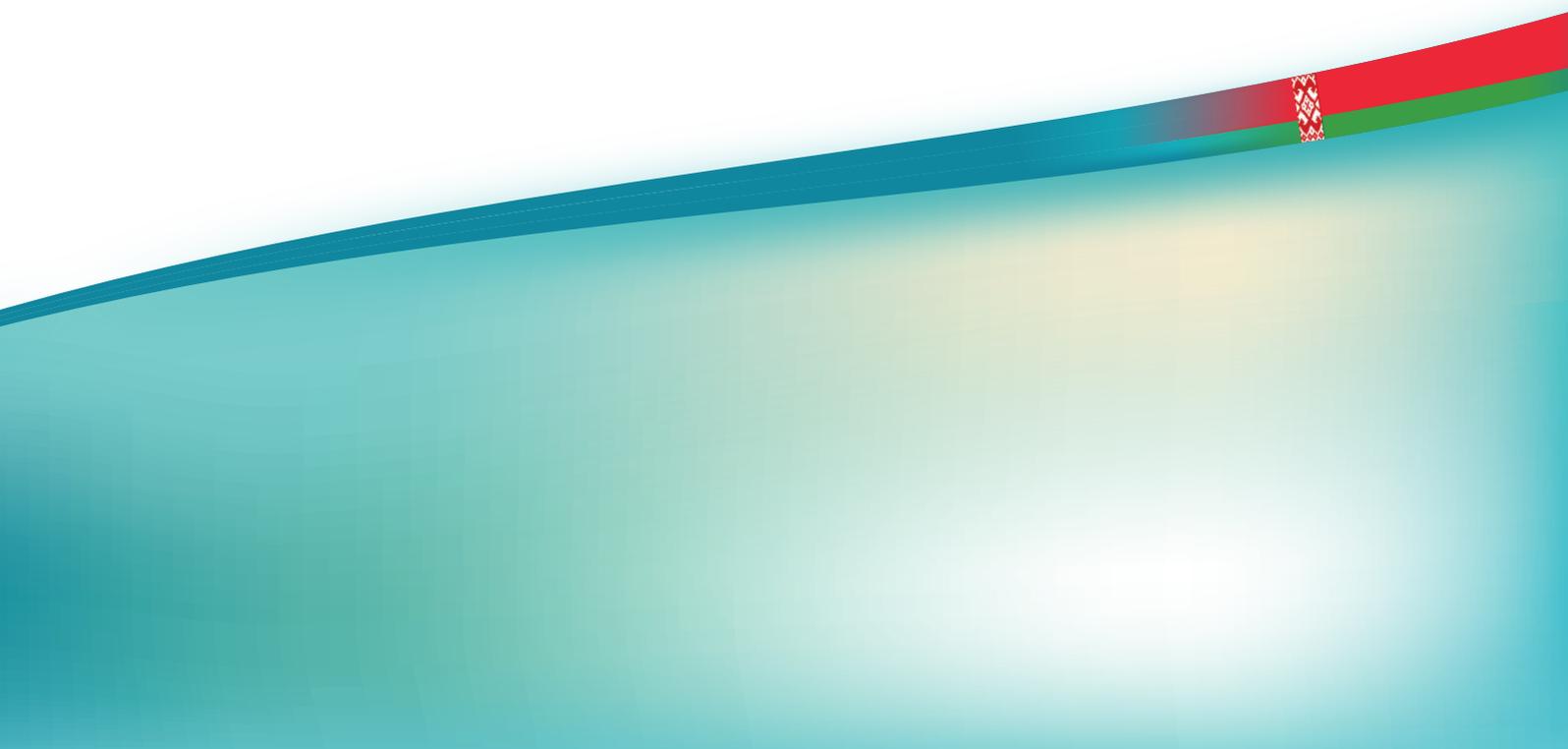




Food and Agriculture
Organization of the
United Nations

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



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Abbreviations and acronyms

Belhydromet	Republican Centre for Hydrometeorology, Radioactive Contamination Control and Environmental Monitoring
Belstat	National Statistics Committee of the Republic of Belarus
BelTA	Belarusian Telegraph Agency
BYR	Belarusian rouble
CIS	Commonwealth of Independent States
CRI	Climate Risk Index
DRR	Disaster risk reduction
EAEU	Eurasian Economic Union
EFAS	European Flood Awareness System
EMFS	Emergency monitoring and forecasting system for natural and man-made disasters
EWS	Early warning systems
FAO	Food and Agriculture Organization of the United Nations
GDP	Gross domestic product
GIS	Geographical information systems
Glavgostekhnadzor	Main State Inspectorate for Supervision of the Technical Condition of Machines and Equipment
LIS	Land information system
MES	Ministry of Emergency Situations of the Republic of Belarus
NAS	National Academy of Sciences
NGO	Non-government organization
NSEM	National System of Environmental Monitoring
NSSD	National Strategy for Sustainable Socio-Economic Development of the Republic of Belarus
PDNA	Post-disaster needs assessment
RCEMR	Republican Centre for Emergencies Management and Response under the Ministry of Emergency Situations
RUE	Republican unitary enterprise
SDGs	Sustainable Development Goals
SES	State system for the prevention and elimination of emergency situations
SUB SES	Sectoral subsystem of the state system for the prevention and elimination of emergency situations
TCP	Technical Code of Common Practice
UNDP	United Nations Development Programme
UNDRR	United Nations Office for Disaster Risk Reduction
USD	United States dollar ¹

¹The study often uses the conversion of the Belarusian rouble into dollars. According to the National Bank of the Republic of Belarus, the average official exchange rate (as an arithmetic mean) of the Belarusian rouble against US dollar for 2019 was BYR 2.0914. In some cases, the average official rate for another period was used with the intention of reflecting real monetary value; in such cases, the rate is indicated in separate footnotes throughout the report.

Executive summary

Threats to natural and food systems. The territory of Belarus is subject to various dangerous weather events, including frost, drought, heavy rain, often accompanied by hail and squally winds, prolonged rainy periods, thaws, severe frost, and ground ice crust. Such weather events have a negative impact and cause damage to agriculture, forestry and fisheries. The climate of Belarus is temperate, it transitional from maritime to continental, is cooler in the north and relatively warm in the south. Climate change affects agriculture and forestry, as well as the fuel and energy sectors. The most frequent and impactful disasters caused by natural hazards in Belarus that affect agriculture are drought, high water (flooding), squally winds, and fire. The period since 1989 has been the longest warming period of the entire time of instrumental meteorological observations in Belarus. During this time, the average annual air temperature increased by 1.3 °C (Melnik *et al.*, 2017). According to the national experts, if no measures are taken to reduce the rate of climate change, by the end of the century, the maximum air temperature will rise to 40 °C to 42 °C degrees, and the duration of the climatic winter will decrease to 40 to 60 days (BelTA, 2019).

Agricultural and food safety profiles. Agriculture is a significant sector of the Belarus economy. As of 2019, together with the forestry and hunting industry, it provided 6.8 percent of the country's gross domestic product (GDP), 10.5 percent of investments in fixed assets (Belstat, 2020a), and about 8.7 percent of the population's employment (Belstat, 2020b). In 2019, the land fund of Belarus amounted to 207 600 square kilometres; the total area of agricultural land constitutes 8.4 million hectares, or 40.4 percent of the country's territory.

The agricultural sector employs 377 000 people (Belstat, 2020l), and 22.4 percent of the country's population lives in rural areas (Belstat, 2020a). At present, Belarus is almost completely self-sufficient in food; imports make up less than 10 percent of the total consumption. Horticulture specialises in the cultivation of cereals (barley, wheat, triticale) and forage (perennial grasses, corn), as well as industrial crops. Traditionally, the livestock industry involves milk production, raising cattle, pigs, and poultry. As of early 2020, agricultural enterprises accounted for 88.8 percent of agricultural land, the share of peasant farms was 2.6 percent, and 8.6 percent of land in rural area is owned or leased by 2.9 million citizens (SPC, 2020a). A fairly effective system for ensuring national food security has been formed in Belarus. In fact, Belarus belongs to the category of countries with a "very low proportion of undernourished population in the total population" (less than 5 percent) – on a par with the Russian Federation, Kazakhstan, and European Union countries.

Regulatory framework for disaster risk reduction (DRR). Belarus has a legislative framework on disaster risk management, including in the agricultural sector. The basis of the regulatory framework is the Law On the Protection of Population and Territories from Natural and Technogenic Emergencies (dated 5 May 1998 No. 141-3), Resolution of the Council of Ministers of the Republic of Belarus On the State system for the prevention and elimination of emergency situations (SES) dated 10 April 2001 No. 495, the National Action Plan for the Prevention of Land Degradation for 2016–2020, as well as a number of other regulations, programmes, and strategies.

The country has a National Disaster Risk Reduction Strategy, according to which the National Platform for Disaster Risk Reduction was created on the basis of the existing State Emergency Service and Civil Defence. Risk management in agriculture is envisioned in a number of regulatory legal acts, in particular in the Order of the Ministry of Agriculture and Food of 19 November 2012 No. 415 On the Sectoral Subsystem of the State system for the prevention and elimination of emergency situations of the Ministry of Agriculture and Food of the Republic of Belarus.

In fulfilment of its obligations under the Paris Agreement of the United Nations Framework Convention on Climate Change (UNFCCC), the Kyoto Protocol, as well as the Sendai Framework for Disaster Risk Reduction 2015–2030, the country has developed and is implementing the Strategy for Agriculture Adaptation to Climate Change, as well as the State Programme of Measures to Mitigate the Consequences of Climate Change for

2013–2020. The State Hydrometeorological Service carries out its activities in accordance with the Law of the Republic of Belarus On Hydrometeorological Activities, and with the sub-programme Development of the State Hydrometeorological Service, Mitigating the Effects of Climate Change, Improving the Quality of Air and Water Resources of the state programme Environmental Protection and Sustainable Use of Natural Resources for 2016–2020.

Institutional framework for disaster risk reduction. The institutional structure for DRR consists of the SES and the National Platform for Disaster Risk Reduction. The Commission on Emergency Situations under the Council of Ministers performs the coordinating role, while the managing role is played by the Ministry of Emergency Situations (MES). The president of Belarus, as well as the Council of Ministers, provide general guidance to the bodies and departments for emergency situations. The minister of emergency situations exercises direct leadership. Disaster risk management at the sectoral level is facilitated by the creation of sectoral subsystems of SES, including the sectoral subsystem (SUB SES) of the Ministry of Agriculture and Food. The coordinating role for the SUB SES in agriculture is played by the Emergency Situations Commission of the Ministry of Agriculture, the managing role is played by the Labour Protection, Transport and Fire Safety Department of the Main Directorate of Technical Progress and Energy of Glavgostekhnadzor. In the course of its activity on disaster risk management, the Ministry of Agriculture and Food actively interacts with other entities of the national platform and the State Emergency Service, including MES and the Ministry of Natural Resources and Environmental Protection, as well as with local executive and administrative bodies of the regions and the city of Minsk.

Early warning systems (EWS). The early warning system in Belarus consists of monitoring, forecasting and emergency warning. Emergency sources are monitored with the use of aviation, space and ground monitoring. Monitoring is carried out by three systems: the emergency monitoring and forecasting system for natural and man-made disasters (EMFS), the national environment monitoring system (NSEM), and the system for social and hygienic monitoring. These systems are represented by relevant agencies (MES, Ministry of Natural Resources, Ministry of Health) and exchange information with each other free of charge. The Ministry of Agriculture and Food, along with some other departments, monitors, analyses and evaluates emergencies such as accidents with the release of potent toxic substances, accidents at treatment facilities, hydrodynamic accidents, hazardous hydrological events, fires in natural ecosystems, epizootics, damage of agricultural plants and forests by diseases and pests. The Ministry of Agriculture and Food and its subordinate structures are notified of emergencies on an equal basis with other departments by the EMFS system. Notifications and information about emergency situations are provided when there is a threat or actual occurrence of emergency situations, which are determined as such in accordance with the instructions on the classification of emergency situations. This instruction describes emergencies that occur in the agricultural and forestry sectors. There is no unified national market information system in Belarus. However, there are prerequisites for its formation on the basis of already existing individual elements and organizations.

Agrometeorology services. Agrometeorological observations in Belarus are carried out by the hydro-meteorological service, Belhydromet, an important part of whose activity is the study of the influence of meteorological conditions on the development of agricultural crops and the formation of crops. Belhydromet studies the peculiarities of agrometeorological conditions in the country, and also provides actual and forecast information. Belhydromet has six branches, inter-district hydrometeorological centres, meteorological, agrometeorological, bog and hydrological stations, laboratories for radiation and environmental monitoring, and an environmental monitoring unit. Agrometeorological information is provided on a paid basis in the form of an agrometeorological year book, and a reference book *Agroclimatic Resources of the Republic of Belarus in the Context of Climate Change* (developed jointly by Belhydromet and the Institute of Nature Management of the National Academy of Sciences of Belarus). Brief information is also provided free of charge through the information resources POGODA.BY and METEOINFO.BY. The target audience of Belhydromet, for which agrometeorological information is prepared, is agro-industrial complexes and authorities. An additional source of information for citizens is the free Weather in Your Pocket application (which has an “agro” mode). Belhydromet provides a number of paid agrometeorological services, such as the preparation of primary agrometeorological data obtained as a result of agrometeorological observations; calculation of the value of the agrometeorological element; information on agrometeorological conditions that caused damage and loss of crops; expert advice by phone about the current agrometeorological situation, as well as written consultations on the observed agrometeorological conditions. The country is training specialists in agrometeorology and agriculture, through advanced training courses.

Disaster risk management in the agricultural sector. The disaster risk management system is represented by SES, and at the sectoral level by SUB SES (in the agricultural sector by SUB SES of the Ministry of Agriculture and Food). At the moment, there is no system for assessing risk of natural hazards in the agricultural sector in Belarus. However, there are prerequisites for the formation of such a system on the basis of existing EMFS, SUB SES, as well as technical regulations on safety and security in emergency situations. One of the directions of the National Disaster Risk Reduction Strategy in Belarus for 2019–2030 is the improvement of emergency risk assessment and analysis, as well as methods for prediction of emergency situations. At the same time, there already exist separate methods, for example, a methodology for assessing natural and man-made risks, developed by the Joint Institute for Informatics Affairs of the National Academy of Sciences of Belarus, intended for use by MES, the Ministry of Agriculture and Food and other departments, as well as for insurance purposes. Belarus has a *Methodology for Assessing Economic Damage from Natural and Man-Made Emergencies* in agriculture; there is also a practice of damage assessment for insurance purposes. Thus, the conditions and algorithm for calculating damage from emergencies in agriculture are set forth by the Law on Insurance Activities and the instruction, which determines the procedure for assessing damage in the event of the loss of agricultural crops subject to mandatory insurance. Belarusian legislation provides for mandatory insurance with state support for crops, livestock, and poultry. Every year, decrees of the president provide for a list of crops, livestock and poultry that are subject to this type of insurance. Mandatory insurance covers only legal entities; individuals (farmers and owners of private subsidiary farms) can have insurance on a voluntary basis.

Projects and programmes. Various state programmes have been implemented and are currently being implemented in Belarus for the period 1994–2030 at both national and regional levels. Many of the programmes are funded directly by the government, but there are also a number of international projects aimed, for example, at developing the capacity of MES or increasing public involvement in environmental monitoring and improving environmental management at the local level.

Conclusions and recommendations

Belarus has legislative framework on disaster risk management, and a number of regulatory acts provide for risk management in agriculture. The main gaps in this area are as follows:

- no unified compilation of current legislation on natural and man-made risks;
- the state programme does not contain any provisions on emergencies management in various sectors, including in the agricultural sector;
- insufficient adaptation of the National Disaster Risk Reduction Strategy (lack of sub-strategies) for its implementation at all levels (territorial, sectoral and facility);
- inconsistency of terminology on DRR in the legislation of Belarus with the international terminology.

The institutional structure for DRR in the country includes the National Platform for Disaster Risk Reduction and the State system for the prevention and elimination of emergency situations (SES). The Commission on Emergency Situations under the Council of Ministers performs the coordinating role, while the managing role is played by MES. There is a SES sectoral subsystem of the Ministry of Agriculture, which is coordinated by the Emergency Situations Commission of the Ministry. The main gaps in the functioning of the institutional structure are as follows:

- the incomplete statistics of MES in relation to some of the statistical indicators included in the Sustainable Development Goals (SDGs) and the Sendai Framework for Disaster Risk Reduction;
- incomparability of some data on the official website of the Ministry of Emergency Situations and on the website of the national platform (reporting data on the SDGs);
- lack of information on the budget for the implementation of action plan measures to implement the National Disaster Risk Reduction Strategy.

The EWS in Belarus is presented in the form of monitoring, forecasting and emergency warning. The Ministry of Agriculture and Food, along with some other departments, monitors, analyses and evaluates the condition and changes in a number of types of emergency situations. The main gaps in the early warning system are as follows:

- low level of openness and adaptability of the available information;
- lack of unified national market and climate information systems.

Agrometeorological observations in Belarus are carried out by Belhydromet. The target audience of Belhydromet is agro-industrial complexes and authorities. Gaps in the existing agrometeorological service include the sparseness of the observation network, shortage of modern instruments and specialists, as well as sporadic provision of relevant information to peasant farms and private subsidiary farms – it is not sufficiently adapted to the needs of farmers.

The main gaps in the disaster risk management system include:

- the lack of a system for assessing the risks of disasters caused by natural hazards in the agricultural sector and related methodologies;
- the lack of methodologies and guidelines for post-disaster needs assessment and post-disaster recovery strategies;
- insufficient statistical information on agricultural insurance;
- only one insurer for mandatory insurance;
- lack of freedom of agricultural organizations to choose crops subject to insurance with state support;
- limited prevalence of voluntary insurance in agriculture.

The implementation of following tasks is advisable to improve adaptation to natural hazards or extreme weather situations in the agricultural sector:

Recommendations for strengthening the regulatory framework for DRR in agriculture and food security:

- Promote the classification and codification of legislation on emergency situations in the agricultural sector in the form of a compendium, as well as a database, of laws.
- Add to the planned activities of the National Disaster Risk Reduction Strategy the development of sector-specific activities (if needed, strategies), addressing both sector and facility levels.
- Develop a new state DRR programme in agriculture or supplement the state programme Agrarian Business for 2021–2025 as a sub-programme of DRR in agriculture.
- Expand the list of natural hazards in the state programme Emergency Management for 2021–2025.
- Harmonise the national terminology for DRR, or emergency situations, with international standards.
- Develop and implement a national strategy or a programme on digital agriculture.
- Consider complementing government programmes and policies with gender equality and the needs of particularly vulnerable groups of the population.

Recommendations for strengthening the institutional framework for DRR in agriculture and food security:

- Improve the quality of statistical reporting, to ensure the coherence of the information presented in various sources.
- Expand the list of statistical indicators for emergencies, including agriculture-related.
- Promote the creation and development of voluntary public associations in order to involve civil society in activities to prevent and prepare for disasters, recovery and rehabilitation in agriculture.
- Promote the participation of non-profit and non-government organizations (NGOs) in activities for the prevention, recovery and rehabilitation from emergencies, as well as their work with the population.
- Facilitate compliance with the Aarhus Convention.
- Establish a budget for the implementation of measures included in the National Disaster Risk Reduction Strategy.

Recommendations on early warning systems:

- Create an institutional global emergency monitoring system, planned in the National Disaster Risk Reduction Strategy.
- Develop a market information system for the agricultural sector, and adapt it to the needs and perceptions of all interested categories of citizen.
- Adapt the existing climate information system to provide information for the needs of representatives of the agricultural sector.

- Develop a methodology for collecting and promptly providing data on the market for agricultural raw materials and food.
- Create training courses and guidelines based on established agricultural climate and market information systems.
- Ensure the use of information on the market of agricultural products in the activities of the EWS and agrometeorology services.
- Raise awareness of agricultural specialists about possible risks.
- Expand the variety of mandatory training programmes for natural emergencies, taking into account their impact on agriculture.
- Examine the demand for educational services on DRR in agriculture.
- Conduct sociological polls of representatives of agro-industrial complexes, agricultural enterprises, peasant farms and private subsidiary farms in order to obtain feedback on the existing challenges in the preparation for and response to natural emergencies.
- Adapt the interfaces of sites presenting information about risks and the information presented on them for understanding by a wide audience.
- Ensure consistent upgrading of technological equipment and production technologies at facilities.
- Introduce modern technical means of informing and alerting the population in crowded places, including in rural areas.

Recommendations on agrometeorological activities:

- Increase the density of the agroclimatic observations network.
- Better equip the whole observation network with state-of-the-art agrometeorological instruments, and increase the number of specialists.
- Create regional hydrometeorological distance learning centres.
- Ensure greater information content and completeness of information regarding the implementation of state programmes and their results.
- Organize refresher courses, events for the exchange of international experience, forums for agrometeorological specialists.
- Use the capacity of the existing climate information system to create a separate section or a unique portal aimed at information and consumer interests of representatives of agriculture.
- Develop forecasts of agrometeorological conditions with specific recommendations, tailored to farmers and representatives of agricultural activities.
- Facilitate the processing of online applications on the Belhydromet website for the purchase of an information product or service.
- Create a more detailed list of provided agrometeorological services with the cost for each item in the list.
- Simplify the method of obtaining agrometeorological year books.
- Develop a climate services community that engages both the producers of climate information and recipients.
- Study the reasons for a lack of interest from agricultural producers in agrometeorological information.
- Raise awareness about the importance of climate information, including agrometeorological information among agricultural workers.
- Provide assistance to farmers and owners of private subsidiary plots to become familiar with agrometeorological information.
- Co-production and co-design climate services: map the climate services market to clearly define the responsibilities for the production and delivery of climate services.
- Study the existing demand in the market for climate and agroclimatic information products and conduct user needs assessments to make sure that the last-mile needs and preferences are taken into account when developing these services.

Recommendations on disaster risk management in the agricultural sector:

- Create a disaster risk management system as part of SUB SES of the Ministry of Agriculture and Food.
- Create a system for assessing disaster risks in agriculture.

- Develop methodologies and guidelines aimed at extensive post-disaster needs assessments in the agricultural sector.
- Develop a national disaster recovery strategy that would cover agriculture also.
- Adapt the existing resource mobilisation tool to support the country's recovery in accordance with the developed (in the future) methodology for assessing the needs and strategy for post-disaster recovery in the agricultural sector.
- Based on the available list of activities to be implemented in case of different emergency regimes, develop a similar list of sector-specific activities for agriculture.
- Facilitate the development of the agricultural property insurance market.
- Raise awareness of farmers and owners of private subsidiary plots about insurance measures.
- Develop new technological solutions using the land information system to analyse the vulnerability of agricultural land to natural hazards.
- Expand the list of agricultural crops subject to insurance with state support.
- Create conditions for engaging other insurance companies (in addition to Belgosstrakh) in the process of agricultural insurance with state support.
- Organize tenders, contests for the provision of insurance services in agriculture with state support.
- Ensure a gradual transition from the practice of mandatory agricultural insurance with state support, to voluntary insurance.
- Consider the possibility of using budget funds not only in terms of compensation for part of insurance premiums, but also for compensation for damage from disasters caused by natural hazards in the agricultural sector.

Introduction

Climate change is being observed all over the world, but according to the estimates of the Intergovernmental Panel on Climate Change, Europe is warming at a considerably faster rate. For more than 130 years of instrumental observations of air temperature in Belarus, the longest period of warming occurred at the end of the twentieth and beginning of the twenty-first centuries. From 1990 to 2019, the annual average air temperature in Belarus increased by 1.3 °C compared with 1961–1990. Climate change is evident not only in temperature increase, but also in precipitation changes, instability of weather conditions, and as a consequence, the spread of pests and diseases. All of this has a significant impact on many sectors of the economy, including agriculture – and therefore on the country’s food security. Adaptation actions will help to mitigate the effects of climate change on agriculture, which will help to lower economic, environmental and social costs. These actions include the development of a DRR system, including the development of an EWS, improvement in agrometeorology services, and increase in the accuracy of disaster risk assessments.

The Regional Office for Europe and Central Asia of the Food and Agriculture Organization of the United Nations (FAO), as part of its Regional Initiative 3 – aimed at ‘Managing natural resources sustainably and preserving biodiversity in a changing climate’ – conducted this baseline study on legislation, policy, capacity and services related to DRR, EWS and agrometeorological services in Belarus. The study includes an overview of the current situation, and an assessment of gaps and needs to improve and strengthen the areas under review. The results of the study are expected to be used as a technical background report for the design and implementation of capacity-development initiatives. Other countries in the series include Azerbaijan, Armenia, Georgia, Kazakhstan, Kyrgyzstan, Republic of Moldova, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan. Similar reports analysing the disaster risk reduction and management systems in the agricultural sector in the Western Balkans (Albania, Bosnia and Herzegovina, Montenegro, North Macedonia, and Serbia) were completed in 2018.²

The report was prepared based on literature review and the results of semi-structured interviews. The following research methods were used: monographic (for comprehensive analysis of the DRR system in agriculture and formulation of proposals and recommendations for capacity development); comparative analysis (during the analysis of disaster risk management in Belarus, the experience of international organizations in this area was taken into account); abstract-logical (the application of analysis and synthesis, induction and deduction in the study of the DRR system, its legislative and institutional framework); structured system and structure–function analysis (for the study of the DRR system in Belarus, its structure, elements and their functions); comparative legal analysis (when studying the legal framework of the DRR system, including for determination of the hierarchy of regulatory legal acts and their significance); expert assessments (when conducting an individual expert survey on the key elements of the object under study, the DRR system in agriculture in Belarus). The literature review was based on academic papers, regulatory documents, statistical databases, official resources of public associations, and other internet sources. The interview stage lasted three weeks from 3 August to 21 August 2020, when 20 semi-structured interviews were conducted with experts from public administration, scientific institutes, and NGOs (the list of respondents is presented in Annex I). In this report, a systematic situational analysis method was applied, developed by the Global Risks Identification Program and the Bureau for Prevention and Recovery in Crisis Situations. The questions were based on the Capacity for Disaster Reduction Initiative (CADRI)³ questionnaire on food security and agriculture disaster risk management and climate services.

²Comprehensive analysis reports of Western Balkan countries are available at the following link: <https://www.fao.org/europe/resources/disaster-risk-reduction-and-management/en/#c589778>

³CADRI brings together six United Nations organizations – FAO, OCHA, UNDP, UNICEF, WFP, and WHO. This UN-led interagency initiative delivers customised capacity-development support in DRR.

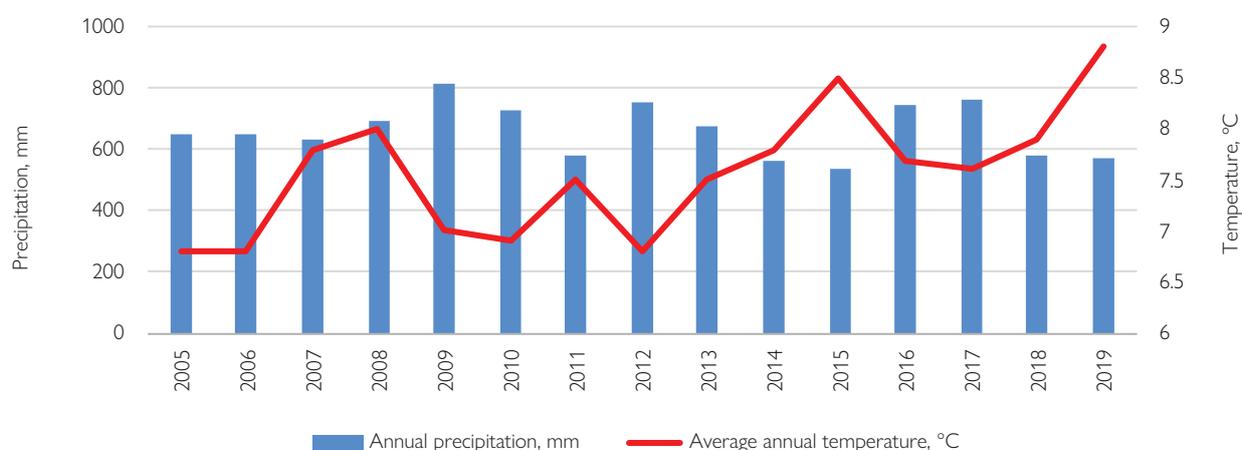
Threats to natural environment and food systems

Actual and predicted impact of climate change in Belarus

For the period 1990–2019, the annual average air temperature in Belarus, compared with the period 1961–1990, increased by 1.3 °C (UNDP, 2020). Figure 1 shows the main climatic indicators for the 2005–2019 period. There has been increase in air temperature both at country level and in individual regions, with 2019 the warmest ever recorded (with an average annual temperature of 8.8 °C (Belstat, 2020d; Ministry of Natural Resources, 2016a). It should be noted that since the 1990s, the average annual temperature has been increasing every two to four years. Since 2005, such situation has been recorded every year, i.e. the deviation of the average annual air temperature annually ranges from +0.5 to +1.5 °C from the climatic norm in Belarus, which is +6.7 °C. Precipitation variation has seen much smaller changes. Deviations towards an increase in precipitation relative to the climatic norm for the country (645 mm) are observed every three to four years. In the past decade, April has become one of the driest months of the year (Belhydromet, 2019a).

