 1 will support the establishment of Shah Dag National Park and expand Ordubad National Park as well as adjacent protected areas. Component 2 will assist residents of 55 villages inside or immediately adjacent to the two national parks and surrounding protected areas to shift their traditional agricultural and natural resources management, using practices and more modern and efficient approaches that place less pressure on natural resources and ecosystems. Component 3 aims to stimulate economic diversification in the project areas by assisting local entrepreneurs to start or expand environmentally sustainable small and medium enterprises. Component 4 will support overall project management and administration, including human resources and operating costs of a central project implementation unit and three field offices or so-called project coordination units (PCU): two in the Shah Dag area and one in the Ordubad area (World Bank, 2020b).</p>
Agriculture development and credit project II	International Development Association, Japanese Ministry of Finance - Phrd Grants, local sources of borrowing country, borrowing country's financial intermediary/ies	N/A	2006–2020	USD 57.70 million	<p>The main objective of the second agricultural development and credit project (ADCP) for Azerbaijan is to further increase rural productivity and incomes by enhancing the access of farmers and small and medium enterprises to rural business and agricultural support services, including financial, advisory and veterinary services and by stimulating market-oriented investments in rural areas. The extension is necessary to satisfactorily complete the remaining project activities and continue funding of some ongoing activities to ensure sustainability of project interventions. An action plan for the satisfactory completion of the project has been developed by the Project Management Unit. An extension will also allow building into the project as many activities as possible to help prepare the next agricultural project. Such activities would include: continued lending to medium agribusinesses, advancing the pilot brucellosis programme, further development of the animal disease information system, specialised studies on food safety standards, agricultural insurance, value chains in agriculture, due diligence of banks interested in lending to agribusiness under the next phase of ADCP, and social and environmental assessments. Finally, the extension would also provide the opportunity to adequately finalise and evaluate the project, articulate lessons learned and incorporate these lessons in the preparation of the subsequent agricultural operation (World Bank, 2020c).</p>

Title of programme / project	Funding agency/ies	Implementing agency/ies	Implementation period	Allocated budget	Project aim/main components
Azerbaijan: Flood mitigation project	ADB	ADB	2004–2008	USD 36.54 million	<p>The agricultural sector is the primary engine of rural growth in Azerbaijan and is highly dependent on water resources control and management. This requires irrigation and drainage systems to be developed and/or rehabilitated, in addition to the adequate prevention, control and management of flooding. However, failure to protect watersheds had exacerbated flooding. Heavy sediment loads in floodwaters has diminished agricultural productivity. Thus, it was recognised that flood control is needed to be managed holistically through the construction of physical control measures in conjunction with non-structural measures.</p> <p>The objective of the project was to improve protection against recurring flood damage through flood management infrastructure, plans, and policies. The project focused on least-cost flood mitigation measures, coupled with medium- to long-term comprehensive flood management. The project components were (a) structural measures (i.e., building protection walls and embankments in 25 schemes); (b) non-structural measures (e.g., watershed management, flood forecasting and warning, and flood zoning); (c) disaster preparedness and flood management (e.g., institutional strengthening and equipment for channelisation); and (d) project management and monitoring (e.g., creation of a project management office [PMO], project implementation units, and project monitoring and evaluation (M&E)). (ADB, 2010)</p>
Azerbaijan: Preparing irrigation and drainage system development in Nakhchivan Autonomous Republic	Technical Assistance Special Fund	ADB	2020–2021	USD 1.20 million	<p>The project will support rehabilitation and modernization of irrigation and drainage networks, which cover an area of 23 230 ha of land in Nakhchivan Autonomous Republic (NAR) of Azerbaijan. The project will also help strengthen institutional management capacity of the irrigation system, including support to water user associations. The project will include two indicative outputs: (i) irrigation and drainage infrastructure improved and/or constructed; and (ii) capacity of State Amelioration and Water Management Committee (SAWMC) and water users' associations (WUAs) in irrigation and project management improved. The limited performance of agriculture points results in low productivity, which in turn results in relatively low wages and limited seasonal jobs that contribute to increased vulnerability and poverty levels. Improving agricultural productivity is central to developing the rural economy and is the most direct route to improving employment and income opportunities. A number of bottlenecks need to be resolved in order to realise these opportunities. One of the most pressing constraints lies in the irrigation sub-sector. Total irrigated area was 1 446 000 ha in 2017, accounting for 64.6 percent of the total cultivated land in Azerbaijan. However, the irrigation systems are not performing to designed capacity. There is a need to fill gaps in irrigation, introduce new technologies, improve access to finance and essential logistics, and develop high quality infrastructure (ADB, 2020).</p>

Title of programme / project	Funding agency/ies	Implementing agency/ies	Implementation period	Allocated budget	Project aim/main components
National Adaptation Plan (NAP) Support for adaptation planning and implementation in Azerbaijan	Green Climate Fund (GCF)	UNDP Implementing Partner: Ministry of Ecology and Natural Resources	August 2020 to Feb 2024	USD 3 million	Financed by the GCF, this project will support the Government of Azerbaijan to facilitate the development of the National Adaptation Plan (NAP) and improve climate-change adaptation actions in three priority sectors identified by the MoENR of the Republic of Azerbaijan through partner consultations: water, agriculture, and coastal areas. The NAP readiness support objective is to increase capacity on climate resilience and adaptation in those three sectors through the implementation of actions and activities that will reduce or eliminate barriers for an effective adaptation process at both the national and local levels.
Locust disaster risk reduction in Caucasus and Central Asia (CCA)	United States Agency for International Development (USAID)	State Agency for Agrarian Services, Ministry of Agriculture	2018–2021	USD 0.48 million	The overall objective of the project is to contribute to food security and livelihoods of rural populations in CCA 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. The expected outcome of the project is that locust management is improved in CCA and more specifically that early warning and reaction are enhanced thanks to appropriate locust monitoring as well as better capacities to respond to locust infestations, with particular attention to human health and environment.
Enhancing locust management and prevention	United States Agency for International Development (USAID)	Ministry of agriculture and National Locust Control Unit	2011–2017	USD 1.66 million	The project covered Caucasus, Central Asia, Russian Federation and Afghanistan, and 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.

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