During 1989–2019, the level of precipitation and its intensity slightly increased. The amount of snow decreased, river runoff in winter increased, while summer flooding decreased. Ice breaking in rivers and lakes starts earlier, and they freeze later. The vegetation period is now extended by ten to 12 days; while a significant change in the frequency of extreme weather events has been registered – there are fewer strong cold waves and more thaws in winter, and more heat waves and drought in summer (UNDP, 2020). The southern and northern regions of the country are the most affected by climate change. Drought, and forest and peat fires, have become much more frequent in the south of Belarus (Polesie). Climate change in the north of the country is manifested through the increased duration of warm periods, and a reduction in snow blanket thickness.

Figure 1. Main climatic indicators in Belarus, 2005–2019



Source: Belstat, 2020d.

The average surface air temperature in Belarus as a whole is projected to continue to increase in the twenty-first century – during the period until 2030, the annual average air temperature will increase by 1 °C, in the period 2041–2060 by about 2 °C, and during the 2080–2099 period by between 0.9 °C and 4.4 °C. The number of days with extremely high daily temperatures is expected to increase almost everywhere, as well as the duration of continuous episodes of extremely high temperatures (heat waves). In winter, an increase in precipitation is expected, while in summer an insignificant increase in precipitation in certain months is expected, notwithstanding a possible increase in the intensity of heavy rain. Arid conditions are expected to develop in the southern regions of Belarus. No significant changes in annual runoff are predicted by the middle of this century – changes will be in the range of 2 percent above or below the norm. The tendency towards an increase in the frequency of dangerous hydrometeorological events, and increase in unfavourable abrupt changes in weather, will persist (Ministry of Natural Resources, 2016a).

Changing climatic conditions can lead to both favourable and negative consequences for the agricultural sector (Table 1). The temperature increase is expected to extend the duration of the growing season in the northern part of the country, and crops currently suitable for cultivation only in the south can be grown also in the northern regions. At the same time, a precipitation increase is expected in summer and winter, with an overall reduction of water supplies in spring (precipitation), which can negatively affect crop yields. The greatest threat to agricultural production is posed by the changing frequency and severity of drought and heatwaves, which are expected to increase in both frequency and duration across the country. The adverse effects on agriculture due to warming are also associated with an increase in the frequency and duration of winter thaws and a related increase in the likelihood of damage to winter crops. Additional threats include an increased likelihood of pest outbreaks and an increased likelihood of fires (USAID, 2018).

Table 1. Positive and negative consequences of climate change for agriculture in Belarus

Positive	Negative
<ul style="list-style-type: none"> ● early onset and increase in the duration of the vegetation period; ● early termination of spring frost and late autumn frost (increase in the duration of the frost-free period); ● improvement of conditions for harvesting of grain crops, beets, late varieties of potatoes, due to the later onset of autumn frost; ● an increase in heat supply for agricultural crops will contribute to the expansion and improvement of the structure of crop production and agricultural potential growth; ● reduction of the intensity and duration of frozen rivers will help to reduce the impact of spring flooding. 	<p style="text-align: center;">Horticulture</p> <ul style="list-style-type: none"> ● an increase in the number of winters with minimum soil temperature dangerous for winter crops; ● an increase in the intensity and frequency of drought, causing a decline in crop yields, soil fertility, and leading to soil degradation; ● the emergence of new pests and diseases of agricultural crops; ● increased intensity of precipitation, leading to soil erosion or plant damage ("rain bombs", hail); ● decrease in the soil water storage capacity due to unstable snow cover and decrease in precipitation; ● reduction in snow cover, as well as lowering of the intensity and duration of frozen rivers contribute to a decrease in the breeding of populations of beneficial insects in spring, which requires an abundance of small water bodies (flooded flood plains, shoreline of lakes, swamps, large relief depressions); ● the spread of invasive plant species.
<ul style="list-style-type: none"> ● increase in the duration of grazing period; ● reduction in the cost of heating premises for keeping animals in winter; ● increase in feed production. 	<p style="text-align: center;">Livestock and fisheries</p> <ul style="list-style-type: none"> ● danger of heat stress, decreased productivity, increased demand for water; ● growth in expenses for ventilation and power supply of premises; ● difficulty in grazing and forage production on waterlogged soils as a result of increased precipitation; ● decrease in the self-generation capacity of pastures due to grazing of pastures by animals in conditions of low precipitation; ● the emergence of new infections, parasites and alien species; ● changes in the temperature regime, deterioration of the state of fish-breeding reservoirs, lack of water for replenishment and self-purification of reservoirs; ● reduction of spawning grounds, changes in the composition of ichthyofauna; ● spread of invasive plant species.

Source: own findings based on the data of the Ministry of Agriculture and Food, 2019a.

Based on the Global Climate Risk Index (CRI), which illustrates the impact of climate-related extreme weather events, Belarus can be considered quite a low risk country. This index is developed through the analysis and ranking of countries according to four main indicators – fatalities per year and per 100 000 inhabitants, and losses in absolute terms (USD) and as a share of GDP. The higher the rank of a particular country (CRI for 2021 covered 180 countries in total), the worse is the recorded impact of the weather-related event, and the higher the risk of similar disasters. In 2019, Belarus ranked 130, which was the lowest rank possible for that year, shared by many countries. For the 2000–2019 period, Belarus ranked 166 (out of 180), which is much lower than the Russian Federation (ranked 32), Republic of Moldova (84), and Ukraine (94); and lower than Caucasus countries (Eckstein, Künzel and Schäfer, 2021).

According to the University of Notre Dame Global Adaptation Index, Belarus is also ranked among the least vulnerable and most resilient states. This index, which covers 182 countries, is calculated based on a number of indicators covering two categories – “vulnerability” and “readiness to improve resilience” (the higher the rank, the better). In 2019, Belarus ranked 37, lower than the Russia Federation (32), but higher than Ukraine (64), Republic of Moldova (80), as well as countries in the Caucasus and Central Asia. Such a high ranking indicates a relatively low vulnerability of the country to emergency situations, as well as a high level of readiness to eliminate their consequences (Chen *et al.*, 2021).

Major natural hazards

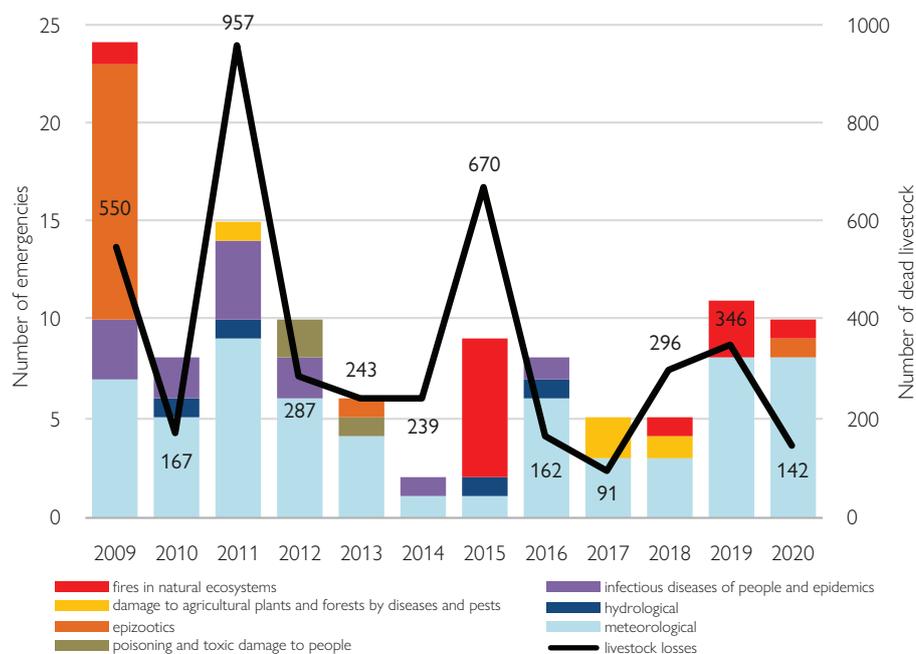
The most dangerous weather phenomena on the territory of Belarus include – during warm periods – frost and arid events that are associated with a long absence of rain and high air temperatures, as well as heavy rain, often accompanied by hail and wind squalls, prolonged rainy periods that worsen the condition of plants due to waterlogging of soil; during the cold season there are thaws, severe frost, ground ice crust; and frost during spring. The changes in the average temperature is especially noticeable in winter period; in summer, there are no major deviations in the average temperature; however, temperature maximums are registered more frequently.

In recent decades, in most regions of Belarus, there has been a 2 percent to 6 percent decrease in the amount of atmospheric precipitation, especially in the winter-spring period. Recent studies by Belhydromet have shown that, compared to 1951–1990, the number of years with spring and autumn frost has decreased, with an increase in the duration of the frost-free period (Pogoda.by, 2006). In the context of climate change, snowstorms have become quite rare. Snowy winters have become extremely uncommon in the twenty-first century, and in the past five years they have lasted only for a short period of time.

Extreme weather events have become increasingly frequent in the country. The number of drought events has increased in all regions without exception, especially in the south of the country. Forest and peat bog fires, and bark beetle outbreaks of pine and spruce forests, are common disasters for the economy and the natural environment, resulting in destruction of ecosystems and economic damage. Strong winds cause great damage, as a result of which agricultural buildings collapse, torrential rains lead to flooding of farmland, washout and damage of crops, and lodging of crops. Strong winds can also cause breakage of electric power transmission lines. Such cases are especially dangerous in winter, when the reliability of power supply to agricultural enterprises plays an important role, especially for cattle and poultry farms (P. Bebko, personal communication, 2021).

Information on natural emergencies that occurred from 2009 to 2020 is presented in Figure 2. Over the past ten years, the most frequent emergencies were meteorological emergencies (54 percent of all emergencies that occurred), epizootics occurred less often (13 percent – mainly due to 13 cases in 2009), as well as fires and infectious diseases of people and epidemics (11 percent). MES also keeps records of livestock killed as a result of emergency situations (Figure 2). A significant number of epizootics were registered in 2009, 2013 and early 2020, the main role in which was played by outbreaks of African swine fever (MES, 2020a). It should be noted that information on the amount of damage caused as a result of various natural emergencies is not publicly available via the resources of line ministries.

Figure 2. Disasters caused by natural hazards and the number of dead livestock for 2009–2020⁴



Source: MES, 2020a.

⁴Data for 2020 is presented for the period January–August.

Natural hazard profile

Frost. Every year, at the beginning (April–May) and at the end (September–October) of the growing season, up to 20 to 25 cases of frost are recorded. The most severe frost occurred in 2000, 2002, and 2004. In 2000, cereal crops perished in significant amounts. Frost in 2004, which passed through most of the country, damaged seedlings of corn, root crops, rapeseed, clover, and flax (Ministry of Natural Resources, 2014; MeteoInfo.by, 2004). In the past five years, frost phenomena have become more frequent; however, they began to manifest themselves in a shorter time: the period has decreased to one month. At present, frost is recorded mainly in May and October, and less often in April and September (Pogoda.by, 2020).

Drought. Classification of information on drought over the past 48 years (1968–2016) carried out by Belhydromet has shown that 90 percent of drought events are observed from May to July. The frequency of drought increases as you move from the northwest to the southeast. In the Gomel region, the frequency of drought, with the coverage area of at least 30 percent of the region, is 50 percent (i.e., approximately once every two years); while in the Brest region it occurs once every two to three years (Melnik *et al.*, 2017). The drought in 2007 had a negative impact on the formation of the harvest, primarily of grain crops and flax. In the Gomel region, the drought persisted for more than a month and covered over 30 percent of the territory; agricultural crops on 57 400 ha were damaged and destroyed (Ministry of Natural Resources, 2014). According to the Institute of Soil Science and Agrochemistry of the National Academy of Sciences of Belarus, more than 350 sandstorms have been recorded in the country over the past 40 years alone. Most of them were observed in the Gomel and Brest regions, where the share of reclaimed land (drained peatlands) is the largest of the country's regions, after cultivation of which loose and light sandy soils are formed on the surface (Lapa *et al.*, 2019).

Forest and peat fires. Traditionally, hazardous fires occur during the spring and autumn periods, when precipitation is at a minimum. The most dangerous months are April, May, August, and October. In total, for the period of 2012–2018, about 2 500 forest and non-forest fires were recorded in the country. The greatest destruction in this period was from the fires of 2015, when 13 800 ha of forest land were damaged by fire (Belstat, 2020c; Ministry of Forestry, 2020). Transboundary fires pose an additional threat. In 2015, a fire spread from Ukraine, covering an area of 2 400 ha. In 2016, 81.9 percent of the area of fires fell on the Polesskiy and Lelchitskiy forestry enterprises, which border Ukraine.

Forest diebacks due to bark beetle outbreaks. In Belarus, naturally regenerating or planted forests of Scots pine (*Pinus sylvestris*) constitute the majority of the forest area and growing stock, and is the species most affected by bark beetle infestations. The extreme weather conditions of recent years – in particular in 2017 – with long periods of dry and severe hot weather, have further reduced the vitality of individual pine trees and made them susceptible to bark beetle attacks. In Belarus, 140 180 ha per year have been damaged on average in the past five years (including pine forests covering an area of 23 426 ha per year) (FAO, 2018).

Strong winds. At least two to five cases of strong winds are observed annually. The hurricanes that occurred on 17 June and 21 June, and on 12–13 July, 2016, had a significant impact on forestry in Belarus, causing damage to forest plantations on an area of more than 110 000 ha, with damaged wood of about 6 million cubic metres. The main damage occurred to forest land in the Smolevichi, Cherven, Starodorozhsky, Berezinsky regions (Bakhur *et al.*, 2018).

Hail is a local phenomenon in Belarus, and as a rule, it is observed within a small territory, and occurs mainly during the warm season (from June to October). Intense hail can destroy crops, and sometimes kills animals. Heavy hail was observed in 2011 in the Myadel and Vileisk districts of the Minsk region (Taras, 2011). In June 2011, the egg-sized hail in the Brest region destroyed gardens and thousands of hectares of grain crops within just 20 minutes (INFOBANK.BY, 2012).

Flooding. Severe flooding in the floodplains of large rivers is an annual and expected phenomenon. Large-scale flooding occurs approximately every five years. Flooding leads to the loss of crops, decrease in

soil fertility due to leaching of the topsoil and, in general, to the loss of agricultural land due to intense water erosion. In some cases, but to a lesser extent, the death of animals happens, although with enough foresight livestock can be moved from flooded areas. Particularly significant flooding was registered on the Svisloch river in Minsk in 1929–1931 (Matokh, 2013). One of the most significant cases in recent decades was the spring flood of 1999, when 49 districts were affected and about 7 000 residential buildings were flooded (INFOBANK.BY, 2012). Flooding in 2011 resulted in the flooding of farmland in floodplains of rivers and individual buildings in riverine areas, and in private houses in a number of districts in Vitebsk, Minsk, Mogilev, Brest and Gomel regions (Ministry of Natural Resources, 2014). In April 2018, flooding was recorded in 12 regions of the country (BelTA, 2018).

Snowstorms. The frequency of snowstorms in Belarus remains low; however, over the past decade, an increase in their negative consequences has been registered. Snowstorms have the greatest impact on crop production, they damage large areas of fruit trees; and the death of animals is sometimes recorded. A particularly strong blizzard (called “Javier”), which affected the whole of Europe, was observed on 15-16 March 2013 (Pogoda.by, 2013). The cases when trees are breaking under weight of snow are quite rare in the country. The annual damaged area ranges from 100 ha to 150 ha. In 2016, there was heavy snowfall, which led affected the area of 12 811 ha and damaged wood of 266 540 cubic meters. Felling had to be carried out on 252 ha (Nosnikov *et al.*, 2018).

Soil degradation manifests in several ways: physical, profile, chemical, biological, biosphere-ecological. Five types of cultivated soil degradation are registered in the country (Chernysh *et al.*, 2016):

- water and wind erosion of land (including soil);
- dehumidification, compaction, local soil salinisation, waterlogging of land as a result of irrational business practices;
- mineralization of peat organic matter;
- human-induced, including radionuclide, contamination of land (including soil);
- fires on drained land with peat soil, on forest land.

Erosion causes significant damage to soil. More than 500 000 ha of land is subject to water or wind erosion of soil, which is more than 5 percent of the area of agricultural land. Soil on an area of about 30 percent of arable land is subject to wind erosion specifically. Annual losses on eroded lands can constitute 16 to 18 tonnes of the mass of the upper layer of the soil cover from each hectare of arable land. The yield on eroded land is reduced by 5 percent to 60 percent. There has been a steady decrease in the humus content in the soil of arable land (in 1996, by 2.28 percent, and in 2010 by 2.23 percent). Twenty-nine districts in the country have land in an unfavourable ecological state, while 62 districts are classified as unfavourable for agricultural production (Council of Ministers, 2015). It should be noted that Belarus pays special attention to preventing land degradation, including through the implementation of measures to preserve, improve the condition and rational use of the natural potential of soil resources (M. Rak, personal communication, 2020).

Main biological and social hazards

Phytopsanitary situation. Changes in climatic conditions in Belarus have led to changes in the phytopsanitary situation. The deviation of temperature and precipitation from previously recorded levels has contributed to a change in the harmfulness of pests common for the country and the emergence of new ones. Over the past ten years, snow mold epiphytotics has occurred in winter wheat crops and triticale, causing the failure of up to 75 percent of plants. The development of soil fungi, the causative agents of root rots, has intensified, which if dominant, inhibit the development of useful species of fungi and microflora. The resistance to stress of field populations of toxin-forming *Fusarium* fungi of cereal grain and corn has increased. Diseases of grain crops that were not previously observed have appeared, such as tan spot of wheat (yellow leaf spot). Due to the increased temperature in winter, winter wheat and winter triticale are affected by leaf rust (brown, crown, dwarf). An intensive development of diseases has been recorded, the causative agents of which respond positively to an increase in temperatures – such as dark brown spot, powdery mildews (V.A. Rakovich, personal communication, 2020). The loss of agricultural products will be caused by the gradual expansion to the north of the habitats and zones of insect pests (*Leptinotarsa decemlineata*, frit flies, European corn borer, barley leaf beetle, snap bugs). The active stage of reproduction of all insects happens in the spring-summer period. At the

same time, climate change has a beneficial effect on pests: higher temperatures do not contribute to the freezing of insect larvae in the soil, which leads to their rapid reproduction (Ministry of Agriculture and Food, 2019a; IPP, 2020).

Epizootic situation. Climate change and other factors (globalization, land cover change) contribute to the outbreak of animal diseases (some of which can be transmitted to humans), which can affect the food security of countries and mutual trade. Climate change can cause changes in the spread of diseases and even cause the emergence of new diseases in areas where such infections have not been recorded before. Higher temperatures can accelerate the growth of pathogenic organisms (parasites). The overall temperature increase and changes in precipitation affect the number, seasonality, and distribution of insects (flies, ticks, and mosquitoes), which are carriers of pathogens. In different periods, the following animal diseases have been recorded in Belarus:

- highly pathogenic avian influenza (poultry is most susceptible to the disease, while poultry kept on agricultural complexes is fully vaccinated annually);
- Newcastle disease also affects poultry (annual vaccination takes place at farms, the disease has not been recorded since 1980);
- bovine spongiform encephalopathy, one of the most dangerous animal diseases – in addition to affecting livestock, there is a risk of infecting people with the deadly Creutzfeldt-Jakob syndrome (Gedroyts, 2019);
- the threat of bluetongue (catarrhal fever of sheep) penetrating the country is increasing. It can come from the countries of southwestern and eastern Europe, where the disease has become widespread, as well as from the western regions of the Russian Federation;
- African swine fever, in some years, has caused great damage to the country's economy;
- anthrax is a deadly disease not only for animals but also for humans. It has not been recorded in Belarus since 1999, but there are 587 potential foci of anthrax in 103 districts of the country. About 360 farms are subject to strict controls. Preventive immunization of livestock is carried out in problematic areas (Krasochko, Krasochko and Borisovets, 2016; Maksimovich, 2007).

COVID-19. The COVID-19 pandemic undoubtedly affects, among other things, the agriculture of Belarus. The main risks are associated primarily with the export and import of food, which emerged and had the greatest impact at the very beginning of the pandemic, when many states closed their borders for any transit and it was not possible to organize safe food supplies. In addition, on 31 March 2020, a three-month ban was introduced on the export of a number of basic food products, including buckwheat, buckwheat groats, onions, and garlic (in accordance with Resolution of the Council of Ministers of the Republic of Belarus of 31 March 2020 No. 85 On ban of export of certain types of goods). On 1 April, a regulation on a no more than 0.5 percent per month increase of selling prices for goods (services) produced by various organizations was passed (Resolution of the Council of Ministers of the Republic of Belarus dated 30 March 2020 No. 184 On temporary measures to stabilize the situation in the consumer market). In general, a reduction in jobs or decrease in wages, emergence of financial problems for organizations associated with various consequences of the pandemic (illness of personnel, decrease in production, exports, and so on) are expected.

Factors that aggravate vulnerability to natural, biological and social hazards

The type of human economic activities that increase vulnerability to emergencies include the mechanical processing of soil (processing of land with the help of machinery, keeping livestock); reclamation activities (drainage); unsustainable practices of livestock management.

The mechanical processing of soil leads to soil compaction, and in some cases is the cause of soil degradation through the formation of technogenic landforms (ditches, dykes, pits), contributing to the development of water erosion. The upper soil horizon (humus) is practically absent on arable land. Soil that is devoid of vegetation is more intensively destroyed by water currents and wind than in normal natural conditions, which contributes to the occurrence of dust storms, among other things.

Land reclamation was of great importance for agriculture in Belarus. However, as a result of a period of active reclamation activities (1960–1970), a number of negative phenomena and processes emerged, both in the reclaimed territories and in adjacent areas, which resulted in a shortage of agricultural products and an

aggravation of the ecological situation, especially in the Polesie region. By the beginning of the twentieth century, the most destructive effects of land reclamation became evident, such as the radical transformation of peat-mineral soil and the spread of dust storms in those territories. Fires are also recorded annually on drained bogs.

The improper maintenance of animals is a potential risk of epizootics, which are rare in Belarus, however (Figure 2), since veterinary and sanitary rules adopted at the legislative level are observed.

State social protection of farms affects their preparedness for emergencies and their ability to successfully and quickly eliminate the consequences, as well as to recover from an emergency. In Belarus, peasant farms make social insurance contributions for their employees on an equal basis with other legal entities, to ensure social protection of employees. In addition, a number of measures are envisaged for peasant farms, including those providing social support, implemented as part of the State Programme for Agricultural Business Development for 2016–2020, as well as within the framework of its continuing state programme, Agrarian Business, for the period 2021–2025. Those measures include the:

- provision of the basic equipment for peasant farms;
- provision of land plots to citizens for subsidiary farming;
- payment of premiums to purchase prices for agricultural products purchased from the population;
- provision of consulting services to agro-industrial production entities.

Farmers, as owners of private subsidiary farms, enjoy state support (Law On private subsidiary farms of citizens No. 149-3 of 11 November 2002) through the facilitation of:

- establishment by village, district executive and administrative bodies of communal unitary enterprises (with consulting centres and rental stores for agricultural machinery and animal drawn vehicles) to provide citizens with subsidiary farm services for the cultivation of agricultural crops and harvesting, forage procurement, sale of grown products, fuel procurement and processing of land plots;
- assistance in the sale of surplus agricultural products produced on private subsidiary plots;
- holding annual events for the prevention of infectious and invasive diseases of animals owned by owners of private subsidiary farms;
- sale by the owners of private subsidiary farms of young breeding stock (pigs, cattle, horses), poultry, mineral and organic fertilizers, plant protection products, planting material for agricultural crops, compound feed, and grain for forage purposes;
- meeting the needs of the owners of private subsidiary farms in hayfields and pastures for personal livestock.

Local executive and administrative bodies provide trading places to the citizens who produce agricultural products for their sale, ensure protection against extortion and other criminal encroachments on their products. If private subsidiary farms are located in an area where there are no industrial and social facilities, local executive and regulatory bodies build roads, radio and power transmission lines, and also provide water supply, gasification, telephone installation, and land reclamation. These activities are financed at the expense of central and local budgets.

Agricultural and food security profile

Land resources in Belarus

Currently, forest-covered and agricultural land prevails in the land profile of Belarus, the share of which as of 1 January 2020 is 46.8 percent and 40.4 percent, respectively. Land under water (rivers, lakes, swamps) is 1.26 million ha, or 6.1 percent of the total. The rest of the land (6.7 percent) is occupied by roads and other transport infrastructure, buildings, and also includes unused and disturbed land. Since 2014, the area of agricultural land has decreased by 335 800 ha, while forest land has increased by 416 300 ha (SPC, 2020a). The tendency for change in the structure of land resources is characterised by a reduction in the area of agricultural land and increase in environmentally stabilizing land, which includes forest land.

The main reasons for the decrease in the area of agricultural land include the transfer of unproductive land to other categories of land, and the withdrawal of agricultural land and its transfer for non-agricultural purposes. In contrast, the increase in the share of forest land is primarily due to the long-term government policy aimed at the development of forestry as a whole. The area of forest land has largely increased due to measures to consolidate open sandy soils with the help of woody vegetation, as well as non-interference into the natural processes of forest growth on low-quality, underused land.

The structure of agricultural land has also undergone significant changes over time. Currently, ploughed agricultural land constitutes 68 percent, permanent crops occupy 1.2 percent of agricultural land, and meadows 30.5 percent. Arable land area has increased by 153 400 ha since 2014. However, the greatest change has taken place with meadows, its total area decreasing by 465 100 ha. The process of reducing agricultural land is mostly associated with a change in the area of forest land and is explained by the overgrowth of trees and shrubs, observed in small-contour areas of meadows, far from agro-industrial activity.

In 2020, irrigated areas amounted to 30 300 ha, including 24 900 ha of arable land, 400 ha of land under permanent crops, and 5 000 ha of meadows. At the same time, 96.7 percent (or 29 300 ha) of all irrigated land belongs to agricultural enterprises (Belgiprozem, 2021). The area of irrigated land is practically not subject to changes: the differences fluctuate around 100 ha to 300 ha (SPC, 2020a). According to the Law of the Republic of Belarus of 23 July 2008 No. 423-3 On land reclamation, all reclaimed land is owned by the state, therefore their maintenance and reconstruction is carried out by the authorised bodies. In total, reclaimed land occupies 3.4 million ha, of which 2.9 million ha is agricultural. Reclamation systems on 356 600 ha are in need of reconstruction, mainly due to physical deterioration (Ministry of Agriculture and Food, 2016).

Currently, the issue of rational use of land resources is of high relevance. The soils in Belarus are characterised by a low quality, therefore there is a need to use large amounts of fertilizer, which creates the conditions for changing their qualitative composition. Soil vulnerability is increasing, due partly to climate change. In future, this problem will affect the southern and (partly) central regions of the country, which are characterised by a significant number of soils with light granulometric composition (sandy, sandy loam).

In this regard, the concept of “agroclimatic regions” has appeared in agriculture. For the first time, the boundaries of agroclimatic regions were identified in 1973, and in 2017 a new region was added (Figure 3).

According to the degree of continentality (determined by the number of days with air temperatures from 5° C to 15 °C), each region is subdivided into western (less continental) and eastern (more continental) sub-regions. Currently, there are four agroclimatic regions in Belarus: northern, central, southern, and new (Loginov, 2015).

Figure 3. Map of agroclimatic regions



- I – Northern (sum of air temperatures above 10 °C is less than 2200),
 II – Central (sum of air temperatures above 10 °C ranges within 2200-2400),
 III – Southern (the sum of air temperatures above 10 °C ranges within 2400-2600),
 IV – New (the sum of air temperatures above 10 °C is more than 2600).

a) the boundaries of agroclimatic areas
 (according to A.Kh. Shklyar, 1973)

b) the boundaries of agroclimatic regions for the warming period of
 1989–2015 (according to Melnikov et al., 2017)

NOTE: The boundaries and names shown and the designations used on these map(s) do not imply the expression of any opinion whatsoever on the part of
 FAO concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers and boundaries.
 Source: Melnik et al., 2017.

The new zone (IV) is characterised by frequent prolonged drought which results in depletion of soil moisture reserves and disruption of the water balance of plants, especially on light sandy and sandy loam soils. The agroclimatic conditions of the region are favourable for cultivation, including for some southern heat-loving crops that were previously atypical for this cultivation zone (for example corn, soybeans, sunflowers, millet). It should be noted that the change in the type of grown crops occurs naturally from north to south: from cold-resistant (fiber flax, perennial, annual grasses, vegetables in greenhouses, winter cereals) to thermophilic (buckwheat, eggplant, cauliflower, sunflower, sugar beet, potatoes, vegetables, pear, plum, cherry plum, watermelon).

Water resources. Almost 21 000 rivers flow through Belarus, and it has more than 10 000 lakes, 1 500 ponds, and 153 water reservoirs (Belhydromet, 2019b). The withdrawal of water from surface water bodies in Belarus is tending to decrease. For the period from 2014 to 2019, removal of water per year was reduced to 208 million m³. Water consumption is about 150 litres per day per person (4.2 m³ to 4.5 m³ per month), approaching the indicators of developed European countries (in Germany, France and Sweden it is 4 m³ to 5.5 m³ per month). Currently, the availability of fresh water in Belarus ranges from 3 100 m³ to 7 800 m³ per person per year, with the average European norm being 4 200 m³. During the period from 2014 to 2018, there were significant fluctuations in river flow. The lowest value was recorded in 2015 (29 800 million m³), which coincided with the strongest drought observed at that time. In the following years, the volume of river runoff gradually increased and reached its maximum in 2017 (60 400 million m³), but in 2018 it decreased again – by 8.9 percent compared with 2017 (Belstat, 2020f). There is a positive trend in the country in terms of increase in the volume of water recorded by metering devices. Thus, despite the availability of vast reserves of water, systematic work is being carried out in the country to ensure its rational use.

Forest resources. As of 1 January 2020, the forest fund of Belarus constituted 9.7 million ha. The forest cover of the country's territory is 39.9 percent, and forest land occupies 8.3 million ha (Belstat, 2020d). Around 75 percent of the forest is naturally regenerating, the remaining 25 percent is planted (FAO, 2020a). The forest structure

is divided into protective, recreational, nature conservation, and exploitable forests. Protective forests occupy 1.9 million ha; recreational and health-improving 328 000 ha; conservation forests 1.46 million ha. The rest of the forests are classified as exploitable and occupy the largest area (5.85 million ha). The species composition is dominated by coniferous forests (59.2 percent), almost half of which is plantations of *Pinus sylvestris* (49.7 percent). Mixed forests are dominated by maple, ash, linden, willow. In terms of rare types, areas with common ash have decreased due to significant drying out. Specially protected natural areas comprise 1.2 million ha of forest land (14.6 percent).

Biodiversity. At present, the situation with biodiversity in Belarus for the period 2014–2018 is quite stable in comparison with other European countries. As of 2018, about 27 100 species of living organisms were registered in the country, of which 4 500 were species of plants, and 16 000 animals. Only 2.5 percent of all fungi and flora species are included in the *Red Book of the Republic of Belarus*, and the largest share of those are vascular plants (11.2 percent), while only 1.2 percent of animal species are included in the book (Bagna, 2019).

Agriculture in Belarus

Agriculture is the most important sector of the economy. As of 2019, together with the forestry and hunting industry, it represents 6.8 percent of the country's GDP, 10.5 percent of investments in fixed assets (Belstat, 2020a), and about 8.7 percent of total employment (Belstat, 2020b). As a percentage share of the Belarusian economy, agriculture has declined from 9.2 percent to 6.8 percent over the past 15 years (2004–2019). The strongest decline was observed between 2004 and 2015. Since 2016, fluctuations in the share of agriculture in GDP have ranged from 0.2 percent to 0.4 percent (up and down) per year. In absolute terms, agricultural production increased over the entire period under consideration, while the highest growth rates (of 1.2 to 1.6 times) were registered in 2006–2011. Over the 2017–2019 period, the growth has been in the range of BYR 10 million (Belstat, 2020a). The total area of land in agricultural turnover is 8.4 million ha, or 40.4 percent of the country's territory. There are 0.89 ha of agricultural land for every resident of the country, including 0.6 ha of arable land. The agricultural sector employs 377 000 people (Belstat, 2020l), and 22.4 percent of the country's population lives in rural areas (Belstat, 2020a). Belarus is the only former Soviet country in Europe that does not permit private ownership of agricultural land. Private ownership of land is limited to small household plots in and around villages (Hartvigsen and Gorgan, 2020). Tenure security is very low for owners of those small plots, as well as those who have long-term rights to use land, as their rights to land are restrictive and can be arbitrarily revoked (FAO, 2021).

There are three types of agricultural producer in Belarus, but the priority area for the development of agro-industrial complexes has been and remains large-scale production (Ministry of Agriculture and Food, 2019a). The three producer types are: (a) large-scale agricultural enterprises (in 2018, more than 64 percent of which were either owned or co-owned by the state); (b) peasant farms, which are registered as legal entities; and (c) household farms, which are not registered as legal persons and represent farms (plots) managed by households (FAO, 2021). As of 1 January 2020, agricultural enterprises manage (both own and rent) 88.8 percent of agricultural land, peasant farms 2.6 percent, and the remaining 8.6 percent is managed by 2.9 million household farms (SPC, 2020a). At the same time, it is worth noting that household farms make a higher contribution to the gross agricultural output. For instance, in 2019 (controlling around 9 percent of agricultural land), household farms produced 17 percent of the gross agricultural output (Belstat, 2020a). The main characteristics and performance indicators of various categories of agricultural holdings are indicated in Table 2.

Table 2. Agricultural producers (as of 1 January 2020) and indicators of activity by category of farm, 2019

	Agricultural enterprises		Peasant farms		Household farms	
		%		%		%
Agricultural land area (thousand hectares)	7 377.20	88.8	213.9	2.6	712.4	8.6
Number of land users (units)	2 073.00	0.1	3 042.0	0.1	2 916 037.0	99.8
Average plot size (ha)	3 558.70	–	70.3	–	0.2	–
Agricultural production volume (million BYR)	16 464.00	79.8	556.0	2.7	3 619.0	17.5
<i>Livestock breeding</i>	10 696.00	95.7	47.0	0.4	437.0	3.9
<i>Horticulture</i>	5 768.00	61.0	509.0	5.4	3 182.0	33.6

Source: Belstat, 2020a; State Committee on Property, 2020a.

The most important components of the agricultural sector are crop and livestock production. Horticulture specialises in the cultivation of cereals (primarily barley, wheat, triticale) and forage (perennial grasses, corn), as well as industrial crops, potatoes, vegetables, and fruit. In 2019, horticulture sector production was worth BYR 9.46 billion (45.8 percent), and the livestock sector worth BYR 11.18 billion (54.2 percent). The country's livestock sector forms the basis of the export potential of the Belarusian agro-industrial complexes. Traditionally, the livestock industry specialises in milk production, cattle, pigs, and poultry breeding (Belstat, 2020a).

Fishery activities occur in two main areas: fish farming and growing in artificial conditions, and fishing in fishing areas. The country's aquaculture includes pond fish farming, fish farming in cages, pools and in recirculating water systems. The main species include carp, silver carp, salmon, and grass carp. In recent years, there has been an increase in the production of fish and seafood (including canned fish) – from 84 900 tonnes in 2013 to 127 300 tonnes in 2019. However, in 2019, Belarus provided only about 13.8 percent of the country's fish needs (the lowest level of self-sufficiency among the main agricultural products). At the same time, in 2019, about 74 000 tonnes of fish were exported (mainly to the Russian Federation), and about 145 000 tonnes were imported (Belstat, 2020a).

Belarus produces meat and meat products, dairy, flour and cereal products, animal feed, bread and bakery products, sugar, a wide range of confectionery and pasta, as well as vegetable and animal oils, fats, a wide range of alcohol, liqueur and spirits, wine, and brewing products. The country is also engaged in the processing and canning of fish and fish products of its own and foreign origin (AgroWeb, 2020). Production indicators for the main types of agricultural products per capita are given in Table 3.

Table 3. Production of the main agricultural products per capita (kg)

Product type	Years					
	2010	2015	2016	2017	2018	2019
Grain	736	912	785	842	649	778
Potatoes	825	632	630	675	618	648
Vegetables	246	178	199	206	184	197
Sugar beet	398	507	450	525	507	523
Fruits and berries	–	66	74	50	101	58
Livestock and poultry (slaughter weight)	102	121	123	127	129	132
Milk	698	743	751	771	774	785
Eggs, pieces	373	395	380	370	355	373

Source: Belstat, 2016; Belstat, 2020a.

The main products that come from Belarusian agriculture are milk, meat of cattle and poultry, grain, potatoes, vegetables, sugar beet and flax for industrial processing. In general, the production of agricultural products by every farm category is increasing annually. The volume of agricultural production in 2019 compared to 2010 increased 3.1 times, and the share of peasant farms as a proportion of the total volume of agricultural production also increased. In 2019, it constituted 2.7 percent (in 2010 it was 1 percent). It should be noted that state-owned farms specialise in the production of meat and milk, and commodity crops, while peasant farms and household farms specialise in the production of fruit, vegetables, potatoes and other high-value crops (FAO, 2021). In 2019, 35 percent of the total agricultural output produced by agricultural enterprises was in crop production, and 65 percent was in livestock production. In the case of peasant and household farms, crop production reached 91.5 percent and 87.9 percent, and livestock production 8.5 percent and 12.1 percent (Belstat, 2020k). With 2.6 percent of the total area of agricultural land in the country, in 2019 peasant farms produced 20.5 percent of the total volume of vegetables, 7.3 percent of potatoes, 2.7 percent of grain, and 2.5 percent of sugar beet. In 2019, their share in the sale of livestock and poultry for slaughter constituted 0.7 percent, and of milk 0.4 percent. The contribution of peasant farms to wool production was more significant, reaching 13.6 percent (Belstat, 2020a).

During 2016–2020, the agricultural production growth rates of peasant farms were higher than those of agricultural enterprises. This may be due to the fact that peasant farms occupy smaller agricultural plots than agricultural enterprises, and are at the initial stages of capacity growth. However, in practice household farms and peasant farms have very limited opportunity to expand the area of cultivated land. In addition, it should be borne in mind that given the limitations for expanding agricultural land, as well as the level of intensification, it is quite difficult to achieve significant growth in agricultural production on a national scale (Republican Scientific Unitary Enterprise, Institute of Systemic Research in Agroindustrial Complex of the National Academy of Sciences of Belarus, report recommendations, 2021).

Foreign trade

Belarus is a net food exporting country. During the entire period under review (2009–2019), the balance of foreign trade in food products was positive. The foreign trade of Belarus in agrifood products plays an important role in the economy of the agricultural sector, as well as for the social and economic development of the country as a whole. In 2019, the share of exports of agricultural products and food processing industries in the country's GDP was 8.8 percent, and in the total export potential of the country, 17.3 percent. The volume of exports of these products in the total volume of their production was 38.8 percent (FAO, 2020b). In 2020, the share of agrifood products of total exports (in USD) was 19.6 percent, and of imports, 12.9 percent (Belstat, 2021). At present, Belarus is almost completely self-sufficient in food: imports make up less than 10 percent of the total consumption (FAO, 2020b).

Foreign trade in food products has undergone significant changes over the past ten years. Food exports were decreasing until 2016, when they amounted to USD 4.23 billion, and then began to grow again and reached USD 5.54 billion in 2019, having increased by 30 percent. The countries of the Commonwealth of Independent States (CIS) have always traded heavily with Belarus. Thus, their share in food exports across different years was 88 percent to 90 percent, of which the Russian Federation accounted for about 90 percent to 94 percent, though by 2019 its share dropped to 88 percent. The main exports are dairy (31.1 percent) and meat (9.9 percent) products, eggs (23.7 percent), and potatoes (11.2 percent) (Table 4).

Table 4. Export and import of basic food types (tonnes thousands)

Product type	2015	2016	2017	2018	2019
Export					
Poultry meat and edible by-products	136.3	145.9	150.4	166.5	170.4
Uncondensed milk and cream	324.9	316.9	307.1	245.5	215.8
Condensed milk and cream	234.3	212.9	230.7	215.1	200.3
Eggs (millions)	874.5	885.3	793.9	646.8	765.9
Potatoes	300.9	297.5	390.1	299.5	360.6
Sugar	362.8	351.6	407.1	427.2	278.2
Cheese and cottage cheese	182.5	205.0	189.4	211.2	244.1
Rapeseed oil	132.7	40.5	62.2	233.1	272.9
Import					
Frozen fish, fish fillets and other fish meat (including minced meat)	123.8	121.3	140.4	132.2	126.4
Apples, pears, quince	907.6	743.6	629.4	317.9	361.0
Soya beans	6.3	78.1	130.7	389.0	487.0
Citrus fruits	122.1	92.2	82.6	95.1	86.6
Rapeseed	3.7	6.0	9.0	261.8	245.4
Sunflower oil	92.2	96.3	117.4	91.9	92.3
Groats	60.4	71.4	112.7	99.5	76.9
Bread and flour confectionery	50.6	50.7	60.1	67.7	79.2

Source: Belstat, 2020a.

Imports from non-CIS countries have grown at a fairly rapid pace, and since 2019, equalled imports from CIS countries (49.1 percent and 50.9 percent). The structure of the import basket has undergone significant changes. From 2009 to 2019, imports of pork increased three-fold, soybeans six-fold, rapeseed by 27 times, and bread and flour confectionery products by 50 percent. At the same time, imports of some vegetables (tomatoes, cabbage) and fruit (apples, pears, apricots, peaches), as well as cereals, has decreased significantly. Traditionally, a high proportion of imports are made up of sea fish and semi-finished fish products (5 percent to 7 percent) (Belstat, 2020a).

It is expedient to introduce innovations into production to strengthen foreign trade in agrifood products. In 2020, the proportion of Belarusian businesses producing food, beverages and tobacco products that also

invested in technological, organizational and marketing innovations, was 30.5 percent – this was of 89 enterprises that provided the state statistical reporting form (1-NT science Report on the implementation of research and development), which is submitted by legal entities that have carried out research and development. In 2019, 2018, 2017 and 2016, the share of such enterprises was 25.8 percent (of 76 reported), 22.6 percent (of 68 reported), 19.7 percent (of 62 reported) and 20 percent (of 62 who reported), respectively. Thus, one can see a positive dynamic both in the number of enterprises that carried out research and development, and those with expenditure on innovation (Belstat, 2020j).

At the same time, it is possible to single out some significant problems in the foreign trade of agrifood products, namely: about 60 percent of sales to foreign markets of agricultural raw materials or partially processed products; a high share of exports from Belarus going to the Russian Federation; insufficient supplies to other countries, including those in the Eurasian Economic Union (EAEU); about 35 percent of imports of products that are similar to domestic ones which there is no shortage of; and large-scale proliferation of transnational corporations and companies (Gusakov *et al.*, 2017; Gusakov, 2020).

Socioeconomic and demographic situation

As of 1 January 2020, the population of Belarus is 9 408 400, of which 2 104 600 (22.4 percent) is rural. In 2019, the number of people employed in the agriculture, forestry and fishery sectors amounted to 377 000 people (or 8.7 percent of the country's total employed population), of which 60.8 percent were men and 39.2 percent were women. There was a noticeable decrease in the number of workers in the sector compared with 2015, when 430 700 people were employed (Belstat, 2020l). At the same time, the number of employees of agricultural organizations in 2019 was 273 200 people (Belstat, 2020a). The country's population is characterised by a decrease in the overall rate of population growth, and birth rate, and an increase in the proportion of elderly people. Until 2008, international migration rate was negative (there was an outflow of the population from Belarus), but since 2008 international migration has been positive (Belstat, 2020h).

The nominal gross average monthly wage in rural areas in 2018 was BYR 651.5 (USD 250), or 67 percent of the national average. In 2018, the national minimum subsistence level was BYR 210.6 (USD 81). This indicator is used in Belarus to calculate the share of the population living below the poverty line. In 2018, 5.6 percent of the population was living below the poverty line (it was 5.9 percent in 2017) (Belstat, 2019). At the same time, the share of the population living below the international poverty line in 2019 was zero percent. The majority of the population employed in the agricultural sector are workers with a general secondary (37.8 percent) and vocational education (25.9 percent). Specialists with higher education make up a minority, and constitute only 11.2 percent. While agriculture is the most important source of employment in rural areas, the sector provides relatively low wages. Consequently, a slow but steady decline in the rural population can be noticed in recent years (from a 25 percent share in 2012, to 22.4 percent in 2020) (FAO, 2021; Belstat, 2020a).

Current state of food security and malnutrition

A fairly effective system for ensuring national food security has been formed in Belarus. It is based on the National Food Security Doctrine until 2030, which was approved by the Resolution of the Council of Ministers of the Republic of Belarus No. 962 dated 15 December 2017. This document defines the strategy for the sustainable provision of food to the population until 2030, for adequate nutrition and a healthy lifestyle through the development of competitive agricultural production, as well as the creation of socioeconomic conditions to maintain the consumption of basic food products at a rational level (Council of Ministers, 2017).

According to the Global Food Security Index (GFSI), Belarus is in 23rd place out of 113 countries under consideration (according to 2020), being ahead of its partner countries in the Eurasian Economic Union, as well as a number of European countries such as Poland, Spain, Greece, Hungary, and Slovakia. According to this index, and SGD indicators, Belarus has the lowest share in the world of the population living below the poverty line. In addition, the compilers of the index noted a developed system of regulatory documents for ensuring food security, a fairly low level of degradation of natural ecosystems, and high level of environmental protection (Global Food Security Index, 2020).

In terms of food security, in particular, Belarus should be classified as a country with a “very low proportion of the undernourished population in the total population” – less than 5 percent (on a par with the Russian Federation, Kazakhstan, and European Union countries). At the same time, in terms of the main indicators (the growth rate of food production, the average caloric content of the daily diet of the population, the proportion of animal proteins in the diet), Belarus meets the criteria of a country that ensures accessibility to food. According to the Global Hunger Index, in 2019 Belarus was among 17 countries with an index below 5, which indicates food security in the country (Global Hunger Index, 2020). This index is calculated on the basis of indicators of malnutrition, infant mortality, stunting, and underweight.

According to the international initiative The Global Nutrition Report, in Belarus, boys are more likely to suffer from overweight among children and youth aged 5–19 (26.3 percent of the number of children in this category) than girls (18.6 percent). At the same time, more boys (10.3 percent) and a small percentage of girls (4.8 percent) suffer from obesity. A similar picture is observed among the adult population. Overweight affects 62.6 percent of men and 56.3 percent of women, while among men this figure has increased by almost 10 percent since 2000. It should be noted that women are more susceptible to obesity (26.3 percent) than men (22.1 percent). As of 2017, about 2.5 percent of the population, or about 240 000 people, suffer from malnutrition. An average growth of 5 percent to 10 percent was observed for all indicators over the 2000–2016 period (Global Nutrition Report, 2020).

The fight against obesity is not a state policy priority in Belarus. This indicator is not included in the target indicators of the state programme People's health and demographic security of the Republic of Belarus for 2016–2020 (Resolution of the Council of Ministers of the Republic of Belarus No. 200 dated 14 March 2016). However, it is reflected in a number of activities of sub-programme 2, Prevention and control of non-communicable diseases such as developing proposals to limit advertising of food for children high in salt, sugar and fat; and catering arrangements aimed at a decrease in the content of salt, sugar, and increase of the amount of fresh vegetables and fruit.

As a result of the implementation of state programmes for the development of the agro-industrial complex (2006–2010, 2011–2015), measures were taken to modernize the material and technical base and increase production capacity. An extensive network of agro-towns was also created to ensure the social development of rural areas. Their construction and provision of public amenities began in 2005. However, along with the positive results of agricultural production in Belarus, there are a number of constraining factors of a technological, economic and social nature. These include low profitability of product sales, shortage of working capital at enterprises, instability of raw material supplies, complexity of the organizational structures of enterprises, lack of a single cost accounting mechanism and an effective system of costs control, the established practice of aggregation of unprofitable agricultural enterprises with processing enterprises, and a rather low level of material technical support of farms.

Regulatory framework of the disaster risk reduction system in agriculture

Legislative framework

Disaster risk reduction legislation

Belarus fulfils its obligations in accordance with the Sendai Framework for Disaster Risk Reduction 2015–2030, and in accordance with the Decree of the President of the Republic of Belarus (dated 25 May 2017 No. 181 On the National Coordinator for Achieving Sustainable Development Goals). In addition, this decree provides for the creation of the position of national coordinator for the achievement of the SDGs. The national coordinator heads the Council for Sustainable Development and carries out general coordination of the activity of state bodies and other organizations towards the achievement of the SDGs by Belarus. Since 2013, Belarus has joined the Global Platform for Disaster Risk Reduction. In addition, to achieve the goals of sustainable development in Belarus, the National Strategies for Sustainable Socio-Economic Development (NSDS) have been adopted and are in effect, in particular the current NSDS-2030 (dated 2 May 2017 No. 10) (ME, 2017), as well as the draft NSDS-2035 (ME, 2020). Currently, Belarus has developed and is implementing the National Disaster Risk Reduction Strategy for 2019-2030 (approved in November 2018) (MES, 2018). The National Platform for Disaster Risk Reduction, and the State system for the prevention and elimination of emergency situations (SES), have been created – they are headed by the Ministry of Emergency Situations of the Republic of Belarus (MES). The Program of Socio-Economic Development of the Republic of Belarus for 2016–2020 (Decree of the President of the Republic of Belarus of 15 December 2016 No. 466) is also aimed at reduction of disaster risk and fatal casualties as a result of them, as well as at mitigation of potential damage caused by natural and anthropogenic disasters.

At present, DRR in Belarus is regulated mainly by various programmes, strategies, and laws, namely the Law of the Republic of Belarus On the Protection of the Population and Territories from Natural and Anthropogenic Emergencies (dated 5 May 1998 No. 141-3), as well as the new (enacted in June 2020) Law of the Republic of Belarus On Radiation Safety (dated 18 June 2019 No. 198-3); the Law of the Republic of Belarus On Industrial Safety (dated 5 January 2016 No. 354-3), which lists potentially hazardous agricultural facilities; the Law of the Republic of Belarus On Bodies and Subdivisions for Emergency Situations of the Republic of Belarus (dated 16 July 2009 No. 45-3); the Law of the Republic of Belarus On Civil Defense (dated 27 November 2006, No. 183-3), which proclaims that the main task of civil defence is creation, accumulation, and storage of material resources reserves for emergency response.

Informing the population about emergencies is carried out in accordance with the Law On Protection of the Population and Territories from Natural and Anthropogenic Emergencies. The procedure for collecting and exchanging such information is determined by the Resolution of the Council of Ministers of the Republic of Belarus No. 1280 of 23 August 2001 on the procedure for collecting information on protection of the population and territories from natural and anthropogenic emergencies and the exchange of this information.

The Decree of the President of the Republic of Belarus On Approval of the National Security Concept of the Republic of Belarus (dated 9 November 2010 No. 575) makes managing emergency situations one of the national environmental priorities. It also notes the need to develop monitoring of emergencies and quality of the environment. In accordance with the Resolution of the Council of Ministers of the Republic of Belarus On the State system for the prevention and elimination of emergency situations (dated 10 April 2001 No. 495), measures to reduce the risks of emergencies are carried out in accordance with the expenditures provided for in the Law on the State Budget (for example, the Law of the Republic of Belarus dated 16 December 2019 No. 269-3 On the State Budget for 2020). The Resolution of the Council of Ministers of the Republic of Belarus of 20 November 1998 No. 1800 provides for the creation of reserves of material resources for emergency response. The State system for the prevention and elimination of emergency situations, and civil defence, constitute the national platform as a set of national mechanisms for coordination and strategic leadership in the area of DRR, which are multi-sectoral and interdisciplinary by nature and involve all partners.

There is a state programme, People's Health and Demographic Security of the Republic of Belarus for 2016–2020, the purpose of which is to implement the constitutional rights of citizens to health protection, favourable environment, family protection, and so on. The programme was extended for the period of 2021–2025 with the aim of creating conditions for improving the health of the population at all stages of life, and improving the quality and accessibility of health care services. There is also the state programme Social Protection for 2021–2025, aimed at improving the provision of social protection of the population, the formation of an accessible living environment, as well as the state programme Labour Market and Employment Promotion for 2021–2025, aimed at promoting productive employment, the development of its new forms and inclusiveness. There is a National Action Plan for Gender Equality in the Republic of Belarus for 2021–2025, which envisions ensuring gender equality and empowering all women and girls, gender education, and awareness. Similar plans were in effect from 2011 to 2015 and from 2017 to 2020. The Resolution of the Council of Ministers of the Republic of Belarus dated 30 June 2012 No. 613 On Approval of the Regulation on the National Council for Gender Policy under the Council of Ministers of the Republic of Belarus and its Composition, sets forth the main provisions of the National Council for Gender Policy under the Council of Ministers of the Republic of Belarus. There is also a National Action Plan for the implementation of the provisions of the Convention on the Rights of Persons with Disabilities for 2017–2025. However, the sectoral national legislation on climate change and environmental protection itself does not cover the issues of gender equality, nor measures to address the needs of especially vulnerable groups of the population. The legislation of Belarus on risks covers primarily the areas of industrial production, environment, climate, and increasing attention is being paid to the issues of aging population and a barrier-free environment. It is important to note that one of the manifestations of the social policy of Belarus is the implementation of the State Programme for overcoming the consequences of the disaster at the Chernobyl nuclear power plant for 2021–2025, the purpose of which is social protection of the population affected by the disaster at the Chernobyl nuclear power plant, the unconditional meeting of radiation safety requirements, accelerated social and economic development, and revival of the territories contaminated with radionuclides.

It should be noted that the legislation on agriculture in Belarus belongs to the branch of agrarian law and is complex; it has not been classified yet. It includes the Civil Code of the Republic of Belarus (dated 7 December 1998 No. 218-3), the Land Code of the Republic of Belarus (dated 23 July 2008 No. 425-3), the Law of the Republic of Belarus dated 2 July 2010 No. 161-3 On Veterinary Activities, the Law dated 2 May 2013 No. 20-3 On Seed Production, the Law of the Republic of Belarus dated 20 May 2013 No. 24-3 On Breeding in Animal Husbandry, Decree of the President of the Republic of Belarus dated 17 July 2014 No. 347 On state agrarian policy, clause 2.7 of which provides for “ensuring sustainable development of rural areas, employment of the rural population, raising the standard of living, including the remuneration of workers employed in agriculture”, Resolution of the Ministry of Agriculture and Food of the Republic of Belarus, dated 9 April 2018 No. 38 on the approval of the instruction on the procedure for the use of funds allocated to finance the state programme for the development of agricultural business in the Republic of Belarus for 2016–2020.

However, in Belarus, DRR and management are included in the general emergency management system. Reducing the risk of disasters in agriculture is enshrined in some programmes (for example, in the state programme for sustainable rural development for 2011–2015, adopted by the Decree of the President of the Republic of Belarus on 1 August 2011 No. 342). The state programme for the development of agricultural business in the Republic of Belarus for 2016–2020 (adopted by the Resolution of the Council of Ministers of the Republic of Belarus No. 196 dated 11 March 2016) covers the main risks in agriculture, as well as the management of these risks, which is carried out on the basis of annual monitoring and evaluation the results

of the programme activities implementation, generation of forecasts and recommendations in the area of management and regulation of the agro-industrial complex. It is planned to continue this programme through the state programme, Agrarian Business, for 2021–2025, one of the sub-programmes of which is aimed at the implementation of engineering flood prevention measures. As of May 2021, under this programme, a competitive selection of implementers was carried out, and changes were made to sub-programmes, which represents an opportunity to include an additional section on risk reduction.

Emergency risk management in the agricultural sector is carried out on the basis of the Order of the Ministry of Agriculture and Food dated 19 November 2012 No. 415 On the Sectoral Subsystem of the State Emergency Prevention and Response System of the Ministry of Agriculture and Food of the Republic of Belarus. This system provides planning, organization, execution of measures to protect the population and territories from natural and anthropogenic emergencies and preparation for civil defence measures. Emergency risk management in the agricultural sector is implemented in accordance with the Order of the Ministry of Agriculture and Food dated 20 February 2013 No. 50 On the Establishment of the Commission on Emergency Situations of the Ministry of Agriculture and Food of the Republic of Belarus; Order of the Ministry of Agriculture and Food of 27 October 2010 No. 500 On the Functioning of the Emergencies Monitoring and Forecasting System in the Sectoral Subsystem of the State system for the prevention and elimination of emergency situations of the Ministry of Agriculture and Food of the Republic of Belarus; Order of the Ministry of Agriculture and Food dated 25 June 2013 No. 224 On Training the Top Management and Employees of the Ministry of Agriculture and Food in the Field of Emergency Protection and Civil Defence; and the Regulation On the Republican Civil Defence Service for the Protection of Agricultural Animals and Plants (approved in 2017).

The Law of the Republic of Belarus On the Legal Regime of Territories Affected by Radioactive Contamination as a Result of the Chernobyl Disaster (dated 26 May 2012, No. 385-3) classifies some territories as contaminated, which excludes their use for agriculture. The Law of the Republic of Belarus On State and Mobilisation Material Reserves (dated 5 January 2008 No. 314-3) designates farm animals and plants as objects of protection against modern means of destruction in emergencies. The legislation of Belarus provides for the establishment of restrictions on the use of natural resources in the event of epizootics and other emergencies (Law of the Republic of Belarus On Wildlife, dated 10 July 2007 No. 257-3). The Decree of the President of the Republic of Belarus on licensing of certain types of activities (dated 1 September 2010 No. 450) provides for the compulsory licensing of veterinary activities. In addition, the law approved the need for compliance by the facilities where farm animals are maintained with veterinary and sanitary requirements, the establishment of certain requirements and standards for food products, and the functioning of an overview system for planned environmentally hazardous agricultural activities or food production activities (Decree of the President of the Republic of Belarus of 23 November 2017 No. 7 On the Development of Entrepreneurship; Resolution of the Council of Ministers of the Republic of Belarus of 11 July 2012 No. 635 on some issues of sanitary and epidemiological welfare of the population). The Decree of the President of the Republic of Belarus dated 21 March 2018 No. 112 On Hunting and Hunting Management establishes a special regime for the use of resources of certain species of game animals to prevent epizootics and other emergencies and eliminate their consequences.

The doctrine of national food security of the Republic of Belarus until 2030 was approved by the Resolution of the Council of Ministers of the Republic of Belarus dated 15 December 2017 No. 962. It mentions features such as instability of agricultural production associated with its dependence on natural and climatic conditions, as well as degradation of agricultural land caused by anthropogenic or natural factors. Climate change and disaster risks are not directly mentioned. At the same time, the doctrine envisions that implementation of relevant measures to ensure food security in the event of emergencies is one of the main activities of the Government of Belarus in this area (Council of Ministers, 2017).

Disaster risk monitoring legislation

The functioning of the national emergency monitoring and forecasting system for natural and man-made disasters (EMFS) is based on the Resolution of the Council of Ministers of the Republic of Belarus No. 1466 dated 19 November 2004 on approval of the regulation on the system for monitoring and forecasting of natural and anthropogenic emergencies. Specialised subdivisions are created as part of state bodies, the purpose of which is to forecast and assess emergency situations, as well as to monitor them. The composition and competence of these bodies is approved by departmental regulations, for example, the Order of the Ministry of Agriculture

and Food of the Republic of Belarus on the sectoral subsystem of the State system for the prevention and elimination of emergency situations of the Ministry of Agriculture and Food of the Republic of Belarus (dated 19 November 2012 No. 415). There is a regulation that determines the procedure for the functioning of the system for monitoring and forecasting emergencies of a natural and man-made character in the aforementioned sectoral subsystem (Order of the Ministry of Agriculture and Food of 27 October 2010 No. 500). State disaster risk management is focused on the management of natural and man-made risks. The Strategy for the Development of Hydrometeorological Activities adopted within the CIS (May 2012) contributes to the effective solution of systemic problems in the activities of the National Hydrometeorological Service.

The State Hydrometeorological Service of the Republic of Belarus carries out its activities in accordance with the Law of the Republic of Belarus No. 64-3 dated 10 December 2020 On hydrometeorological activities, as well as in accordance with the sub-programme Hydrometeorological activities, protection of natural resources in the context of climate change of the state programme Environmental protection and sustainable use of natural resources for 2021–2025. Until 2021, the sub-programme Development of the State Hydrometeorological Service, Mitigation of Climate Change Consequences, Improvement of the Quality of Air and Water Resources of the state programme Environmental Protection and Sustainable Use of Natural Resources for 2016–2020 was implemented.

The state programme, Environmental Protection and Sustainable Use of Natural Resources for 2016–2020, establishes the main directions of the state policy on environmental protection and rational use of natural resources. It includes sub-programme 2, Development of the State Hydrometeorological Service, Mitigation of Climate Change Consequences, Improvement of the Quality of Air and Water Resources. Within the framework of climate protection, a new Law of the Republic of Belarus On the Protection and Use of Peat Bogs, has been developed (dated 18 December 2019, No. 272-3). Monitoring and protection of the environment from natural hazards are facilitated by the Council of Ministers Resolution No. 1077 of 25 August 2006 On the National Register of Carbon Units; Resolution of the Council of Ministers of the Republic of Belarus dated 10 April 2006 No. 485 On Approval of the Regulation on the Procedure for Maintaining the State Inventory of Anthropogenic Emissions from Sources and Absorption by Sinks of Greenhouse Gases; Resolution of the Council of Ministers of 4 May 2006 No. 585 On Approval of the Regulation on the National Greenhouse Gas Inventory System.

The state programme, Environmental Protection and Sustainable Use of Natural Resources for 2021–2025, is aimed at improving the organizational, economic, technical and technological conditions to improve the environmental situation in Belarus. Among the tasks to achieve this goal, one can single out the introduction of modern technologies of hydrometeorological observations, technical upgrade of the state network of hydrometeorological observations; climate change mitigation and adaptation, including in terms of water resources management; fulfilment of the obligations on the implementation of the Stockholm Convention on Persistent Organic Pollutants dated 22 May 2001; conservation, restoration and sustainable use of ecological systems; conservation, restoration and sustainable use of wildlife habitats; ensuring the functioning and development of systems for environmental observation, assessing and forecasting changes in the state of the environment under the influence of natural and anthropogenic factors; ensuring the rational (sustainable) use of natural resources and environmental protection.

It is particularly worth mentioning risk insurance as a monitoring and protection mechanism. There is a Decree of the President of the Republic of Belarus On Insurance Activities (dated 25 August 2006 No. 530). Environmental and agricultural insurance is enshrined in the Law of the Republic of Belarus On Environmental Protection (dated 26 November 1992, No. 1982-XII) and is regulated by civil legislation. The establishment of such norms is based on the model Law On Environmental Insurance adopted by the Inter-Parliamentary Assembly of CIS countries (13 June 2000, No. 15-6). Such mechanisms promote economic incentives to reduce the environmental damage caused and to compensate for the resulting losses. Each year a president's decree approves a list of crops, livestock and poultry subject to mandatory insurance, as well as insurance rates for mandatory insurance with state support (Decree of the President of the Republic of Belarus dated 23 January 2020 No. 23 On Insurance of Crops, Livestock and Poultry in 2020. The resolution of the Ministry of Agriculture and Food of the Republic of Belarus dated 11 July 2014 No. 34 provides for the procedure for calculating the cost of restoring agricultural crops perished as a result of an insured event.

The terminology in the field of DRR in the legislation of Belarus differs from the terminology used internationally. For example, the national legislation speaks more about “emergency situations” rather than “disaster risks”.

It uses terms such as “reduction”, “mitigation of consequences”, “prevention”, as well as “readiness to respond”, in particular in the sectoral legislation on emergencies, so readiness for response is mentioned in a new Law of the Republic of Belarus On Radiation Safety (18 June 2019 No. 198-z) that came into force in June 2020. Emergency preparedness and response are also envisioned in technical legal acts (sub-paragraph 4.4.7 of paragraph 4.4 of STB ISO14001-2005, Resolution of the Committee for Standardization, Metrology and Certification under the Council of Ministers of the Republic of Belarus No. 33 dated 19 July 2005). However, there is a similar terminology used in agricultural legislation, for example, in the State Programme for Sustainable Rural Development for 2011–2015. Elimination of the consequences of emergencies is also mentioned in the Concept for the development of the hunting sector in the Republic of Belarus (Resolution of the Council of Ministers of the Republic of Belarus No. 1029 dated 31 October 2014).

Belarus is party to many international treaties and agreements, such as the Kyoto Protocol and the Paris Agreement (2015), on the basis of which it develops and harmonises its domestic legal acts with the above and other international agreements.

MES approved the combat regulations for organizing fire extinguishing, which also provides for “mitigation”, “prevention” of consequences, as well as “readiness to respond” (Order No. 185 dated 30 June 2017). Enterprises that carry out potentially hazardous activities have additional internal documents regulating the procedure for preventing and responding to emergency situations.

The legislation of Belarus ensures the participation of civil society, private sector and scientific institutions in the adoption of important state decisions, for example, public discussions of draft laws are held (Resolution of the Council of Ministers of the Republic of Belarus No. 56 dated 28 January 2019). Public-private partnership is actively developing, some foundations for its implementation in the field of environmental management have been created (Law of the Republic of Belarus dated 26 November 1992 No. 1982-XII (latest changes in 2019) On environmental protection; Law of the Republic of Belarus dated 30 December 2015 No. 345-3 On public-private partnership). The Law on the Republican Budget for 2020 (Law of the Republic of Belarus dated 16 December 2019 No. 269-3) does not contain a concept such as “disaster risk reduction”; however, more than BYR 265 million (about USD 127 million as per the 2019 average annual exchange rate) has been allocated for emergencies prevention, and elimination of their consequences. With a total state budget for 2020 of about BYR 25.4 billion (USD 12.2 billion), that means about 1.04 percent of the budget is allocated for the purpose.

Education of children and youth about emergencies and natural hazards is actively developing, as well as training on how to behave when they occur. The Resolution of the Ministry of Education of the Republic of Belarus of 27 July 2017 No. 91 stipulates the introduction of topics in the school curriculum on the general characteristics of emergencies, and the procedure for action in case of occurrence. A compulsory educational discipline, “protection of the population and territories from emergencies”, has been introduced in institutions of higher, as well as general secondary, and specialised secondary education (Resolution of the Ministry of Education of the Republic of Belarus dated 27 July 2018 No. 76). An instruction on the procedure for training workers on fire safety and testing their knowledge in this area is in force (Resolution of the Ministry of Emergency Situations of the Republic of Belarus No. 36 dated 22 May 2018). The term “disaster risk reduction” has not yet become widespread in Belarusian legislation, which, however, does not impede the implementation of measures to prevent, reduce and eliminate them.

Policy, plans, strategies

The policy for the reduction and management of disaster risks in Belarus is aimed at creating conditions for the sustainable development of the state by increasing safety for citizens and society; it is formed on the basis of a number of strategic and programme documents. The strategic goal of the state policy in the field of environmental protection in accordance with the Constitution of the Republic of Belarus is to achieve a higher quality of it, providing environmentally friendly living conditions for the population, and sustainable socioeconomic development of the country. National strategies are goal-setting documents, the conceptual basis of the strategic planning system, the main examples of which are the following:

The National Disaster Risk Reduction Strategy of the Republic of Belarus for 2019–2030 (MES, 2018) takes into account the provisions of the Sendai Framework for 2015–2030 and the commitments made by Belarus to achieve the SDGs. This strategy establishes a set of official views on the essence and content of the activities of Belarus to reduce risk of natural and man-made emergencies. The measures envisaged in the strategy are aimed at the implementation of the following priority areas of activity: understanding the risk of emergencies, including their analysis, assessment and management, as well as mitigation of consequences; improvement of the organizational and legal framework for emergency risk management; investing in DRR measures to strengthen resilience; enhancing disaster preparedness to ensure an effective response; and integrating the “build back better” principle in recovery, rehabilitation and reconstruction activities. The implementation of the strategy will make it possible to more effectively withstand natural emergencies, that are characterised by more and more serious consequences every year as they increase in scale. The objectives of the strategy include “ending hunger, ensuring food security, improving nutrition and promoting sustainable agricultural development” (task 2), as well as “ensuring gender equality and empowering all women and girls” (task 5).

In 2019, the United Nations Office for Disaster Risk Reduction (UNDRR) conducted an independent multilateral assessment of the National Disaster Risk Reduction Strategy for 2019–2030. The assessment was focused on the strategy’s compliance with the recommendations of the Sendai Framework. The independent expert group included representatives from the European Scientific and Technology Advisory Group, the financial sector, local authorities, civil society, UN organizations, Sendai Framework national focal points, and other experts in the field of DRR. The group reviewed the current strategy and provided recommendations aimed at ensuring the greatest reduction of existing disaster risks and prevention of new ones (UNDRR, 2020).

In 2020, an online seminar of the twinning project, Strengthening the Ministry of Emergency Situations of the Republic of Belarus, was held at the University of Civil Protection of MES. Experts from Belarus, Finland, Croatia, Slovenia, and Cyprus made online presentations of their national strategies to reduce the risk of emergencies and compared the Belarusian document with similar documents used in European Union countries (BelTA, 2020).

The National Strategy for Sustainable Socio-Economic Development for the Period up to 2030 (NSSD-2030) (ME, 2017) is a long-term strategy that determines the goals, stages and directions of the transition of Belarus to a post-industrial society and innovative development of the economy while guaranteeing comprehensive development of individuals, raising human life standards, and ensuring a favourable environment. NSSD-2030 was adopted in February 2015. The strategic goals for the development of agriculture in NSSD-2030 are fully consistent with the national interests and priority areas for the development of the agricultural sector. The indicators of agricultural development contained in NSSD-2030 (profitability of sales, the rate of growth of labour productivity in agriculture, the share of areas with organic farming) are relevant and correspond to the future-oriented parameters of industry development, indicated in the main state programmes. NSSD-2030 also determines the criteria for agricultural development that include increasing exports of agricultural products and food, as well as stimulating investments in new types of agricultural activities. However, NSSD-2030 does not contain any quantitative indicators for the assessment of these processes.

The threat of global climate change is indicated in the strategy as one of the main challenges for the sustainable development of the global economy. NSSD-2030 touches upon the relevance of land degradation issues, identifies the risks and possible threats for the ecological component of sustainable development, such as the risk of an increase in man-made load and disruption of nature's ability to heal itself; transboundary transfer of harmful and hazardous substances from the territories of other states; the problem of depletion of non-renewable natural resources. Among regional and local environmental threats, the main ones may become the danger of man-made accidents, the formation of toxic waste and lack of capacities (opportunities) for their processing or safe storage, degradation of soil and natural systems due to the violation of environmental and water balance. The main tools of state control include forecasting development scenarios, indicative planning, coordination, monitoring and performance evaluation. The intensity of agricultural production is linked to maintaining soil fertility and reducing the negative impact on the ecosystem. The strategy implies wide application of new progressive technologies (precision farming, use of the achievements of genetic engineering, automation and robotization of production, use of biologically safe fertilizers and pesticides).

In 2020, it was planned to adopt the National Strategy for Sustainable Development of the Republic of Belarus for the period up to 2035 (NSSD-2035) (ME, 2020) to replace NSSD-2030, the concept of which still emphasises environmental problems such as land degradation and chemical soil contamination. The main tasks of the environmental component will include ensuring environmental safety; preservation of natural ecological systems, biological and landscape diversity, ensuring a zero balance of land degradation; creation of an effective system for protecting the population from the harmful effects of natural and man-made emergencies; enhancing the resilience of the ecosystem (natural resource management), and ensuring environmental health by improving the quality of the environment.

The strategic goal of NSSD-2035 is the development of competitive, environmentally friendly agriculture and its intellectualisation on the basis of transition to a digital model of production development, which makes it possible to reduce its resource intensity, increase the volume of production and export of products with high added value. A new impetus will be given to the introduction of adaptive-landscape farming systems that take into account the intensity of crop production technologies on the land with different levels of soil and resource potential; increasing the level of environmental and biological safety due to introduction of environmental management systems, new feed additives, preventive and therapeutic drugs; intensification of activity to preserve and increase soil fertility, reduction of the degraded land share. It is planned to strengthen support for agricultural organizations, peasant farms and other entities involved in the production of organic products, as well as the creation of a national food market for organic products for export. It will be necessary to ensure the production of high-quality varieties of crops, resistant to recurring adverse weather conditions, diseases and pests by applying molecular genetic methods. The improvement of the methods of cultivation of crops and soil, and introduction of resource-saving technologies in agriculture (mulching, non-mouldboard ploughing), are envisaged. Particular attention will be paid to the digitalisation of agriculture through the development and implementation of intelligent robotic systems, machines and devices with artificial intelligence in agricultural production. Animal husbandry robotization and the application of digital farm technologies are becoming more common. It is planned to develop a programme on digitalisation of agricultural production in Belarus.

The Resolution of the Council of Ministers dated 29 April 2015 No. 361 on some issues of preventing degradation of land (including soil), enacted two documents, namely, the Strategy to implement the United Nations Convention to Combat Desertification in those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa, and the National Action Plan to Prevent Degradation of Land (including soils) for 2016–2020 (Ministry of Agriculture and Food, 2015). The objectives of this strategy implementation include conservation and rational (sustainable) use of land (including soils), prevention of their degradation, and increase in productivity leading to ensuring national security and improvement of living standards of the population. Comprehensive measures are being implemented to achieve the set goals:

- improvement of legal regulation and economic mechanisms to prevent degradation of land (including soil);
- improvement of the registration system of the land subject to degradation; systemic obtaining of up-to-date information on the quantity, condition, distribution of land subject to degradation, dynamics of land degradation processes and their restoration; improving the functioning of the land monitoring system;
- preservation, improvement of natural ecological systems and their use;

- preservation and enhancement of the natural potential of soil resources; effective functioning of land-reclamation systems; optimization of the use of agricultural land; implementation of agroforestry amelioration, anti-erosion and other measures aimed at protecting land from degradation;
- development and implementation of innovative agricultural technologies; development of organic farming systems; adaptation of agricultural production on land contaminated with radionuclides;
- reduction in the proportion of land subject to degradation; reclamation of disturbed land; restoration of territories exposed to chemical contamination;
- increasing the level of scientific and technical knowledge and awareness of the population on the rational use of land resources and prevention of land degradation, building human and institutional capacity in this area; international and regional cooperation.

It is planned to continue the implementation of this plan through the approval of the National Action Plan for the Prevention of Land (Soil) Degradation for 2021–2025, which provides for the following measures:

- improvement of legal regulation on prevention of land (soil) degradation;
- implementation of practical measures to prevent degradation and to restore degraded land (soils);
- increasing the level of scientific and technical knowledge;
- capacity development, information support, strengthening of international cooperation in this area.

Priorities of Belarus on prevention of land degradation include:

- achieving neutral (zero increment) land degradation (including soil);
- restoration of degraded and transformed ecological systems;
- compliance with agricultural technologies that ensure the preservation and increase of natural soil fertility, development and implementation of innovative agricultural technologies;
- minimisation of organic matter mineralization in peat soils;
- development of organic farming;
- scientific capacity development in the field of protection and rational use of land.

The Agriculture Adaptation Strategy to Climate Change adopted in 2019 (Ministry of Agriculture and Food, 2019a) provides that there is no choice but to introduce adaptation measures to mitigate the inevitable climate impacts and their economic, environmental, and social costs. Adaptation measures through the development and implementation of new insurance options for agricultural risks associated with climate change include, in particular, expanding the list of risks accepted for insurance, as well as reducing tariffs for insurance of agricultural products against risks associated with the loss or significant decrease in crop productivity; death or disease of livestock and poultry due to long-term climate change; studying the possibilities of “index insurance” with reimbursement of direct costs according to index (for example, meteorological) criteria, while improving the regulatory legal framework and the practice of its application by changing tax and insurance legislation; gradual creation of institutional conditions for the participation of international insurance companies in reinsurance of risks of agricultural production on the territory of Belarus. The directions for further adaptation of the country’s agriculture to climate change in the twenty-first century should include, in particular:

- in-depth assessment of changes in climatic and agroclimatic characteristics and new agroclimatic zoning of the country’s territory in view of changes in agroclimatic conditions for the growth of agricultural crops; land-use changes given the sensitivity and vulnerability of agricultural soils to increased drought, compaction, and erosion;
- introduction of moisture-saving technologies and expansion of irrigated agricultural land, modernization of irrigation and drainage networks and infrastructure given the expected change and seasonal redistribution of water flow, the introduction of an integrated management system of the country’s water resources;
- optimization of crops and agricultural practices, as well as the breed composition, nutrition and conditions of keeping farm animals;
- strengthening and developing the activities of plant protection services;
- strengthening research and innovation activities in the field of climate-change impact on agriculture, monitoring of climate change, adverse weather events, surface and ground waters and soil conditions and prompt dissemination of information about them;

- raising awareness of the authorities, large and private farms, and the population, about the problems of climate change, opportunities and ways of adaptation to it;
- developing the institutional framework for adaptation to climate change, improving the regulatory framework and economic incentives for agriculture adaptation, strengthening the interaction of government bodies and other partners by creating permanent intersectoral mechanisms for the preparation and implementation of specific recommendations and measures in this area;
- increasing the number of farms, redistributing land plots taking into account the specialisation of agricultural production and increasing the share of the private sector in agriculture, creating conditions for attracting businesses to participate in mitigation and adaptation to climate change;
- introduction of new progressive directions of agricultural production (including environmentally friendly organic agriculture) and planning the further development of the industry in view of changes in agricultural conditions in other countries, the evolution of the agricultural market and foreign economic conditions.

The Environment Protection Strategy of the Republic of Belarus for the period to 2025 (Ministry of Natural Resources, 2011) defines the priority directions of state policy in the field of environment protection, the implementation of which will ensure sustainable socioeconomic development of the state in the interests of society and individuals. The principles of this strategy include minimising the acceptable environmental risk along with economic growth to ensure environmental safety. The priority areas in the field of environmental monitoring and information support of public administration include the development and implementation of a set of measures for forecasting, identifying and preventing environmental risks associated with economic and other types of activities. The strategy will be implemented through the development and implementation of state target strategies, programmes and action plans (including regional ones) for the protection, restoration and rational use of individual components of the environment and natural ecosystems, and research programs in the field of environmental protection.

The tasks for the conservation of biological and landscape diversity include ensuring the development and implementation of a nationwide system of measures aimed at strengthening biological security, including control over the import and spread of alien species that can harm natural habitat and agricultural crops, over pests, vectors and pathogens of diseases, genetically modified organisms, as well as preventing the use of chemicals that cause environmental degradation. The tasks to ensure the reduction of the impact on climate and adaptation of the social and economic spheres to its change include the introduction of the best agricultural practices in keeping animals and poultry, storing and applying organic fertilizers to the soil; construction of biogas plants; development of mechanisms of economic incentives for business entities to reduce greenhouse gas emissions; the use of a system of insurance and special compensation funds to increase the adaptive capacity of the social economic sphere to probable climatic changes.

The National Action Plan for the Development of a Green Economy in the Republic of Belarus until 2020 (Ministry of Natural Resources, 2016b) enshrines the country's commitment to the principles of a green economy. The plan foresees the creation of conditions for the production of agricultural organic products. The introduction of organic production in agriculture, resource-saving technologies, including minimum and zero tillage, will ensure a reduction in the level of environmental impact, and will also contribute to the development of a peasant (farm) economy (increasing employment in agricultural regions). At the time of preparing this study, the reports on the results of the plan's implementation had not yet been published. It is also worth noting that a new National Green Economy Development Plan for the period to 2025 is already being developed (with UNDP support).

The programme of socioeconomic development of the Republic of Belarus for 2016–2020 (ME, 2016) provides for the competitive growth of economic sectors based on innovation. The paragraph on “digital transformation of the economy” notes that transition to precision farming is planned in agriculture on the basis of widespread use of data from satellite communication and navigation systems, automated information collection and process control systems. The programme assumes widespread use of satellite monitoring of crops. The surveillance systems should be based on satellite navigation equipped with radio and cellular communications, as well as special computers and digital maps. At the time of the preparation of this study, the reports on the results of the programme implementation had not yet been published. A socioeconomic development programme for 2021–2025 is under elaboration. One of the priority directions in the draft programme is “efficient agriculture”, which foresees production of heat-loving and drought-resistant melons, walnuts, and apricots in the southern regions of the country.

The State Programme of Measures to Mitigate the Consequences of Climate Change for 2013–2020, approved by the Resolution of the Council of Ministers of the Republic of Belarus dated 21 June 2013 No. 510, has objectives which include the fulfilment of the country's international obligations under the UN Framework Convention on Climate Change and the Kyoto Protocol; and implementation of climate-change mitigation activities. Tasks to achieve the set goals include improving climate-change observations, mitigating climate impacts, and adaptation to climate change; scientific, staff and information support for the development and implementation of measures to mitigate climate-change effects; and international cooperation in this area.

The main measures to improve climate-change observation and adaptation include:

- improving the monitoring system for the main climatic characteristics;
- improvement of forecasting methods, including changes in climatic characteristics in the short and long term;
- introduction of modern automated observation systems at the stations participating in the constant international exchange of information on climate;
- obtaining climatic data on meteorological parameters in the atmosphere, in accordance with international standards;
- development and implementation of a set of measures for restoration and preservation of hydrometeorological data of the State Hydrometeorological Fund and modernization of telecommunication means of access to these data in accordance with the requirements of the World Meteorological Organization;
- studying the regional climate using digital predictive models, improving the efficiency and quality of the system for assimilating contact and remote sensing data to form the basis for objective analysis and release of products using domestic technology without using the forecast information of foreign centres;
- preparation of annual reviews of climate and its changes in the territory of Belarus;
- development and improvement of the system of criteria and conditions for the country's climatic security;
- assessment of the vulnerability of individual regions to climate change;
- development and implementation of sectoral strategies for adaptation to climate change;
- stimulation of activities related to the implementation of agricultural activities for adaptation to climate change;
- minimisation of the consequences of dangerous hydrometeorological events caused by climate change, including the development of methods for calculating risks and assessing damage, as well as scenarios for adaptation to such events;
- minimisation of the risk of decrease in agricultural production, including decrease in the productivity of farm animals, productivity and gross harvest volumes of agricultural crops;
- introduction into production of heat-loving species and varieties of agricultural crops with the expansion of their growing areas;
- assessment of the impact of climate change and potential threats to the biodiversity of natural ecosystems in Belarus along with the development of measures for their conservation.

This programme also provides for the improvement of information support, training of personnel and the development of scientific knowledge about climate change, including by assessing the factors of productivity and optimizing the structure of various crop areas in the context of modern climate change. At the time of preparing this study, the reports on the results of the programme implementation had not yet been published. It is also worth noting that the list of state programmes for implementation in 2021–2025 (approved by the Resolution of the Council of Ministers of the Republic of Belarus No. 759 of 24 December 2020) does not contain this programme.

The state programme for the development of agricultural business in Belarus for 2016–2020 (Ministry of Agriculture and Food, 2016) was adopted in order to increase the efficiency of agricultural production and marketing of agricultural and food products, as well as to increase their competitiveness, and provide the country's internal market with food in the necessary volumes and quality based on the formation of market mechanisms and the development of agricultural business. The implementation of a number of tasks is envisaged to achieve this goal, including the tasks related to risk management in agriculture – the protection of settlements and agricultural land from flooding and flash-flooding in the most flood-prone areas of the Polesie region; and

the creation of conditions for sustainable and dynamic development of the agro-industrial complex of Belarus (including an increase in export volumes, an increase in the productivity of reclaimed agricultural lands, an improvement in the financial condition of agricultural organizations). The programme lists the main risks, including natural and climatic ones, as well as risk management mechanisms and measures to minimise them. According to a 2019 assessment (which assessed implementation as average), the programme has achieved the following (Ministry of Agriculture and Food, 2019b):

- updating the database of the accounting statistics software package, aimed at analysing data from enterprises and organizations of the Ministry of Agriculture and Food, as well as storing data on the activities of peasant farms, marketing information and monitoring prices for the main types of agricultural products;
- protection of communities and agricultural land from flooding and flash-flooding in the most flood-prone areas of Polesie (2 155 ha protected, above the 2 100 ha that was planned);
- reconstruction of land-reclamation systems on an area of 32 400 ha – only 26 300 ha was planned;
- replenishment of the reserve fund of veterinary products in the planned volume, purchase and sale in full of baits with a vaccine for immunizing wild and carnivorous animals against rabies;
- purchase of mineral fertilizers, plant protection products for scientific organizations of the National Academy of Sciences of Belarus that carry out scientific research in the field of agricultural sciences;
- payment of 95 percent of the insurance premium under mandatory insurance contracts for agricultural crops, livestock and poultry listed in the annual presidential decree concerning mandatory insurance;
- financing the maintenance of veterinary laboratories and stations.

As mentioned earlier, the state programme Agrarian Business is envisaged for implementation for the period 2021–2025.

The state programme Belarusian Forest for 2016–2020 (Resolution of the Council of Ministers of the Republic of Belarus No. 215 dated 18 March 2016) is aimed at the phased implementation of the activities of the strategic plan for the development of the forestry industry for the period 2015 to 2030, by addressing a number of tasks between 2016 and 2020, including: improving forest inventory and monitoring systems, the organization of forest management and registration of forest resources in order to improve the quality of forestry; development of a system of scientifically based forestry activities and environment protection technologies that ensure effective protection of forests. The implementation of Belarusian Forest is planned to continue in 2021–2025. Its main tasks include improving the forest resources inventory system; sustainable forest management and maintenance of the forest fund in an appropriate sanitary condition; increasing the availability of forest resources to meet the raw material needs of industries and ensure the provision of ecosystem services; sustainable game management; modernization of logging, woodworking, furniture, pulp and paper and wood chemical industries, increasing their efficiency and competitiveness; creation of a pool of potential hires for continued development of the timber industry.

The State Programme for Innovative Development of the Republic of Belarus for 2016–2020 (Decree of the President of the Republic of Belarus dated 31 January 2017 No. 31) provides that public–private partnership under the programme will be carried out on the basis of sharing the risks of innovation activity, income and responsibility between the state and business entities of private ownership in the joint implementation of innovative projects. The priority areas of innovation for 2016–2020 include agro-industrial technologies and production; environmental management and advanced processing of natural resources; national security and defence, protection from emergencies. Based on the assessment of the implementation of the programme for 2019, it was deemed efficient. The implementation of the programme is planned to be continued. In addition, the State Programme Scientific and Innovative Activities of the National Academy of Sciences of Belarus, is planned for implementation in 2021–2025.

The state programme Disaster Management for 2021–2025 is aimed at implementing state policy on prevention and elimination of emergencies, civil defence and fire safety. The programme includes sub-programme 1, “prevention and elimination of natural and man-made emergencies with the use of aircraft and aviation personnel”, as well as sub-programme 2, “modernization of buildings and structures and technical equipment of emergencies bodies and units”. In general, the programme is aimed at increasing the potential of aircraft and aviation personnel; modernization of buildings and structures, as well as the improvement of technical equipment

of emergency bodies and departments to combat dangerous natural phenomena such as fires. The programme measures are financed from the central budget to the tune of BYR 31 149 035 (or USD 11 993 776),⁵ including funds of the state investment programme of BYR 20 322 159 (USD 7 824 943).

The state programme Land and property relations, geodetic and cartographic activities for 2021–2025 is aimed at developing a system of geodetic and cartographic support, appraisal activities, property relations, as well as increasing the efficiency of the use of land resources and state property. The tasks of this programme include: development of geodesy and cartography; development of the Earth remote sensing system; development of land management; cadastral assessment; development of the state land cadaster; development of evaluation activities; development of a property relations system.

Since February 2019, the Minsk Regional Executive Committee has begun the implementation of a large-scale project, Support for economic development at the local level in the Republic of Belarus, which is funded by the European Union and implemented by the United Nations Development Programme (UNDP) in partnership with the Ministry of Economy of the Republic of Belarus (approved by the Resolution of the Council of Ministers of the Republic of Belarus dated 21 January 2019 No. 40). This project is a component of the large-scale programme, Strengthening Private Initiative Growth in Belarus (SPRING). The project aims to support and develop economic initiative, competitiveness and innovation for inclusive development at the national and local levels. At the national level, the project provides for activities aimed at facilitating a dialogue on issues of support for the development of small and medium-sized enterprises, solving socially significant problems. Agriculture itself, disaster risks and climate change issues, are not mentioned in this project. However, since the project is aimed at stimulating the development of small and medium-sized farms, it is planned to stimulate the development of peasant farms and organic farmers as well, since they are small and medium businesses.

⁵Exchange rate of 2.5687 USD to BYR as of 22 March 2021.

Main challenges

The main gaps of the existing regulatory framework for DRR in agriculture include the following aspects:

- absence of a single data book, or a database of the current legislation in relation to natural and man-made risks, including in the agricultural sector, which complicates the analysis of existing problems;
- the state programme Emergency Management for 2021–2025 does not tackle the issues of emergencies handling within the sectors, including the agricultural sector; also, it does not consider the issues of regulation of dangerous natural phenomena, except for fires;
- insufficient adaptation of the National Emergency Risk Reduction Strategy for 2019–2030 to its implementation at all levels: the need to develop sub-strategies is indicated only at the territorial level, while sectoral and facility levels are not considered;
- the terminology in the field of DRR in the legislation of Belarus differs from the international approach. For example, the national legislation speaks more about “emergency situations” rather than “disaster risks”, which can be disorientating when trying to harmonise the national risk reduction system with regional and international versions.

Institutional framework for disaster risk management

Institutional mechanisms

The activities of international and national bodies and organizations are aimed at addressing the issues of disaster risk reduction (DRR). The mechanism at the supranational level is established on the basis of the Sendai Framework for Disaster Risk Reduction 2015–2030 as the main document in the area under consideration, as well as the 2030 Agenda for Sustainable Development, the United Nations Framework Convention on Climate Change, and the Paris Agreement, which contain separate provisions aimed at achieving DRR goals. These documents provide a framework for the establishment of national mechanisms.

Thus, the National Platform for Disaster Risk Reduction of the Republic of Belarus (national platform) was formed on the basis of the idea of creating a Global Platform for Disaster Risk Reduction, uniting the relevant regional and national platforms in order to create an effective mechanism for the prevention and elimination of emergencies. The Global Platform is an essential institution for DRR at the supranational level. Documents issued by international organizations, such as the United Nations Office for Disaster Risk Reduction (UNDRR) and the International Federation of Red Cross and Red Crescent Societies, constitute the basis for the functioning of the national platform in Belarus, which was created in 2013 on the basis of the SES and Civil Defence (BelTA, 2013). The platform encompasses entities whose activities are aimed at preventing and eliminating emergencies. The Emergency Situations Commission under the Council of Ministers is the coordinating body of the national platform. An action plan for the implementation of the National Emergency Risk Reduction Strategy for the period 2019–2030 sets the timeline for the development of both the national platform itself and other constituent elements of the DRR system in Belarus. The platform operates in three modes (similar to the functioning of the State Emergency Service): daily, high alert, and emergency mode at the moment of emergency occurrence and during emergency response.

Since the end of 2018, the National Emergency Risk Reduction Strategy has been in effect. It must be consistent with the strategies for adaptation to climate change (Ministry of Agriculture and Food, 2019a) and the strategy for sustainable development (ME, 2017), the implementation of which is carried out with the help of institutional mechanisms achieving the SDGs in Belarus (SDGs in Belarus, 2018).

Legal basis for the activities of state bodies, other organizations, their structure, key roles, responsibilities and activities

The National Platform for Disaster Risk Reduction includes a set of coordination mechanisms, the functional core of which is the Ministry of Emergency Situations (MES), which ensures coordinated interaction of all platform participants (MES, 2018). The national platform brings together a large number of state bodies and organizations (Figure 4).

Operational management and information support of the constituent entities of the national platform is carried out by an information management system, which includes:

- Republican Centre for Management and Response to Emergencies under MES;
- operational control centres of regional and Minsk municipal departments for emergency situations;
- centres of operational control and response to emergencies of regional and municipal city emergencies departments;
- information centres (control points) of republican government bodies, other government organizations subordinate to the Government of Belarus;
- duty dispatching services of districts, cities and organizations;
- task force headquarters for emergency response management at all levels.

Figure 4. Entities of the national platform for disaster risk reduction and the State system for the prevention and elimination of emergency situations



Source: compiled in accordance with the Resolution of the Council of Ministers of the Republic of Belarus No. 495 of 10 April 2001 On the State system for the prevention and elimination of emergency situations and MES, 2018.

Ministry of Emergency Situations of the Republic of Belarus

The Ministry of Emergency Situations of the Republic of Belarus (MES) is a government body that heads the system of emergency bodies and departments, regulates and administers prevention and elimination of emergencies, civil defence and fire safety, and other activities in accordance with the regulation on MES, legislation of Belarus, and decisions of the president. Territorial bodies for emergency situations are regional departments of MES, the Minsk Municipal Department of MES, city and district departments for emergency situations. Emergency situations bodies and units carry out their activities in cooperation with other state bodies, other organizations and citizens, in accordance with the rules and principles defined in the Law On Emergency Situations Bodies and Units of the Republic of Belarus, dated 16 July 2009 No. 45- Z. MES is the central body of the national platform. The president of Belarus, as well as the Council of Ministers, carry out general guidance for the bodies and departments for emergency situations. The minister of emergency situations exercises direct control over the bodies and departments of emergency situations. The entity responsible for the agricultural sector is the Ministry of Agriculture and Food.

The structure of MES includes several organizations, each of which is endowed with functions that are different from each other:

- The Republican Centre for Emergency Management and Response (carries out special functions for managing and responding to emergencies of a natural and man-made nature, monitoring and forecasting emergencies, monitoring the constant readiness of reserve civil defence stations);
- The Republican Centre for Certification and Expertise of Licensed Activities;
- Research Institute of Fire Safety and Emergency of MES;
- other organizations (territorial administrations, departments, university, and so on).

Measures to protect the population and territories from emergencies, and improve the material and technical base of the State system for the prevention and elimination of emergency situations, are provided for in the programmes of socioeconomic development of Belarus.

Disaster risk reduction implementation budget

Measures to reduce the risks of emergencies are implemented in accordance with the funding provided for in the Law on the State Budget. The legislation also stipulates the creation of material resources reserves for emergency response (Resolution of the Council of Ministers of the Republic of Belarus dated 20 November 1998, No. 1800).

The annual budget does not include an expenditure section that addresses directly DRR and climate-change adaptation. However, there are expenditure sections in the budget relating to national defence and the agro-industrial complex. In 2019, expenditure on national defence and security amounted to BYR 3.55 billion (USD 1.70 billion), including funding for emergency response agencies and departments, which amounted to BYR 238.3 million (USD 113.9 million), or 6.7 percent of the total national defence budget.

A total of BYR 246.1 million (USD 117.7 million) was allocated for financing of the agro-industrial complex in 2019 under the State Program for the Development of Agricultural Business in the Republic of Belarus for 2016–2020 (Ministry of Finance, 2019). Within the framework of some state programmes, measures were implemented that relate to DRR and adaptation to climate change. For example, funding of BYR 51.8 million (USD 24.8 million) was planned for 2019 within the framework of the state programme Environmental Protection and Sustainable Use of Natural Resources for 2016–2020.

State system for the prevention and elimination of emergency situations

The State system for the prevention and elimination of emergency situations (SES) is regulated by the Resolution of the Council of Ministers of the Republic of Belarus No. 495 of 10 April 2001, On the State system for the prevention and elimination of emergency situations, and unites MES, other government bodies, state organizations subordinate to the Council of Ministers, local executive and administrative bodies, and other organizations whose powers include resolving issues to protect the population and territories from emergencies.

SES functions as the responsible body in peacetime, while the same functions are performed in wartime by the Civil Defence system. The system of bodies and elements that make up SES is presented in Table 5. The principles of formation, the composition of forces and means, the procedure for performing tasks and the interaction of the main elements, as well as other issues regarding SES, are determined by legislation. The functioning of SES is provided by MES.

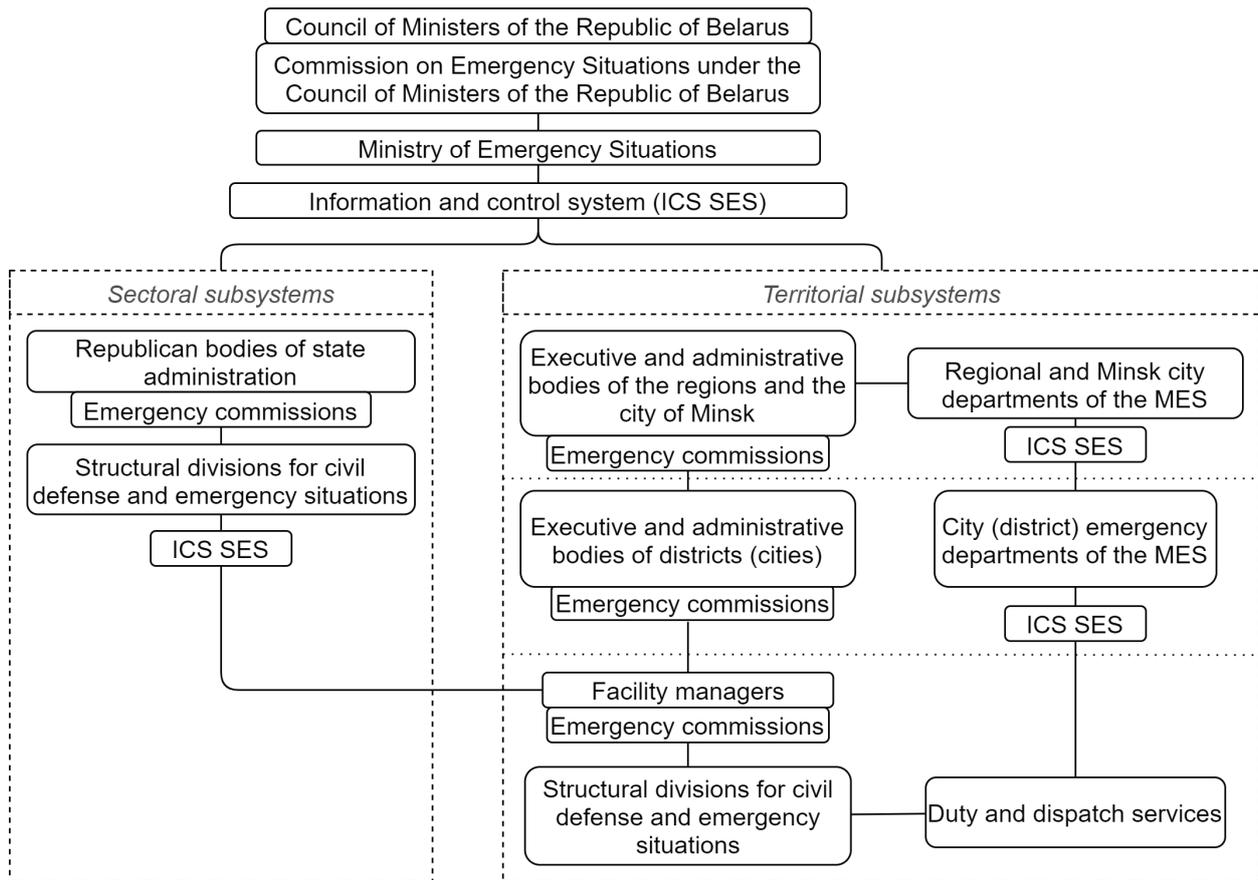
Table 5. Bodies and elements that make up SES

Level	SES bodies	
	Coordinating	Divisions
Republican	Commission on Emergency Situations under the Council of Ministers of the Republic of Belarus and Commissions on Emergency Situations of republican government bodies, other state organizations subordinate to the Council of Ministers of the Republic of Belarus	Ministry of Emergency Situations, structural unit, sector or department (Republican Centre for Emergencies Control and Response – RCEMR), created to perform tasks of protecting the population and territories from emergencies in republican government bodies, other state organizations
Sectoral	Emergency Commission under the republican government body or state organization (for the agricultural sector – Emergency Commission under the Ministry of Agriculture)	A republican government body or a state organization of the relevant industry (agricultural industry – the Ministry of Agriculture and Food), a structural subdivision, sector or department of the relevant industry (in the agricultural industry – the Labour Protection, Transport and Fire Safety Department of the Main Directorate of Technical Progress and Energy with Main Technical Supervision Authority)
Territorial, covering the territory of the region and the city of Minsk	Emergency Situations Commission under the executive and administrative bodies of the regions and the city of Minsk	Regional and Minsk municipal city departments of MES
Local, covering the territory of the district, city	Emergency Situations Commission under the executive and administrative bodies of districts (cities)	District (municipal) emergency departments of regional and Minsk municipal departments of MES
Facility, covering the territory of a specific organization	Emergency commission of an organization	Structural unit (department, section) or a specially appointed employee to perform tasks of protecting organizations from emergencies

Source: compiled in accordance with the Resolution of the Council of Ministers of the Republic of Belarus No. 495 of 10 April 2001 On State system for the prevention and elimination of emergency situations.

The structure of SES has a unified form both at the republican and sectoral levels (Figure 5). At the republican level, the governing body is MES, its structural unit directly related to emergency response is the RCEMR. At the sectoral level, the governing body is the respective line ministry, and it is subordinate to MES. For the agricultural sector, this is the Ministry of Agriculture and Food. In accordance with the resolution of the Council of Ministers dated 8 February 2002 No. 181, there are 18 state bodies and organizations, in which the sectoral subsystems of SES are created (listed in Figure 4).

Figure 5. Structure of the state system for the prevention and elimination of emergency situations (SES)



Source: compiled on the basis of the Resolution of the Council of Ministers of the Republic of Belarus 10 April 2001 No. 495 (as amended by the Resolution of the Council of Ministers of the Republic of Belarus 28 May 2020 No. 324).

According to the Law On Protection of Population and Territories from Emergencies dated 5 May 1998 No. 141-3, the main tasks of SES include:

- development and implementation of legal and economic norms to ensure the protection of the population and territories from emergencies;
- implementation of targeted scientific and technical programmes aimed at preventing emergencies and increasing the resilience of organizations in emergencies;
- ensuring preparedness for action of emergency bodies, forces and means intended and allocated for the prevention and elimination of emergency situations;
- creation of republican, sectoral, territorial, local and facility reserves of material resources for emergency response;
- collection, processing, exchange and issuance of information on protection of the population from emergencies;
- preparation of the population for action in emergencies;
- forecasting and assessing the social and economic consequences of emergencies;
- implementation of state expertise, supervision and control in the field of protection of the population and territories from emergencies;
- emergency response;
- implementation of measures for social protection of the population affected by emergencies, undertaking humanitarian activities;
- implementation of the rights and obligations of the population on protection from emergencies, as well as persons directly involved in their elimination;
- international cooperation on protection of the population and territories from emergencies;
- planning and implementation of a set of measures to protect the population and territories from emergencies;

- preparation for civil defence measures;
- prompt delivery of warning signals and information about emergencies, the procedure and rules of behaviour in emergency situation to government bodies, other organizations and the population;
- monitoring and forecasting of emergencies.

The role of government bodies and other state organizations subordinated to the Government of Belarus (as well as Belgosstrakh) in protecting the population and territories from natural and man-made emergencies is regulated by the Resolution of the Council of Ministers of the Republic of Belarus No. 495 of 10 April 2001 On State system for the prevention and elimination of emergency situations. The role of Belarusian organizations that play an important role in the prevention and elimination of emergencies in the agricultural, forestry and food sectors is presented in Table 6.

Table 6. Roles of Belarusian organizations in protection of the population and territories from natural and man-made emergencies, in particular in agriculture, forestry, and food

Government agency or organization	Functionality within the SES framework
Ministry of Agriculture and Food	<ul style="list-style-type: none"> – Organization of interaction with local executive and administrative bodies in resolving issues of epizootic, phytopathological and toxicological control, elimination of epizootics and epiphytotics; radiation control over the pollution of agricultural land, raw materials and products, as well as the rational agricultural production in conditions of radioactive contamination; implementation of measures to prevent and eliminate emergencies at subordinate facilities. – Observation, analysis and assessment of the conditions and changes in the sources of emergencies (epizootics, damage to agricultural plants by diseases and pests, fires, explosions and accidents with the release of potent toxic substances at hazardous industrial facilities, accidents at treatment facilities, hydrodynamic accidents, hazardous hydrological events, fires in natural ecosystems), monitoring and forecasting their occurrence. – Forecasting and assessment of the emergency situation at subordinate facilities, epizootic, epiphytotic situation in emergency zones. – Research work on prevention and elimination of emergencies in agriculture. – Implementing a set of measures to ensure trouble-free operation of land reclamation facilities in emergencies. – Organization and implementation of measures to prepare for civil defence activities. – Maintaining constant preparedness of observation and control forces and means included in the civil defence network of observation and laboratory control. – Creation and ensuring functioning of the branch subsystem of the State Emergency System.
Ministry of Forestry	<ul style="list-style-type: none"> – Forecasting the possibility of emergencies in the forest fund of the republic. – Organization and provision of measures to prevent emergencies associated with fires in the forest fund, as well as with the massive spread of forest vegetation diseases and pests. – Forecasting and assessment of the situation in case of fires in the forest fund, forest pathological situation in emergency zones. – Coordination of the activities of local executive and administrative bodies in the organization of extinguishing forest fires, as well as in the conduct of emergency rescue operations related to fires. – Monitoring, analysing and assessing the state and changes in the sources of emergencies (fires in natural ecosystems, damage to forests by diseases and pests), monitoring and forecasting their occurrence. – Organization and implementation of measures to prepare for civil defence activities. – Maintaining constant preparedness of observation and control forces and means included in the civil defence network of observation and laboratory control. – Creation and ensuring functioning of the branch subsystem of the State Emergency System.

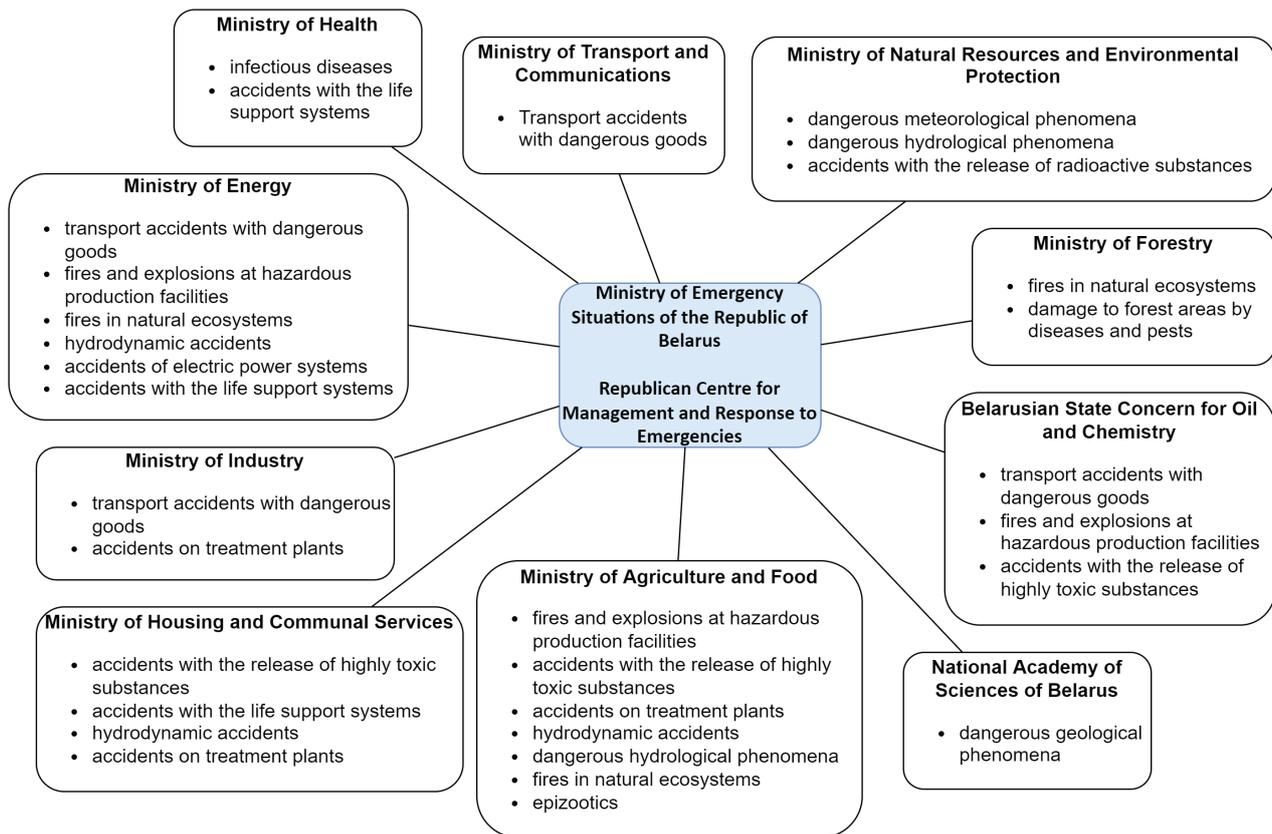
Government agency or organization	Functionality within the SES framework
Ministry of Natural Resources and Environmental Protection	<ul style="list-style-type: none"> – Organization and implementation of observations of the state of the environment and its pollution, including during emergencies. – Organization and implementation of state control in the field of environmental protection, including emergency situations. – Monitoring, analysing and assessing the state and changes in emergency sources (accidents with the release, or threat of release, of radioactive substances and environmental pollution, hazardous meteorological and hydrological events), monitoring and forecasting their occurrence. – Organization and participation in the work on assigning certain territories to the zones of environmental risk. – Participation in the development of measures for the prevention and elimination of emergencies. – Maintaining constant preparedness of observation and control forces and means included in the civil defence network of observation and laboratory control. – Organization and implementation of measures to prepare for civil defence activities. – Creation and ensuring functioning of the branch subsystem of the State Emergency System. – Informing the population and government bodies about the environmental condition. – Taking measures to compensate for the harm caused to the environment as a result of emergencies. – Organization and implementation of operational control and forecasting of zones of spread of radioactive and chemical contamination in emergency areas.
Belarusian Republican Unitary Insurance Company Belgosstrakh	<ul style="list-style-type: none"> – Insurance payments for the damage caused to legal entities and individuals as a result of emergency situations under insurance contracts concluded by the Belarusian Republican Unitary Insurance Company Belgosstrakh. – Assistance in the implementation of international treaties and agreements on interaction in the event of cross-border emergencies and the provision of humanitarian assistance. – Ensuring the priority customs clearance procedures and unimpeded passage of humanitarian aid at the state border checkpoints.
Ministry of Antimonopoly Regulation and Trade, Belarusian Republican Union of Consumer Societies	<ul style="list-style-type: none"> – Organization of provision of food and essential commodities to the affected population. – Ensuring emergency supplies of building materials, tools and equipment for emergency response (Belarusian Union of Consumer Societies). – Organization and implementation of measures to prepare for civil defence activities. – Creation and ensuring functioning of the branch subsystem of the State Emergency System.

Source: compiled in accordance with the Resolution of the Council of Ministers of the Republic of Belarus No. 495 of 10 April 2001 On State system for the prevention and elimination of emergency situations.

Republican Centre for Management and Response to Emergencies under the Ministry of Emergency Situations

By the Resolution of the Council of Ministers of the Republic of Belarus dated 24 June 2005 No. 688, the state institution Republican Centre for Management and Response to Emergencies of the Ministry of Emergency Situations of the Republic of Belarus (RCEMR) was created. RCEMR is included in the system emergency bodies and divisions of Belarus and carries out special functions for managing and responding to emergencies of a natural and man-made nature, monitoring and forecasting emergencies, monitoring the constant preparedness of reserve civil defence posts. It is the main organization associated with early warning tasks (MES, 2020b). Figure 6 presents an overview of the interaction of the RCEMR – as a structural subdivision of MES – with other departments and organizations on issues of various types of emergencies.

Figure 6. Interaction of RCEMR with other departments and organizations on various types of emergencies



Source: MES, 2020a.

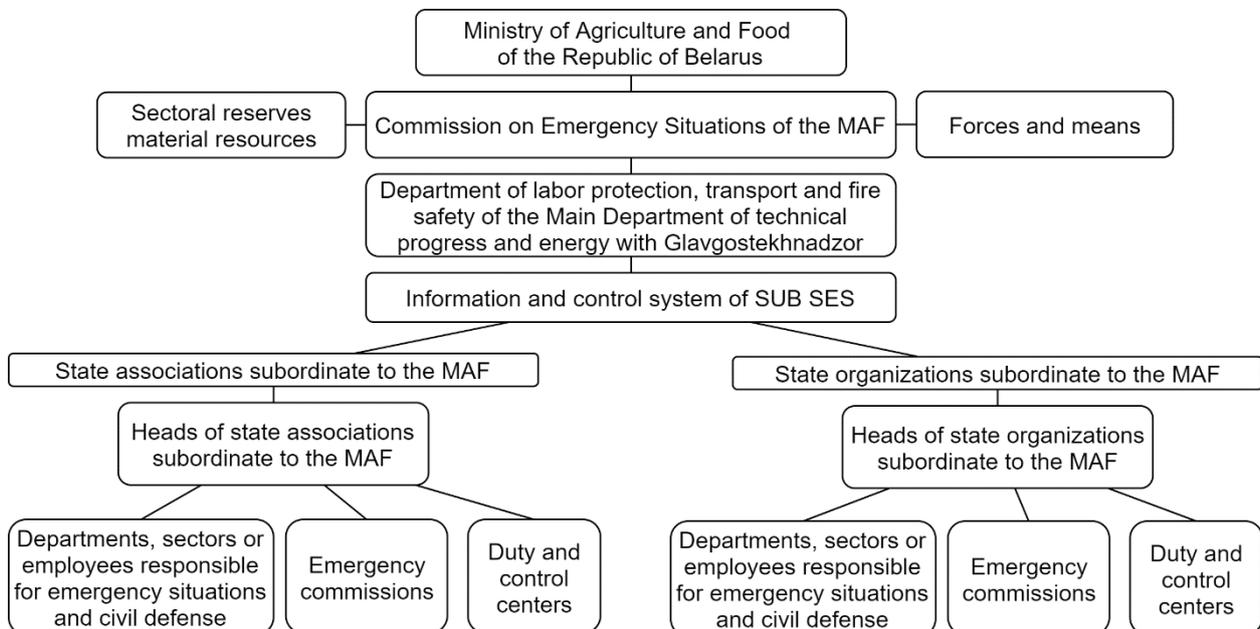
The organization performs the following activities: international cooperation; monitoring of emergency situations; operational control of forces and assets; warning and informing the population and government agencies. Notification of the population about emergencies is carried out by two departments within the RCEMR – the department of service and combat readiness of units, and the department of telecommunication systems and equipment. The second one is responsible for emergency population warning. The main tasks of the RCEMR of MES include:

- ensuring the operational management of forces and means of emergency bodies and subdivisions during emergency response, coordination of the work of government bodies, local executive and administrative bodies, and other organizations;
- informing (alerting) the population, government bodies, local executive and administrative bodies, other organizations on the emergence, elimination of emergencies and civil defence;
- ensuring the constant readiness of the forces and means of emergency bodies and units;
- ensuring, within its competence, the functioning of the system for monitoring and forecasting emergencies of a natural and man-made nature;
- ensuring readiness control of civil defence reserve points of central government bodies and other government organizations;
- participation in the preparation and implementation of measures to prevent natural and man-made emergencies, providing conditions for their elimination, and increase resilience.

Ministry of Agriculture

The sectoral subsystem of the state emergency prevention and response system of the Ministry of Agriculture and Food (SUB SES) functions in the agricultural sector. Its structure is presented in Figure 7. The main tasks of the SUB SES are defined as: implementation of programmes aimed at preventing emergencies; ensuring readiness for actions of emergency management bodies, forces and means intended and allocated for the prevention and elimination of emergency situations; collection, processing, exchange and issuance of information on protecting the population and territories from emergencies, forecasting and assessing the socioeconomic consequences of emergencies, emergency response, international cooperation on protecting the population and territories from emergencies. The regulation stipulates that the emergency response forces of the SUB SES consist of organizations of the civil defence service for the protection of farm animals and plants. The leadership of the republican civil defence service for the protection of farm animals and plants is entrusted to the Ministry of Agriculture and Food (MAF). The system also includes district services, the management of which is entrusted to the department of agriculture and food of the respective district executive committee.

Figure 7. Structure of the sectoral subsystem of the state emergency prevention and response system (SUB SES) of the Ministry of Agriculture and Food



Source: Regulation on the sectoral subsystem of the State system for the prevention and elimination of emergency situations of the Ministry of Agriculture and Food, approved by order of the Ministry of Agriculture and Food of 19 November 2012 No. 415.

The coordinating bodies of the SUB SES include the Emergency Situations Commission of the Ministry of Agriculture and the Emergency Situations Commission of state associations at the central level; at the facility (organization) level, a structural unit (department, sector) or a specially appointed employee to perform the tasks of emergency protection by the subordinate organization. The Commission for Emergency Situations of the Ministry of Agriculture and Food of the Republic of Belarus was established by order of the Ministry of Agriculture and Food of the Republic of Belarus No. 50 of 20 February 2013. The chairman of this commission is the first deputy minister of agriculture and food. In accordance with the Regulation on the Commission for Emergency Situations of the Ministry of Agriculture and Food, approved by order No. 415 of 19 November 2012, the tasks of the commission are as follows:

- coordination of the activities of emergency commissions subordinated to the Ministry of Agriculture, emergency commissions of state associations and other state organizations;
- interaction with the emergency commissions of the territorial subsystems of SES;

- participation in the development and implementation of targeted scientific and technical programmes aimed at preventing emergencies and increasing the resilience of state associations and subordinate organizations;
- organization of activity on creation of local monitoring and warning systems at hazardous production facilities of subordinate organizations;
- ensuring readiness of the command and control bodies, forces and means of the SUB SES for actions in case of emergency, coordination and management of activities to eliminate emergency situations at the facilities of state associations and subordinate organizations, including evacuation of workers from the facilities;
- participation in the organization and implementation of measures to prepare for civil defence measures;
- ensuring implementation of measures for the conduct of rescue and other urgent work in emergencies;
- organization of the creation of sectoral reserves of material resources for emergency response;
- organization of financing of measures to prevent and eliminate emergencies;
- organization and maintenance of activities to assess the economic and environmental damage caused to the agricultural sector as a result of emergency situations;
- participation in the implementation of measures for the social protection of the population affected by emergencies, as well as for exercising the rights and obligations of the population in the field of protection from emergencies, including those directly involved in their elimination;
- participation in the development of industry standards and rules for the safety of production, technological processes, as well as rules for the protection of employees of state associations and subordinate organizations from emergencies;
- organization of training of the leadership of the Ministry of Agriculture, forces and means, as well as employees of state associations and subordinate organizations for action in emergencies.

The governing body of the commission is the emergency management body of the SUB SES – Labour Protection, Transport and Fire Safety Department of the Main Directorate of Technical Progress and Energy with the Main State Inspectorate for Supervision of the Technical Condition of Machines and Equipment (Technical Supervision Authority) of the Ministry of Agriculture of the Republic of Belarus (the secretary of the commission is an employee of this department). The main functions of the emergency management body are the following:

- organization and participation in documents drafting for the preparation and conduct of exercises and training on the prevention and elimination of emergency situations of the SUB SES;
- annual development of organizational and methodological instructions, plan of basic measures for the preparation of the SUB SES for prevention and elimination of emergencies and civil defence, monitoring their implementation;
- collection, processing, exchange, assessment and transmission of information on the condition and change of sources of emergencies within the framework of emergencies monitoring and forecasting system, sustainability and safety of operations of state associations and subordinate organizations, information about the threat of emergencies and emergencies that have occurred;
- development of plans for checking the state of readiness of the SUB SES for emergencies prevention and elimination;
- organization of training and methodological conventions, meetings and other events on the functioning of the SUB SES.

A civil defence surveillance and laboratory control network is created for observation and laboratory control of pollution (contamination) of the environment (open water bodies, air, soil and vegetation), food products, food raw materials, forage and water with radioactive, poisonous and potent poisonous substances, biological (bacteriological) and other means, as well as to control the occurrence of epidemics, epizootics, epiphytotics and other infectious diseases. The civil defence surveillance and laboratory control network includes hygiene and epidemiology centres, veterinary laboratories and stations, agrochemical laboratories, laboratories for analytical environmental control, radiation and chemical observation posts, as well as facility laboratories and other organizations.

In addition to the law, civil defence issues are regulated by the Resolution of the Council of Ministers of the Republic of Belarus On Civil Defence Services (dated 12 August 2008, No. 1151). In accordance with this act,

the republican civil defence service for the protection of farm animals and plants is entrusted with organizing and carrying out measures aimed at preventing and protecting farm animals and plants, as well as protecting livestock and crop products from hazardous emergency factors. Activities related to DRR are carried out by the first deputy minister of agriculture and food.

In accordance with the Order of the Ministry of Agriculture and Food of the Republic of Belarus dated 27 October 2010 No. 500, the procedure for the functioning of the SUB SES, as well as the procedure for collecting and transmitting of monitored information, are determined. The system operates at the sectoral and facility levels. At the sectoral level, the coordination is performed by the Department of Labour Protection, Transport and Fire Safety of the Main Directorate of Technical Progress and Energy with Main Technical Supervision Authority, and structural units of the ministry responsible for organizing emergencies monitoring and forecasting in the respective sector. The tasks of the coordinating structural bodies of the organizations of the Ministry of Agriculture and Food include organizing observations of emergency sources, collecting, processing and analysing information about them, analysing and presenting observation data, as well as creating and maintaining a data bank on emergency sources. The powers for monitoring and forecasting emergencies are distributed among the structural units of the SUB SES depending on the type of emergency (Table 7). At the republican level, the emergency control body of the Ministry of Agriculture and Food interacts with the emergency control bodies of MES, while at the territorial level it interacts with the emergency control bodies of the territorial subsystems of the State Emergency System, as well as with the structural divisions of the Ministry of Agriculture and Food.

Table 7. Organizations within the Ministry of Agriculture and Food responsible for monitoring and providing information on certain types of emergencies in the RCEMR

Organization	Monitoring object
State production association Belmeliovodkhoz. Information submission period: annually, twice a year	Hydrodynamic accidents (dam breaks, emergency dam draining)
	Hazardous hydrological events
Main Directorate of Technical Progress and Energy, State Supervision of the Technical Condition of Machines and Equipment (Department of Labour Protection, Transport and Fire Safety). Information submission period: annually, twice a year	Fires (explosions) at hazardous production facilities
	Fires (explosions) in natural ecosystems
	Accidents with the release of potent toxic substances at the sector facilities (except for transport)
Department of Veterinary and Food Surveillance (Anti-Epizootic Control Department). Information submission period: annually, twice a year	Epizootics of animals in agricultural organizations of the sector and in the personal use of the population
Main Veterinary Directorate (Department of Agrochemistry and Plant Protection). Information submission period: annually	Damage to agricultural plants and forests by diseases and pests
Directorate General for Investment and Construction (Agricultural Radiology and Environmental Protection Section). Information submission period: annually, twice a year	Accidents at sewage treatment plants

Source: compiled on the basis of the Order of the Ministry of Agriculture and Food dated 27 October 2010 No. 500.

In addition, the Ministry of Agriculture provides information on the phytopathological situation in cereal crops (Ministry of Agriculture and Food, 2020a), gives recommendations on the care and protection of major crops from leaf diseases during the growing season of the reference year, modifies organizational and technological standards for the cultivation of grain, legumes, cereals, feed and industrial crops in terms of the seeding rate, and gives recommendations on the maintenance of reclaimed lands (Ministry of Agriculture and Food, 2020b). These recommendations are drawn up jointly with the branch institutes of the National Academy of Sciences of Belarus and published on the official website of the Ministry of Agriculture and Food.

Consulting services, research and other relevant organizations

Consulting, research and other services in Belarus are provided by a wide range of organizations. The services are intended for organizations of the agro-industrial complex, but they can also be provided to the population if necessary. These services include:

- development of scientific and technical documentation (draft programmes, methodologies);
- development, testing and implementation of technical devices, and equipment necessary for adaptation to climate change;
- monitoring of various spheres of the national economy, as well as the environment, by the relevant departments with the release of documentation on the monitoring results (operational information, periodic newsletters);
- educational services (training and retraining of personnel for various sectors of the national economy).

The Ministry of Agriculture and Food coordinates activities in the field of agriculture. The Main Directorate of Education, Science and Personnel within the ministry is responsible for the following main functions:

- participation in drafting of scientific research programmes and innovative projects in accordance with the priority areas of development in Belarus;
- participation in the drafting of state programmes, and the directions of agrarian education;
- training of specialists in view of the needs and conditions of the business environment.

The National Academy of Sciences of the Republic of Belarus (NAS), namely the Department of Chemistry and Earth Sciences, is engaged in the creation of the means of protection and stimulation of plant growth. The Department of Biological Sciences deals with the development of the scientific basis for the preservation of natural biological resources, introduction and acclimatization of plants and animals, restoration and rational use of disturbed ecosystems. The Department of Humanities and Arts deals with the development of mechanisms for sustainable socioeconomic development in Belarus, including in the agricultural sector. The Department of Agrarian Sciences deals with the elaboration of a development strategy, organizational and economic mechanisms for the activity of the agro-industrial complex, enhancing the country's food security, and the creation of highly productive, high-quality and resistant varieties of plants (I.M. Khasenevich, personal communication, 2020).

NAS has three experimental forest bases, seven experimental agricultural stations, the production farms Ustye and Konus, and two breeding enterprises, where scientific developments are tested, scientific support is provided, and the responsibility for the implementation of technical regulations is observed.

Ministry of Natural Resources and Environmental Protection. The main areas of activity include:

- implementation of a unified state policy in the field of environmental protection, rational use of natural resources, as well as hydrometeorological activities;
- implementation of state administration in the field of study, reproduction and rational use of natural resources, environmental protection, as well as state regulation in the field of hydrometeorological observations;
- ensuring conservation and sustainable use of biological diversity;
- ensuring access to environmental and hydrometeorological information, participating in the creation of a system of environmental education, upbringing and training;
- international cooperation, study of international experience in environmental protection and rational use of natural resources, hydrometeorological activities.

The ministry regulates the activity of the state Republican Centre for Hydrometeorology, Radioactive Pollution Control and Environmental Monitoring (Belhydromet) and six of its branches in the regional centres (Belhydromet, 2020a). Belhydromet carries out the following activities: hydrometeorological, agrometeorological, radiation-ecological, aviation-meteorological, scientific, as well as international cooperation. Scientific research is carried out in the following areas:

- functioning of the state network of hydrometeorological observations;
- assessment of changes in climatic and hydrological characteristics on the territory of Belarus in the context of global climate change;
- improving the system of climate data processing, storing, and managing;
- automation of the process of calculating periods of abnormally cold weather.

The Ministry of Emergency Situations of the Republic of Belarus is a state customer of scientific research and development under the state scientific and technical programme, Elaboration and Implementation of Means and Technologies for the Development of the State system for the prevention and elimination of emergency situations. Under the auspices of MES, scientific activities are carried out by the Research Institute of Fire Safety and Emergency Situations of the Ministry of Emergency Situations of the Republic of Belarus. The main goal of the programme is to minimise social, economic and environmental damage caused to the population, economy and the environment as a result of natural and man-made emergencies through the development and implementation of effective means and technologies of civil protection.

Non-profit and non-government organizations (NGOs). The Center for Environmental Solutions supports the development of organic agriculture in Belarus. This organization considers it an environmentally friendly alternative to traditional agriculture, a way to improve the environment and enhance the quality of life for each individual. It took part in drafting of the Law On the production and circulation of organic products.

Higher education institutions: Belarusian State Agricultural Academy; Belarusian State Agrarian Technical University; Grodno State Agrarian University; Vitebsk State Academy of Veterinary Medicine.

Thus, there are organizations in Belarus that have great potential for research and implementation of measures related to DRR at all levels.

Hydrometeorological service

Hydrometeorological activities in Belarus are regulated by the Law On Hydrometeorological Activities (No. 64-3 dated 10 December 2020), in accordance with which state governance and regulation of hydrometeorological activities is carried out by the president of Belarus, the Council of Ministers, the Ministry of Natural Resources and Environmental Protection (Ministry of Natural Resources), the State Military-Industrial Committee, state bodies and organizations with state aviation units, local councils of deputies, local executive and administrative bodies.

The Ministry of Natural Resources and Environmental Protection is the authorised meteorological body and it also:

- implements measures of a unified state policy;
- approves and enacts technical normative legal acts;
- determines, jointly with MES, the procedure for using the system of colour codes for the degree of danger of hydrometeorological events;
- creates the state hydrometeorological service, ensures its functioning and development;
- creates a state network of hydrometeorological observations, ensures its functioning and development;
- organizes the collection, processing, analysis, storage, provision and dissemination of hydrometeorological information by the state hydrometeorological service, including the provision of such information to civil aviation;
- makes submissions to the local executive and administrative bodies on the establishment of protective zones around stationary points of hydrometeorological observations of the state network of hydrometeorological observations and the establishment, in accordance with the legislation, of requirements for their protection and use;
- ensures the uniformity of measurements in the production of hydrometeorological information by the state hydrometeorological service;
- interacts with the State Committee for Standardization on issues of ensuring the uniformity of measurements;
- ensures the comparability of methods for the implementation and regulation of hydrometeorological observations, collection, processing, analysis and storage of hydrometeorological information;
- establishes the procedure for keeping records by producers of hydrometeorological information;
- organizes and coordinates scientific research activity;
- in agreement with the interested state bodies, determines the lists of characteristics and parameters according to which hydrometeorological observations are carried out;
- international cooperation.

The production of hydrometeorological information includes:

- hydrometeorological observations;
- collection, processing, analysis and storage of hydrometeorological information;
- compilation of weather forecasts and other information resulting from the analysis of primary hydrometeorological data;
- other works and services stipulated by legislation on hydrometeorological activities.

Hydrometeorological information includes:

- primary hydrometeorological data obtained as a result of hydrometeorological observations (certain types of hydrometeorological observations), including using the state network of hydrometeorological observations, the analysis of which has not been carried out;
- compilation of weather forecasts and other information resulting from the analysis of primary hydrometeorological data.

Hydrometeorological information is provided free of charge on dangerous and unfavourable hydrometeorological events. It is provided to controlling (supervisory) bodies, law enforcement bodies, other state bodies in order to fulfil the tasks assigned to them; to the state hydrometeorological service by other producers of such information; to the Armed Forces of the Republic of Belarus, other troops and military formations; and it is provided for the purposes of experimental aviation, state aviation. The rest of the information is provided for a fee on the basis of an agreement on performance of work or provision of services in the field of hydrometeorological activities.

Belhydromet is subordinate to the Ministry of Natural Resources and Environmental Protection, is a state hydrometeorological service and is engaged in maintaining:

- The Unified State Register of Organizations and Individual Entrepreneurs Carrying Out Hydrometeorological Activities. This activity is carried out to obtain information about the producers of hydrometeorological information, as well as information about the work performed and the services provided by them, by including this information in the register under consideration.
- State Climate Cadastre, the purpose of which is to provide government agencies, other organizations and individuals with climate data.
- State Hydrometeorological Fund, the purpose of which is classification, storage and use of hydrometeorological information by the Ministry of Natural Resources.

The main tasks of Belhydromet include:

- ensuring hydrometeorological safety;
- ensuring the continuity of hydrometeorological observations;
- provision of hydrometeorological information to consumers of such information, including to civil aviation;
- activities aimed at improving the efficiency of activities related to the production of hydrometeorological information, minimising the time of its provision and dissemination;
- production, provision and dissemination, in order to ensure hydrometeorological safety, of information on predicted dangerous or unfavourable hydrometeorological events;
- continuous improvement of methods and ways of disseminating hydrometeorological information, including about predicted dangerous or unfavourable hydrometeorological events;
- introduction of the most progressive international experience;
- scientific activities in the field of hydrometeorology.

The procedure for collecting information on protecting the population and territories from natural and man-made emergencies and exchanging this information between the Ministry of Emergency Situations, other departments, other state organizations, as well as local executive and administrative bodies, is determined in accordance with the resolution of the Council of Ministers of the Republic of Belarus dated 23 August 2001 No. 1280 On the Procedure for collecting information on protecting the population and territories from natural and man-made emergencies and the exchange of this information.

Producers of hydrometeorological information are organizations or their structural subdivisions, as well as individual entrepreneurs engaged in the production of hydrometeorological information. Producers of hydrometeorological information that are not part of the State Hydrometeorological Service provide hydrometeorological information to the Ministry of Natural Resources for free, and provide such information to other users on the basis of contracts.

The main organization engaged in the collection and dissemination of information on hydrometeorological, including weather and climate, events is Belhydromet. Belhydromet and six of its branches are part of the State Hydrometeorological Service of Belarus and are subordinate to the Ministry of Natural Resources (Ministry of Natural Resources, 2020a). According to the Resolution of the Council of Ministers of the Republic of Belarus dated 10 April 2001 No. 495, the main activities of Belhydromet in the context of measures to protect the population and territories from natural and man-made emergencies include observations, analysis and assessment of the conditions and changes in the sources of emergencies, monitoring and forecasting their occurrence, as well as informing the population and government bodies about the condition of the environment.

Regional coordination and information-exchange mechanisms

MES cooperates with four international organizations. These are:

The International Atomic Energy Agency (IAEA). MES is the national focal point for the conventions On Early Notification of Nuclear Accidents, and On Assistance in the Event of a Nuclear or Radiological Emergency.

Preparatory Commission of the Comprehensive Nuclear-Test-Ban Treaty Organization. MES is the national data centre under the Comprehensive Test Ban Treaty signed by Belarus.

International Charter on Space and Major Disasters. MES is an authorised user of the Charter. Obtaining such a status makes it possible, in the event of a major emergency, to promptly request and receive, through the charter's executive committee, the results of space imagery of the territory where the emergency occurred from the satellites of the space agencies participating in the charter.

European Flood Awareness System (EFAS). MES is a partner of EFAS, which aims to provide early information about possible flooding in transnational river basins and to ensure the readiness of countries to prevent them. This is achieved by providing additional forecast information and early warnings to national civil protection services. To forecast hazardous hydrological phenomena, EFAS uses its own models of river basins (including those of Belarus) and data from national hydrometeorological services.

The exchange of forecast, analytical and monitoring information in the emergencies monitoring system for prompt response by emergency authorities and units is carried out through the internet resource, 'automated system for collecting, processing and analysing information from the monitoring and forecasting system of natural and man-made emergencies based on internet technology' (MES, 2020d). MES provides daily operational information about emergencies that have occurred in Belarus, and a weekly review of emergencies that have occurred in the world. Belhydromet also publishes information on unfavourable weather events (MES, 2020e).

A map of adverse events is updated daily. It is a joint project of the Belarusian Red Cross, the Belarusian Telegraph Agency (BelTA), and MES (MES, 2020f). Forecast data are provided by Belhydromet. The map was created in order to inform the population about the operational situation during periods of flooding and fires in ecosystems. There is an opportunity to use the map and receive notifications about hazardous and unfavourable events through the MES mobile application, Help is Near.

Main challenges

The following aspects can be singled out as the main challenges for the functioning of the institutional structure of disaster risk management:

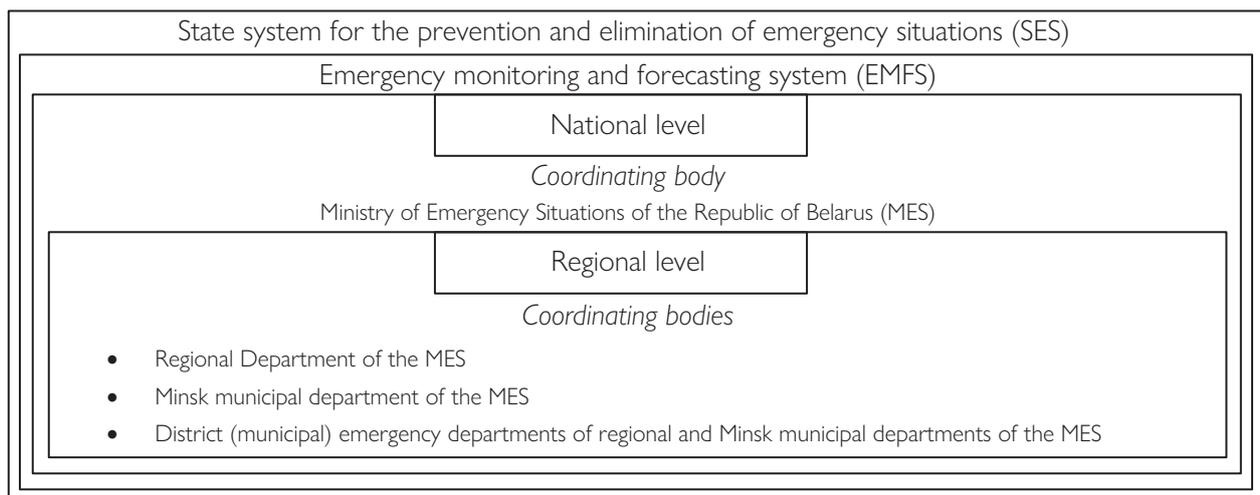
- absence in MES reporting of some statistical indicators included in the SDGs and the Sendai Framework for Disaster Risk Reduction – for example, the number of deaths and injuries as a result of emergencies is indicated, but the number of those who fell ill as a result of the emergency is not indicated. It also does not indicate what type of emergency (man-made or natural) led to death or injury, nor the destruction of buildings, structures, equipment and livestock. The reporting is mainly focused on sub-types of emergencies such as fires, with little attention to other natural hazards;
- incompatibility of data on the number of deaths and injured people as a result of emergencies on the official website of MES, and the SDG reporting data on the website of the national platform (the latter provides indicators, the metadata of which specifies that the data is produced by MES);
- the action plan for the implementation of the National Disaster Risk Reduction Strategy does not specify the budget needed for implementation measures.

Early warning systems

System of emergencies monitoring and forecasting

The EWS in Belarus is presented in the form of a national emergency monitoring and forecasting system (EMFS) of a natural and man-made character, which also includes warning the population about emergencies. MES, through the RCEMR, ensures coordination of the functioning (as well as collection, storage, processing of information about emergencies) of the monitoring and forecasting system at the central level. At the territorial and local levels, the collection, storage, processing of information about emergencies and their forecasting is carried out by the regional and Minsk municipal departments of MES (Figure 8).

Figure 8. Coordination system for the functioning of the emergency monitoring and forecasting system at national and regional levels



Source: Resolution of the Council of Ministers of the Republic of Belarus No. 1466 of 19 November 2004 On approval of the regulation on the monitoring and forecasting system of natural and man-made emergencies.

The exchange of forecast, analytical and monitoring information in the EMFS for prompt response by emergency authorities and units is carried out through the (internet resource) automated system for collecting, processing and analysing information from the monitoring and forecasting system of natural and man-made emergencies based on internet technology. The main tasks of the EMFS include:

- observation of emergencies sources;
- collection, processing and analysis of information about emergencies sources;
- creation of a data bank on emergencies sources;
- forecasting of emergencies;
- provision of information about the threat or occurrence of emergencies to government bodies and organizations subordinate to the Government of Belarus, local executive and administrative bodies.

Monitoring of natural and man-made emergencies in Belarus is carried out by 11 government bodies in 15 areas, for different types of emergencies (Table 8).

Table 8. State organizations carrying out observation, analysis and assessment of the state and changes in the sources of emergencies within the framework of emergency monitoring and forecasting system

Sources of emergencies	Organizations
Transport accidents with dangerous goods	MES Ministry of Transport and Communications Belarusian Railway Ministry of Energy Belarusian State Concern for Oil and Chemistry
Fires and explosions at hazardous industrial facilities	MES Ministry of Industry Ministry of Energy Belarusian State Concern for Oil and Chemistry Ministry of Agriculture and Food
Accidents with the release of potent toxic substances at facilities	MES Ministry of Housing and Communal Services Ministry of Agriculture and Food
Accidents with release (threat of release) of radioactive substances and environmental pollution	MES Ministry of Natural Resources
Power system failures	Ministry of Energy
Life support systems failures	Ministry of Housing and Communal Services Ministry of Energy Ministry of Health Care
Wastewater treatment plant accidents	Ministry of Housing and Communal Services Ministry of Industry Ministry of Agriculture and Food
Hydrodynamic accidents	Ministry of Energy Ministry of Agriculture and Food Ministry of Housing and Communal Services
Hazardous geological events	National Academy of Sciences
Dangerous meteorological events	Ministry of Natural Resources
Hazardous hydrological events	MES Ministry of Natural Resources Ministry of Agriculture and Food
Fires in natural ecosystems	MES Ministry of Energy Ministry of Forestry Ministry of Agriculture and Food
Human infectious diseases and epidemics	Ministry of Health Care
Epizootics	Ministry of Agriculture and Food
Damage to agricultural plants and forests by diseases and pests	Ministry of Agriculture and Food Ministry of Forestry

Source: compiled in accordance with the regulation on the System for Monitoring and Forecasting of Emergencies of Natural and Technogenic Nature (Resolution of the Council of Ministers of the Republic of Belarus No. 1466 of 19 November 2004).

Monitoring of emergency sources is carried out using aviation, space and ground monitoring.

- Aviation monitoring is used to detect fires in natural ecosystems, to control ice and hydrological conditions, assess both the consequences of dangerous weather events (cyclones, heavy snowfall) and the consequences of emergencies at potentially hazardous facilities. This type of monitoring is carried out by the state aviation rescue institution Aviation.
- Space monitoring contributes to the prompt identification of the foci of natural fires and their consequences, and to the study of flooding during periods of river flow, as well as the assessment of the results of heavy rainfall. This type of monitoring is carried out with the help of the Belarusian Space System for Remote Sensing of Earth, which receives information both from Belarusian

spacecraft and from foreign satellites. Space monitoring data are sent to the National Space Operator, RUE Geoinformation Systems, of NAS, where they are processed before being sent to the RCEMR, where employees of the Emergency Monitoring and Forecasting Department analyse the received information with the help of software and GIS technologies.

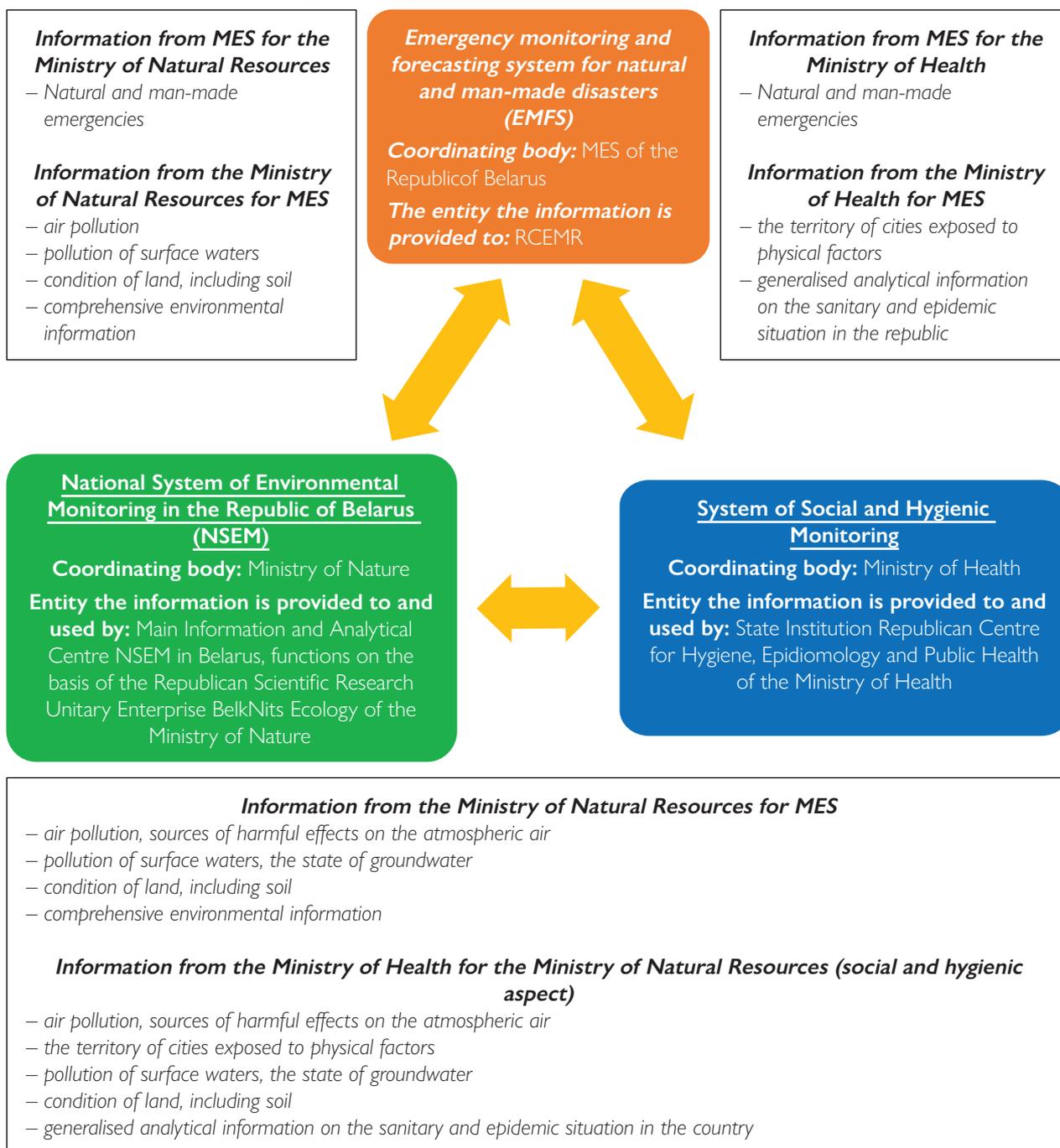
- Ground monitoring is carried out by the entities of the EMFS through posts, laboratories and stations using hardware and software for monitoring the sources of emergencies.

The National System of Environmental Monitoring (NSEM) was established in 2002 and is the information centre of Belhydromet. The purpose of the NSEM is to provide all levels of management with the necessary environmental information to determine the strategy of environmental management and make operational management decisions. The task of the NSEM is fulfilment of the environmental obligations of Belarus under international treaties, conventions and agreements, including the fulfilment of obligations under the Aarhus Convention to ensure public access to reliable environmental information (NSEM, 2020a). The NSEM includes various types of environmental monitoring. Depending on the type of monitoring, it is carried out by different state bodies: the Ministry of Natural Resources organizes monitoring of atmospheric air, surface and ground waters, radiation monitoring and local monitoring of the environment. Monitoring of the ozone layer is carried out by the Ministry of Education; forestry by the Ministry of Forestry; land by the State Property Committee; and monitoring of flora and fauna, geophysical monitoring, as well as complex monitoring of ecosystems in specially protected areas, is carried out by NAS.

The EMFS exchanges information with the NSEM and the Social and Hygienic Monitoring System. Information exchange between these systems is free of charge and is regulated by the Resolution of the Ministry of Natural Resources, Ministry of Health, Ministry of Emergency Situations dated 12 September 2005 No. 41/30/45 On approval of the instruction on the exchange of environmental information between the NSEM in the Republic of Belarus, the System of Social and Hygienic Monitoring and the EMFS (Figure 9).

It is also worth noting that the National Disaster Risk Reduction Strategy for 2019–2030 envisions measures to create an institutional global emergencies monitoring system, the implementation of which will make it possible to create a National Crisis Management Centre (an intelligent multi-level control complex that ensures round-the-clock inter-departmental coordination, operational management and emergency response to emergencies), as well as an intelligent information and analytical platform for monitoring emergencies (an improved EMFS), and an information management system (a system of timely warning and prompt informing of citizens about emergencies).

Figure 9. Exchange of information between national monitoring systems



Source: compiled on the basis of the Resolution of the Ministry of Natural Resources, the Ministry of Health, MES dated 12 September 2005 No. 41/30/45 On approval of the instruction on the exchange of environmental information between the NSEM in the Republic of Belarus, the Social and Hygienic Monitoring System and the EMFS.

Classification of natural emergencies

Warning and informing about emergencies is carried out in the event of a threat or occurrence of a natural and man-made emergency in the cases specified in the resolution of the Ministry of Emergency Situations dated 19 February 2003 No. 17 On the classification of natural and man-made emergencies, and in cases of threats during or as a result of military activities. Information on the protection of the population and territories from emergencies consists of information about foreseeable and actual emergencies, their consequences, as well as information about nuclear, radiation, chemical, medical and biological, explosive, fire and environmental safety in the respective territories (in accordance with the law On protection of the population and territories from emergencies, dated 5 May 1998 No. 141-3). The Instruction on the Classification of Natural and Man-Made Emergencies includes the following types of natural emergencies that affect:

Agriculture:

- hail (feature – mass loss of agricultural crops);
- drought (features – a combination of high air temperatures, lack of precipitation, low air humidity, low moisture reserves in the soil for one month or more, leading to a significant decrease in yield or death of agricultural crops);
- frost (features – a decrease in air temperature, or soil surface, below 0 °C during the active growing season of agricultural crops, leading to their damage or loss);
- cases of exotic and especially dangerous infectious diseases of farm animals (features – the number of sick animals, the number of forced killing of sick animals; the introduction of quarantine);
- mass diseases of farm animals (features – the number of sick animals, the number of dead animals (in percentage of the total herd); the introduction of quarantine);
- mass poisoning of farm animals (features – the number of sick and dead animals);
- diseases of agricultural plants of undetected aetiology.

Forestry:

- forest fires;
- mass death of wild animals (features – the number of dead animals of one species as a result of an infectious disease and disaster caused by natural hazard; introduction of quarantine);
- infestation of forests with pests and diseases.

Agriculture and forestry:

- progressive epiphytotics – damage to agricultural plants and forests by diseases and pests;
- mass distribution of harmful plants.

Table 9 contains criteria for classifying emergency situations at the respective level (local, district, regional or state) in accordance with the amount of caused or expected economic losses.

Table 9. General signs of referring emergency situations to the appropriate level according to the criterion of the amount of caused or expected economic losses

Affected sphere	Criteria	Unit of measurement	Threshold value for emergency level			
			local	district	regional	state
Agriculture	Withdrawal of land from agricultural use	Hectare	Up to 50	from 50 to 1 000	from 1 000 to 20 000	More than 20 000
	Decrease in the total number of animals or birds (fish) as a result of their mass death	% of the total herd at the appropriate level	Up to 15	Up to 10	Up to 7	Exceeding the regional level
	Loss of agricultural crops	% of the total area under crops at the appropriate level	Up to 20	Up to 15	Up to 10	Exceeding the regional level
	Economic losses	Baseline values ⁶	Not more than 1 000	More than 1 000, but not more than 5 000	More than 5 000, but not more than 0.5 million	Over 0.5 million
Forestry	Exclusion of forest plots from forestry use	Hectare	Up to 1 000	From 1 000 to 20 000	From 10 000 to 50 000	Exceeding the regional level
	The incurred (expected) losses	% of the total cost of timber at the corresponding level	Up to 15	Up to 12	Up to 8	Exceeding the regional level

Source: Resolution of MES dated 19 February 2003 No. 17 On the classification of natural and man-made emergencies.

⁶The baseline value in 2020 was 27 BYR (USD 11.28). The dollar exchange rate as an arithmetic mean for January to September 2020 was BYR 2.3939 according to the National Bank of the Republic of Belarus.

Informing and alerting the population about emergencies

The Ministry of Emergency Situations is entrusted with the functions of informing (alerting) the population on prevention and elimination of emergencies (in accordance with the Law of the Republic of Belarus dated 16 July 2009 No. 45-3). The Ministry of Communications and Informatization, the National State TV and Radio Company, the republican unitary enterprise “Belarusian Radio and Television Broadcasting Centre”, are obliged to ensure the transmission of warning signals and timely delivery of information to the population about natural and man-made emergencies (in accordance with the Resolution of the Council of Ministers of the Republic of Belarus No. 1280 dated 23 August 2001). The agricultural sector is not privileged in receiving information from the RCEMR, it receives information on an equal basis with other state bodies, other organizations and citizens of Belarus. The only official sources of information are MES, Belhydromet, and the Ministry of Agriculture and Food.

The Republican Centre for Emergencies Management and Response (RCEMR) monitors emergencies, and informs the population about them. The main task of the RCEMR warning system is to pass warning signals and information to:

- the population throughout the territory of Belarus;
- the Emergency Situations Commission under the Council of Ministers of the Republic of Belarus;
- government bodies, government organizations subordinate to the Government of Belarus;
- regional and Minsk municipal departments of MES.

Warnings and information about emergencies for citizens of Belarus is carried out through:

- transmission of alert signals of SES Civil Defence (Attention to all!);⁷
- transmission of information through radio and television by interrupting programmes;
- placement of creeping lines on television channels;
- sending free of charge SMS messages by operators of cellular mobile telecommunications;
- posting information on the internet (MES, 2020g; Minsk City Executive Committee, 2020).

Farmers are alerted both through activities to alert the entire population and through specialised official information channels, such as the official website of Belhydromet (and the “agrometeorology information” section), along with similar sections with information for hydrologists and climatologists. Starting from 31 March 2020, this section has provided an overview of agrometeorological information as of a specific date, with a frequency of around every three to nine days (Belhydromet, 2020b).

Preparing the population

One of the main principles of the National Disaster Risk Reduction Strategy is the principle of transition from information about existing threats to awareness about these threats, which implies the development of training programmes for the broadest possible spectrum of the population on life-safety issues. It is assumed that on the basis of the gained knowledge, a pattern of safe behaviour will be formed, both increasing the level of public safety of the trained population, and involving other citizens in the learning process.

⁷A warning signal “attention to all!” to attract people’s attention. It can be recognized by the sound of electric sirens and other signaling devices and lasts for three minutes. The signal calls for turning on radios or televisions, since at this time an emergency message is broadcasted, which tells about the emergency that has occurred, and recommendations for subsequent actions are given.

The procedure for training the population on protection from emergencies is determined by the Council of Ministers and is carried out in organizations, including educational institutions, as well as at places of residence. Creating awareness on protection of the population and territories from emergencies is ensured by MES, including through the media. Citizens, heads, and employees of organizations are prepared for action in emergencies in accordance with the Resolution of the Council of Ministers of the Republic of Belarus dated 23 May 2013 No. 413. The main objectives of the training include obtaining and improving knowledge, skills and competencies on preventing natural and man-made emergencies by all categories of population; use of collective and individual protective equipment; as well as action in emergency situations and in response to civil defence warning signals.

The Ministry of Emergency Situations creates educational security centres, the main purpose of which is to educate the population on the correct action to take in the event of various emergencies. There are seven MES security centres in Belarus. They teach what to do during thunderstorms, hurricanes, storms, strong winds, and flooding; how to help a drowning person or a person who has fallen under the ice (MES, 2020h). With the support of the ministry, a Belarusian youth public organization of rescuers and firefighters was created – its task is to educate the younger generation in order to shape their values in life and encourage their readiness to help those in need. The official website of the ministry contains material on teaching and promoting life values, safety basics, videos, audio clips, games, tests, cartoons, comics, and songs about rescuers.

In general, the training of agricultural specialists takes place within the framework of SES of the Ministry of Agriculture and Food, as well as within the framework of civil defence activities for training and preparing of all categories of citizens for emergencies. While the training system itself has already been organized, attention should be paid to improving specialised training, depending on the profile of the trainees. A promising direction is the development of specialised courses for agricultural workers on the preparation and mitigation of weather emergencies risks, and recovery after them. These courses should be compulsory in the curricula of agricultural higher education institutions, and the market should be stimulated for private educational services, which would develop appropriate courses, practices, and seminars.

The emergency monitoring and forecasting system (EMFS) can be developed by more active informing of agricultural specialists, including peasant farms and private subsidiary farms about possible risks, as well as by raising their education and readiness in advance of emergencies. In particular, education can be improved by including compulsory training programmes on natural emergencies for students in higher educational institutions of future specialists in the agricultural and food sectors; and by stimulating the private education sector to provide appropriate courses, seminars and training. In addition, the capacity of EWS can be increased through sociological surveys of representatives of agro-industrial complexes, agricultural enterprises, peasant farms and private subsidiary farms in order to obtain feedback on the existing problems in the preparation for emergencies, elimination of consequences of natural emergencies, as well as recovery after them.

Climate information systems

The parties interested in the provision and use of climate information systems include government agencies and organizations responsible for providing relevant information (Ministry of Natural Resources, Belhydromet, MES); state bodies and organizations that ensure the efficient operation of state agricultural organizations (Ministry of Agriculture and Food); research organizations (such as NAS of Belarus); educational institutions (such as the Belarusian State University); peasant farms and private subsidiary farms; organizations whose activities depend on climate change, as well as all citizens in Belarus.

The main organization engaged in the collection and dissemination of hydrometeorological information, including weather and climate events, is Belhydromet, which is subordinate to the Ministry of Natural Resources and Environment Protection.

Forecasts by Belhydromet

Weather forecasts are prepared on the basis of recommendations of the World Meteorological Organization. A characteristic feature of Belarus is centralized forecasting activity, as forecasts for the entire territory of the country, districts and regions are compiled only in Belhydromet and are communicated to district and regional divisions for their further dissemination. The forecasting process consists of two stages: determining the nature of synoptic processes for the forecast period, and determining meteorological values and weather events (Belhydromet, 2020c).

At the first stage, all available information about the current weather is observed and analysed; meteorological conditions are monitored, weather maps, upper-air information, satellite and radar information, and climatic data are analysed. A weather forecaster analyses baseline and forecast data.

At the second stage, prognostic information is analysed – atmospheric processes (trajectory and speed of movement of atmospheric formations, taking into account local features) undergo synoptic interpretation. At this stage, the data of mathematical numerical models are applied, and it becomes possible to calculate temperature, humidity, wind and other parameters at different heights and in different parts of the world. Calculations for short- and medium-term forecasts are prepared by a forecaster who analyses actual and forecast weather maps at the surface of the earth and at heights, determines source of air masses, the type of pressure system in which they circulate, detects atmospheric fronts, and predicts their movement.

Belhydromet uses the results of numerical calculations from the global network of the World Meteorological Organization, leading forecast centres such as Offenbach (Germany), Bracknell (England), and the Hydrometeorological Centre of the Russian Federation. In its operational work, Belhydromet uses its own regional six-level low-parameter numerical model. Within the framework of the joint Programme of the Union State, a regional numerical model of a new generation is being developed.

Some weather phenomena, due to the complex nature of their formation and local nature, cannot be predicted using automated forecasting technologies. Such phenomena include, for example, fog and ice. Therefore, when such events are forecasted, along with the results of model calculations, it is necessary to use the knowledge of forecasters about the conditions for the formation of such events and their development in a particular region.

Provision of information

All types of hydrometeorological information are provided to state bodies free of charge. Specialised forecasts are made for individual sectors of the economy, including the agricultural sector. The population receives free of charge data only on dangerous or unfavourable hydrometeorological phenomena (observation data);

all information related to the analysis or interpretation of this data is provided only on paid basis (E.V. Istomina, personal communication, 2021). Examples of the communication channels used for dissemination of warnings and information about emergencies are listed in the previous section on “informing and alerting the population about emergencies”.

The Belhydromet weather cartographic site contains information on long-term climatic data, which includes data on weather extremes, and can be sorted depending on the city and month. This resource also presents UKMET, GFS, GEM, and NAVGEM maps, which display air temperature, forecast of precipitation, pressure and wind, as well as other data. The country has developed and operates mobile applications – ‘Weather in your pocket’ developed by Belhydromet, and ‘MES of Belarus: Help is nearby’ (the programme has built-in notification of adverse and dangerous events, including storm warnings from Belhydromet; and a 112 button for calls and messages to MES).

In addition, Belhydromet has a corporate website, METEOPORTAL, which presents specialised hydrometeorological information, including satellite and forecast data. Synoptic data, numerical weather model data, meteorological data from automatic meteorological stations, monitoring based on Earth remote sensing data (ERS), hydrological data, agrometeorological data, radiation control and monitoring data are broadcasted on the screen in real time. The METEOPORTAL software package presents specialised hydrometeorological and radiation information, including spacecraft data. The information is intended for official use by subdivisions of Belhydromet and other departments (MES, Ministry of Transport, Ministry of Agriculture and Food, and others).

These are the following information centres and communication channels of Belhydromet (Ministry of Natural Resources, 2020b):

- official website (<http://www.belgidromet.by/>);
- website about the weather in Belarus (<http://www.pogoda.by/>);
- resource on radiation and environmental monitoring in Belarus (<http://www.rad.org.by/>);
- main information and analytical centre of the National Environmental Monitoring System of the Republic of Belarus (<http://www.nsmos.by/>);
- weather cartographic site (<http://www.meteoinfo.by/>);
- social networks (<https://www.facebook.com/belgidromet/>, <https://twitter.com/belgidromet>, <https://www.instagram.com/belgidromet/>, <https://ok.ru/group/55152360554595>);
- messengers (<https://telegram.me/belgidrometbot>, <https://chats.viber.com/belgidromet/ru>).

The National Environmental Monitoring System (NEMS) is also important for climate information systems.

All of these channels of information about the climate provide it to all government agencies, other organizations, and citizens. The agricultural sector is also informed through these information channels. Currently, there is no specialised information system in the country that provides up-to-date climate information for the agricultural sector.

Belarus needs to improve the quality of hydrometeorological and climate services provided to end users, in particular to those in the agricultural sector. This goal can be achieved by improving observation networks, introducing new technologies, providing access to higher resolution weather and climate products, and thereby improving the quality of climate forecasts. At the same time, it is critical to ensure that this information is meaningful and arrives to the users in a timely manner. It is also advisable to develop a climate information system directly for the agricultural sector, and to adapt this climate information system for all categories of citizens involved in agricultural activities, both for representatives of large-scale enterprises, and for owners of peasant farms and private subsidiary farms. The development of training courses based on the created agricultural climate information system is promising.

Market information systems in the agricultural sector

Information from market information systems must be accurate and timely, as well as valuable “here and now” for suppliers and buyers of agricultural products. In this way, market information systems are fundamentally different from statistical information, which is not operational and is intended, rather, to serve the achievement of long-term goals at the level of enterprises or states. The parties interested in using the services of market information systems include producers and consumers of agricultural products, intermediaries (wholesalers, carriers), retailers, government agencies, and other participants interested in the production and sale of agricultural products.

Prices in international markets, including the markets of neighbouring countries, are presented on international electronic trading platforms, and using international and national market information systems, for example the Agricultural Market Information System (AMIS) or the electronic trading platform of the National Center for Marketing and Price Study.

For an analysis of the impact of the global agrifood market on the agro-industrial complex of the members of the Eurasian Economic Union (EAEU), including Belarus, the Eurasian Economic Commission (EEC) monitors prices and analyses the dynamics of price indices for various types of agricultural raw material and food produced in the EAEU (EEC, 2020). However, such monitoring is static and does not make it possible to receive real-time information in accordance with the operational requests of consumers and manufacturers. Such information remains valuable for government administrators and researchers. The EAEU has been tasked with implementing the main directions, including those promoting the development of market information systems:

- As part of the implementation of the EAEU Digital Agenda until 2025, the development of cross-border electronic commerce, which involves the creation of market information systems, is of particular importance (EEC, 2020b).
- To achieve an agreed agro-industrial policy through the implementation of interstate cooperation of the EEC together with the member states within the integrated information subsystem of the agro-industrial complex (EEC, 2020c).

Market information systems at the national level

The fundamental condition for the formation of prices for agricultural products is the legislation of Belarus. At the national level there is a cap on trade markups for a list of socially important goods, including some types of agricultural products. The legislation only regulates the ceiling for the trade markup, and the final price may vary depending on the manufacturer’s price and the wholesale price of the reseller. While the regulatory authorities can trace the entire pricing chain, this information is closed to the public, including to competitors of the enterprise.

There is no unified national market information system in Belarus. However, there are prerequisites for its formation on the basis of already existing individual elements and organizations. These are:

- Ministry of Agriculture and Food;
- Ministry of Antimonopoly Regulation and Trade;
- National Statistics Committee of the Republic of Belarus.
- National Center for Marketing and Price Study;
- Public Association Belarusian Society for Consumer Protection;
- Belarusian Universal Commodity Exchange;

- Belarusian Chamber of Commerce and Industry;
- Belarusian Fund for Financial Support of Entrepreneurs (<http://belarp.by>);
- Entrepreneurship Development Council (<http://ced.by/>);
- Republican Confederation of Entrepreneurship (<https://rce.by>);
- Belarusian Republican Union of Consumer Societies <https://bks.gov.by>);
- Belarusian Public Association of Farmers (<https://info.fermer1.by>).

These organizations provide information on purchase (producer prices), wholesale and retail prices for agricultural raw materials and food; its quantity; existing suppliers and customers. At the same time, the data may differ both in the sample scope and in the frequency of collection and provision (Annex II).

In addition to the organizations listed above, information on prices for agricultural raw material and food is provided by manufacturers and wholesalers, on general and specialised electronic trading platforms, by representatives of the retail network through advertising brochures and their own websites, as well as mobile applications, in which all the promotions of retail chains are presented. In addition, there are several services that, to varying degrees, operate on the principles of market information systems and present to different extent information about suppliers, buyers, products and prices for agricultural raw materials and foods (Annex III).

Market information systems at the local level

There are no specialised market information systems at the local level. National legislation governing pricing and trade rules is applied in the regions. There are several regional associations that are potentially interested in obtaining market information on agricultural products (Ministry of Agriculture and Food, 2020d):

- Brest Agro-Industrial Union;
- Vitebsk Regional Association of Farmers;
- Public Association of Farmers of the Gomel Region;
- Grodno Regional Association of Farmers;
- Minsk Regional Association of Farmers;
- Public organization Union of Farmers of the Mogilev Region.

In the villages, the population is provided with food, both thanks to gardening and private subsidiary plots, as well as the smooth food supply system established in the country. There are car shops in the country that deliver products to cities, towns, and villages. Car shops are mainly represented by Eurotorg, the Belarusian Republican Union of Consumer Societies, as well as individual entrepreneurs.

Main challenges

Belarus faces the following challenges in developing and improving existing EWS:

- There are many different systems and individual elements of emergency monitoring (EMAS, NSEM, Social and Hygienic Monitoring System, RCEMR) instead of a unified national system for emergencies or disasters monitoring. Nevertheless, the National Disaster Risk Reduction Strategy is planning to create an institutional global emergency monitoring system.
- A lack of a separate section in the unified climate information system, as well as of components/modules focused on providing up-to-date climate information to representatives of the agricultural sector.
- The inadequacy of the available climate information for its perception by the public at large, including representatives of peasant farms and private subsidiary farm, which do not have enough resources to analyse the primary climate information and make useful conclusions leading to practical activities for the preparation or elimination of emergencies.
- A lack of feedback from representatives of agro-industrial complexes, agricultural organizations, peasant farms and private subsidiary farms, the need to conduct surveys and interviews, and other forms of obtaining information about concerns.
- A lack of a unified market information system at both national and local levels.
- The limited access to operational data on volumes and prices of products sold by manufacturers and wholesalers.
- The partial incompatibility of data provided from different sources, which limits the possibilities for analysis (with regard to price lists of various manufacturers).
- The absence of private educational services offers to prepare for emergencies and their elimination when they arise.

Agrometeorology services

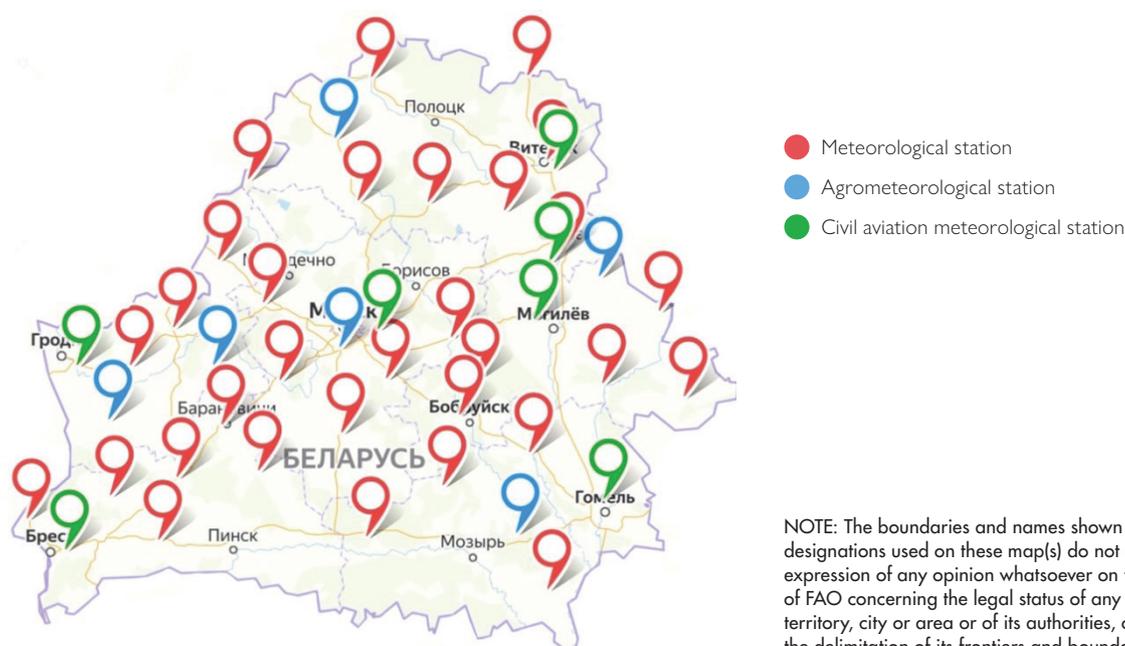
Agrometeorological observations in Belarus are carried out by the hydrometeorological service to study the influence of meteorological conditions on the development of crops and crop formation (in accordance with law No. 64-3 On hydrometeorological activities, dated 10 December 2020).

Agrometeorological activities in the country are carried out by Belhydromet, which studies the peculiarities of agrometeorological conditions in Belarus, and also provides actual and forecast information about these conditions to government bodies, local executive and administrative bodies, legal entities and the population, including individual entrepreneurs (in accordance with the Charter of Belhydromet, approved by the order of the Ministry of Natural Resources of 31 December 2014 No. 399-OD).

Currently, the hydrometeorological service of Belarus is based on the state network of hydrometeorological observations, which includes 191 hydrometeorological facilities, six regional centres for hydrometeorology and environmental monitoring (branches of Belhydromet), three inter-district centres for hydrometeorology and environmental monitoring, 51 meteorological stations, seven civil aviation meteorological stations, five agrometeorological stations, three hydrological stations, one bog station, one background monitoring station, 114 hydrological stations (Belhydromet, 2021). Despite the fact that the number of hydrometeorological facilities has increased since 2017, data on their location is available only for some of them (Belhydromet charter, approved by order of the Ministry of Natural Resources No. 399-OD dated 31 December 2014) (Figure 10).

As a result of the implementation of the state programme, the sub-programme on the hydrometeorological service development and on environmental protection for 2016–2020, instruments and equipment for meteorological observations were purchased to increase the accuracy of weather forecasts and storm warnings; radiosondes and shells for them were purchased to conduct temperature wind sounding of the atmosphere in the cities of Brest, Gomel, and Minsk (Ministry of Natural Resources, 2020c).

Figure 10. Map of Belarus with indications of meteorological stations



Source: own development based on the Charter of Belhydromet, approved by the order of the Ministry of Natural Resources of 31 December 2014 (as amended by the order of 2 May 2017).

Observations of the following meteorological parameters are made every three hours at meteorological observation points, and every ten minutes at automatic meteorological stations (a total of 58 stations were automated as of 2019) (Ministry of Natural Resources, 2020c): air temperature and humidity, wind direction and speed, atmospheric pressure, precipitation. Radio sounding of the atmosphere is used at the points of upper-air observations to determine the main meteorological parameters. A network of meteorological radars is also being developed in the country, with which clouds are analysed within a radius of 200 km, the type and intensity of meteorological phenomena are determined, the speed of mass movement is calculated, and the intensity of precipitation is determined. This type of monitoring makes it possible to update the information every ten minutes and timely identify the centres of convective cloudiness, which are associated with thunderstorms, heavy rain, hail, and squall wind intensification.

According to Belhydromet, agrometeorological observations during the cold season include:

- soil temperature;
- the depth of freezing and thawing of the soil;
- autumn survey of the state of wintering field crops;
- determination of the viability of wintering field crops and fruit trees;
- snow cover in fields with winter crops.

Agrometeorological observations during the warm period:

- spring survey of the state of field crops and orchards;
- moisture in the upper layers of the soil;
- moisture content of the root layer of the soil;
- phases of development of crops, grasses, woody and shrub plants;
- the state of agricultural crops: plant density, plant height, weed infestation of crops, lodging of crops, general visual assessment of the state of plants;
- formation of productivity elements, the yield structure of agricultural crops;
- damage to plants by adverse meteorological event, pests and diseases.

Belhydromet prepares forecasts of the yield of leading agricultural crops, the state of winter crops before winter season and after overwintering, the reserves of productive moisture in the soil at the beginning of the agricultural spring, the time for beginning spring field work, sowing of early spring and winter crops, forecasts of the development of grain crops, grasses, fruit trees. Agrometeorological information is based on the widespread use of field observation data from the state network of hydrometeorological stations. The lead time of most agrometeorological forecasts ranges from 20 to 30 days, to three months (Belhydromet, 2018a).

At the moment, the system for providing forecast agrometeorological information to citizens includes actual and forecast agrometeorological information at Belhydromet and its branches, as well as official websites indicating phone numbers where citizens can receive more detailed information about the services provided. The development of this system can be realised through a more specific list of provided agrometeorological information, including forecast information, with an indication of its cost on the official website of each branch of Belhydromet, as well as through the provision of free agrometeorological information, actual and forecast, on existing information platforms, such as websites and applications.

Provision of agrometeorological information

Belhydromet and its branches carry out a number of administrative procedures, including (Belhydromet, 2020a):

1. in relation to legal entities and individuals:
 - issuance of a permit for the performance of certain types of work that have an active impact on meteorological and other geophysical processes (implementation period: 36 days; fee: free) – carried out only by Belhydromet;
 - issuance of certificates on the recorded levels of pollution of atmospheric air, surface waters and soils, on the hydrometeorological conditions observed on the territory of Belarus, its individual administrative-territorial units (implementation period: 15 days; fee: 1 base amount – BYR 27 (11.27 USD));
2. with regard to individuals:
 - issuance of certificates on the recorded levels of pollution of atmospheric air, surface waters and soils, on the hydrometeorological conditions observed on the territory of Belarus, its individual administrative-territorial units (implementation period: 15 days; fee: 0.7 of the base amount – BYR 18.90 (7,90 USD)).

Belhydromet and its branches provide the following agrometeorology services (Belhydromet, 2018b) (tariffs are indicated for legal entities and individuals; services to government organizations are provided free of charge):

- preparation of primary agrometeorological data obtained as a result of agrometeorological observations for one meteorological element at one station per observation period (one item – BYR 1.24 (0.52 USD));
- calculation of the sum of one agrometeorological element at one station for a certain period (one item – BYR 1.98 (0.83 USD));
- information on agrometeorological conditions that caused damage and death of crops (one table and one report – BYR 113.13 (47.26 USD));
- consultations of specialists by phone about the developing agrometeorological situation (one consultation – BYR 7.63 (3.19 USD));
- preparation of a written consultation of a specialist on the observed agrometeorological conditions (excluding services for the preparation of primary agrometeorological data; one consultation – BYR 23.48 (9.81 USD)).

To assess and improve the quality of the provided services, questionnaires are sent to collect feedback from the users of such services or consumers of information products. Various information is provided, both primary (it is also free of charge), as well as analytical and consulting information (which is already paid in accordance with the law). In addition, the information can be single-time as an ad-hoc request, or it can be provided as a subscription to a weekly newsletter (E.V. Istomina, personal communication, 2021).

The hydrometeorological service compiles an agrometeorological yearbook, which publishes annual summary materials of agrometeorological observations and measurements at the network of stations and posts located on the administrative territory. This collection includes data from standard agrometeorological and meteorological observations carried out in agricultural fields, gardens, meteorological and water balance sites over the past agricultural year. The purpose of the yearbook is:

- provision of agrometeorological information to government bodies, the agro-industrial complex, enterprises of economic sectors, interested organizations;
- operational and research work;
- climate-change assessments;
- agroclimatic zoning for agricultural crops;
- accumulation and generalisation of objective data on the meteorological regime and agroclimatic resources of individual territories and the country as a whole.

The provision of the yearbook can be improved by advertising it, as well as by simplifying the ordering or purchasing procedure (for example, to provide the opportunity to conclude an agreement in electronic form, to speed up processing of online application on the website). It is assumed that due to the commercialization and expansion of the list of services for farmers and owners of private subsidiary farms, additional funds will be generated to improve the quality of processing the requests for paid services. Agrometeorological reference books and yearbooks can be used in the archives of Belhydromet, they are provided free of charge. Fishermen often seek information (E.V. Istomina, personal communication, 2021).

The main forms of agrometeorological support include information and forecasts about the yield of main agricultural crops, the state of winter crops before winter and after overwintering, the reserves of productive moisture in the soil at the beginning of the agricultural spring, the time for the beginning of spring field work, sowing early spring and winter crops, as well as forecasts on the development of grain crops, grasses, and fruit trees. The short section on “agrometeorologist information” on the Belhydromet website sometimes also mentions which crops might be more suitable based on expected weather conditions. As noted on the official website of Belhydromet, the target audience for which the information is prepared includes the agro-industrial complex and authorities. Based on the annual observation results, the database is replenished, it serves as the basis for Belhydromet’s preparation of the agroclimatic reference book *Agroclimatic resources of the Republic of Belarus in the context of climate change*. The reference book and the *agrometeorological yearbook* are provided on a paid basis, they can be ordered from the Agrometeorology Department of the State Institution Republican Hydrometeorological Centre.

Belhydromet has the information resources POGODA.BY and METEOINFO.BY, which are designed to inform users about current, past and future hydrometeorological conditions, about the state of the environment, about upcoming dangerous and extreme weather events. Every month the POGODA.BY website publishes a “report on the hydrometeorological conditions prevailing on the territory of the Republic of Belarus”, with an indication of the current agrometeorological conditions, a brief description of unfavourable meteorological events, and the situation in the regions regarding the appropriateness of conditions for the planting season (T.P. Evdaseva, personal communication, 2020). Agrometeorological information is published as part of this report. The information is provided post facto in the “publications” section and is stored in an electronic archive, where the year and month can be set to receive a report on the agrometeorological situation at that time.

Starting from 31 March 2020, the “agrometeorologist information” section of the official website of Belhydromet provides a brief overview of agrometeorological information as of a specific date. These overviews are published on the website every three to nine days (Belhydromet, 2020b). Agrometeorological information is also covered by information resources such as Belta (RUE Belarusian Telegraph Agency), 1prof.by from the Federation of Trade Unions of the Republic of Belarus (UE Publishing House Prof-Press), and fermer1.by of the Belarusian Public Association of Farmers. The country has a mobile application from Belhydromet, ‘Weather in your Pocket’, and an application ‘MES of Belarus. Help is nearby’. The first application includes the “allotment gardener” function with an “agro” sub-function which provides information on the temperature of the underlying surface, the temperature of the soil under the bare surface at a depth of 3 cm, the air temperature at a height of 2 cm, and the minimum temperature of the soil surface at night.

The Ministry of Natural Resources and Environmental Protection maintains the State Hydrometeorological Fund (Hydrometfund), which is a collection of documented hydrometeorological information that can be provided by manufacturers that are not part of the State Hydrometeorological Service (in accordance with the Resolution of the Council of Ministers of the Republic of Belarus No. 1301 On the State Hydrometeorological Fund and the State Climate Cadastre dated 4 October 2006). Each year, the State Climate Cadastre is compiled, which consists of three parts (Belhydromet, 2017):

- monthly and annual meteorological data (summarised in tables);
- annual “review of climatic features and hazardous hydrometeorological events in the Republic of Belarus”;
- long-term data (norms).

Agricultural producers do not request agrometeorological information from Belhydromet, and the reason for this is unknown. As a rule, most of the requests are both official and unofficial requests of the Ministry of Agriculture and Food (E.V. Istomina, personal communication, 2021).

Capacity development

Training of agrometeorology specialists in the country is carried out only by the Belarusian State University, and its Department of General Geography and Hydrometeorology. After graduation, specialists are awarded the qualification “Geographer. Hydrometeorologist” with one of the following specialisations: land hydrology, meteorology, agrometeorology (BSU, 2020). There is a branch of this department in Belhydromet.

Specialists in agriculture and food are trained in a number of educational institutions of the country (academies, universities, agricultural colleges). Specialists with a qualification as organizer-technologist specialising in organization of peasant farms are trained for three years and five months in the educational institution, Smilovichi State Agrarian College. Farmers can also undergo training at the Institute for Advanced Studies and Retraining of Specialists of Agro-Industrial Complex of the Belarusian State Agrarian Technical University (BSATU). The institute organizes three to five-day training for novice farmers and specialists with the opportunity to visit advanced agricultural organizations, peasant farms, including in the Russian Federation and Poland. Areas of training are as follows: production of fruit and berries; vegetable growing; commercial floriculture; mushroom growing; commercial production of nuts; progressive energy-saving technologies for the cultivation of agricultural crops; modern beekeeping. Adaptation to climate change and weather emergencies are not included in the course.

Training is provided on a contractual basis with living accommodations included. One of the institute’s advanced training programmes is Sustainable Development of Rural Areas and Environmental Safety, which covers issues of territorial and organizational basics of the environmentally friendly and sustainable development of agriculture. Each advanced training programme is developed individually according to the requests of trainees (managers and specialists of peasant farms and family farms). If there is a specific demand coming from a number of students, who could form a group, a course on a requested topic can be organized (for instance, on adaptation to climate change). However, no requests for training on such topics or on risk management in agriculture have been received so far. In rural areas, employees of agricultural organizations also own private subsidiary plots and undergo in-house advanced training, thus they have necessary knowledge required for work at their own subsidiary plots (N.V. Kireenko, personal communication, 2021).

The Center for Environmental Solutions organized an “organic school” as part of the project Prevention of pollution of natural reservoirs through public education and assistance to the development of organic agriculture in Belarus (CES, 2020). The trainees are enrolled on a competitive basis following applications and an interview. Trainees pay a one-time registration fee of BYR 200, and a 30 percent discount is given to representatives of organic farms. Within the framework of this school, specialists are trained (the course lasts six months) in the following areas: soil science, equipment and soil cultivation; the role of crop rotation in organic crop production; modern technologies for the production and use of organic fertilizers and soil improvers; breeding, maintenance, feeding and treatment of animals. However, the training does not include preparation for weather emergencies risks.

Measures on the development of agrometeorological activities

Since 2016, Belhydromet has been responsible for sub-programme 2 of the state programme Environmental protection and sustainable use of natural resources for 2016–2020. In 2018, a meeting of the presidium (executive standing committee) of the Council of Ministers of Belarus was held, where the effectiveness of the state programmes of 2017 was considered – the implementation of the Belhydromet sub-programme was recognised as highly effective. It is aimed at the development of the hydrometeorological service, including its agrometeorological activities (sub-programme 2, Development of the State Hydrometeorological Service, mitigation of climate change consequences, improvement of the quality of atmospheric air and water resources). Among the list of objectives of sub-programme 2, the following are relevant to agrometeorology:⁸

1. Introduction of modern technologies of hydrometeorological observations, technical re-equipment of the state network of hydrometeorological observations (purchase and use of instruments and equipment, including automatic meteorological stations).
2. Development of technologies for weather forecasting, detection and warning of dangerous hydrometeorological events (purchase and use of instruments, equipment, software, and consumables for aerological observations and development of basic technologies for collecting, processing and disseminating hydrometeorological and environmental information, predicting the state of the environment, and its pollution).
3. Improvement of the material and technical base of the hydrometeorological service (maintaining hydrometeorological facilities in proper condition through the repair of facilities, maintenance work, verification and repair of instruments and equipment for hydrometeorological purposes, telecommunication systems, software and hardware systems).
4. Meteorological and technical support for hydrometeorological activities, radiation and environmental monitoring of the environment (dismantling, sorting and disposal of meteorological radar equipment; maintenance, verification and repair of instruments and equipment for hydrometeorological and environmental purposes, telecommunication systems and software and hardware systems).
5. Development of scientific activities and international cooperation, advanced training of employees of the Ministry of Natural Resources (improvement of the management system of hydrometeorological activities and the quality management system; improvement of the staffing of the industry through seminars, refresher courses for managers and specialists; participation in international forums, in the activities of the working bodies of the World Meteorological Organization, the International Council for Hydrometeorology of the CIS and the Union State Committee for Hydrometeorology and Monitoring of Environmental Pollution).
6. Mitigation of climate impact and adaptation to climate change, scientific and information support for the development and implementation of measures to mitigate the effects of climate change (development of measures for adaptation actions and practices; improvement of the system for processing, storage and management of climate data; preparation of a draft strategy for low-carbon development of the country until 2030; assessment of threats to biological diversity and productivity of natural ecological systems caused by climate change, and development of measures for their conservation; development of scenarios and statistical models of climate change in the country; assessment of the relationship of climate change in Belarus with internal climate-forming factors; assessment of opportunities for optimization and improvement of the planted areas structure on the territory of the country for adaptation to changing climatic conditions; creation and care of forest crops; creation of sustainable forests in the context of changing climate).

⁸Objectives 7 and 8 of the sub-programme are not considered here, as they are less relevant to agrometeorological activities.

Sub-programme 2 included the following outputs (related to hydrometeorology):

- 92 percent accuracy of short-term weather forecasts in regional centres;
- up to 90 percent automation of meteorological observations;
- increasing the accuracy of storm warnings with a lead time of one and a half to two days.

A total of BYR 83 827 230 (USD 42 175 100)⁹ was planned to finance sub-programme 2, including BYR 83 698 230 (USD 42 110 198) from the central budget, and BYR 129 000 (USD 64 902) from organizations' own funds. In accordance with the report on the programme implementation, most of the goals and indicators of sub-programme 2 set for 2019 have been achieved. The exceptions include incomplete automation of meteorological stations (58 out of 59 planned stations have been automated, the contractor failed to meet deadlines in the other case); the cities of Brest and Gomel were not fully covered by the two-term temperature-wind sounding of the atmosphere; failure to achieve the goal of reducing the discharge of insufficiently treated wastewater into water bodies, due to significant technical wear of equipment and structures, insufficient preliminary wastewater treatment, or its complete absence (Ministry of Natural Resources, 2020c).

⁹The dollar rate is taken for 2016, the year when the state programme was adopted. According to the National Bank of the Republic of Belarus, the average dollar exchange rate (as an arithmetic mean) for 2016 was BYR 1.9876.

Main challenges

The challenges of the existing agrometeorology services in Belarus include:

- agrometeorological information is not adapted to the needs and perception of farmers (including the lack of interactivity, no focus of the websites interface on this target group, lack of periodicity);
- the list of services provided to population in relation to agrometeorological information is not sufficiently exhaustive, this list should be more detailed, with an indication of service fees for each item in the list;
- the lack of agrometeorological yearbooks, reference books and other documents in free access, user-unfriendly purchase method (it is necessary to place an order by phone), there is a need to adapt this service to make it possible to purchase documents online and preview the table of contents;
- lack of requests from agricultural producers for agroclimatic information of Belhydromet (it is requested only by fishers, as well as by farmers when there is the need to confirm an insured event);
- sparse observation network (insufficient number of observation points – stations, including automatic ones);
- insufficient equipment with modern agrometeorological devices in the entire observation network (shortage of humidity sensors, for example), as well as a shortage of specialists (lack of physical force for some types of work, for example, for soil drilling).

Disaster risk management in the agricultural sector

The transition from disaster response to risk management is one of the main five principles of the National Disaster Risk Reduction Strategy in Belarus for 2019–2030. The coordinating body in the disaster risk management system in the agricultural sector is the Emergency Situations Commission of the Ministry of Agriculture, and the governing body is the Labour Protection, Transport and Fire Safety Department of the Main Directorate of Technical Progress and Energy of the Main Technical Supervision Authority (a structural subdivision of the Ministry of Agriculture and Food). Operational management and information support of the sectoral subsystem of the State Emergency Prevention and Response System (SUB SES) is carried out by an information and control system, which includes the information centre of the Ministry of Agriculture and the dispatch centres of state associations and subordinate organizations. Operational groups of the Ministry of Agriculture, state associations and subordinate organizations are formed to clarify the situation arising as a result of emergencies, and to solve urgent problems. The composition of these task forces is determined depending on the type, nature and scale of the emergency.

Depending on the situation, the scale of the predicted or actual emergency, one of the following modes of operation of the SUB SES is established:

- regular daily regime;
- high alert regime in case of deterioration of industrial, radiation, chemical, biological (bacteriological), seismic and hydrometeorological conditions, upon receipt of a forecast about the possibility of an emergency;
- emergency regime in the event of and during emergency response.

The main tasks of the operational group of the Ministry of Agriculture include:

1. When operating in a high-alert regime:
 - identifying the causes and assessing the nature of a possible emergency, forecasting the development of the situation and preparing proposals for preventing emergency situations;
 - coordination of actions or direct management of the implementation of measures to prevent emergencies.
2. When operating in an emergency regime:
 - assessment of the scale of the emergency and forecasting the development of the situation;
 - preparation of proposals for the refinement of the previously developed solutions for the localization and elimination of emergencies, their adjustment in accordance with the evolving situation;
 - coordination and control over the activities of the SUB SES in the emergency area to evacuate the population, provide the victims with the necessary assistance and implement other urgent measures;
 - direct management, if necessary, of work to eliminate emergencies in cooperation with the commissions and emergency management bodies.

In the course of the regular activities, the reserves of material resources for the elimination of emergencies are created, replenished and refreshed, and all forms of insurance are being provided, along with other activities.

Disaster preparedness plans

The Ministry of Agriculture and Food develops, coordinates and controls the annually developed *Organizational and Methodological Guidelines* and the Plan of Main Measures for the Training of Management Bodies and Forces of the SUB SES. These plans are brought to the attention of the heads of the committees on agriculture and food of the regional executive committees, other organizations included in the SUB SES and Civil Defence. Subsequently, the heads of the committees and organizations inform the Ministry of Agriculture and Food about the progress in the implementation of these instructions in their semi-annual and annual progress reports.

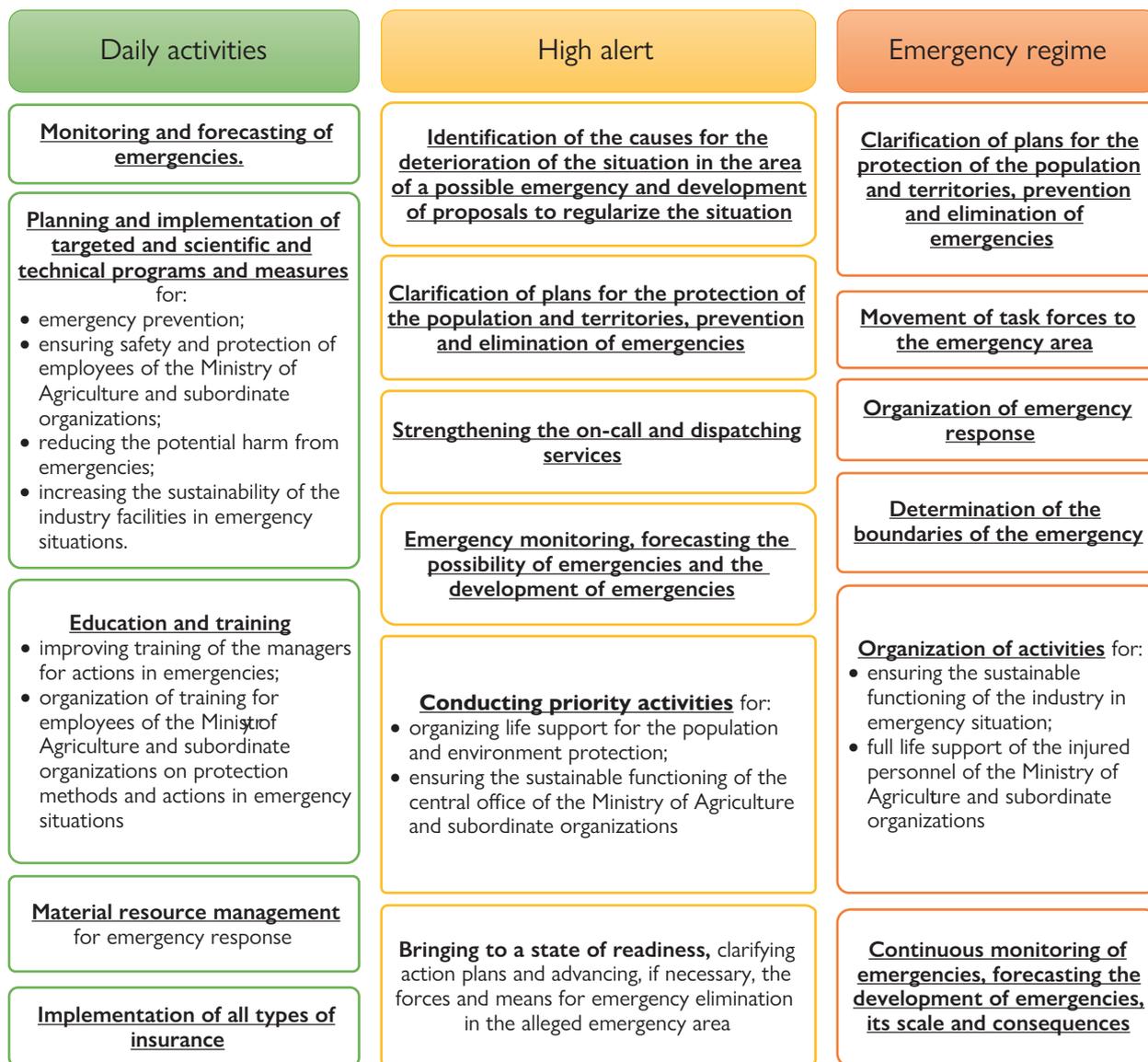
- The main activities for the training of command and control bodies and forces of the SUB SES and Civil Defence for 2017 and 2018 included:¹⁰
- drafting of National Disaster Risk Reduction Strategy in the Republic of Belarus for 2019-2030;
- participation in the development of guidelines for assessing damage from natural emergencies;
- inspection of the SUB SES of the Ministry of Agriculture and Food on protection of the population and territories from emergencies in peacetime and wartime;
- participation in the preparation and conduct of a training and methodological meeting with officials of emergency and civil defence management bodies;
- participation in the preparation and conduct of a demonstration exercise with management bodies, forces and means of the territorial subsystem of the State Emergency Service on the topic “elimination of the consequences of an emergency situation with the collapse of industrial buildings and structures”;
- participation in the preparation and conduct of command-staff exercises with the republican civil defence service for the protection of farm animals and plants, as well as in the preparation of command and control bodies, forces and means for functioning in the autumn-winter period;
- participation in the preparation and conduct of joint tactical and special exercises for the elimination of emergencies associated with the disease of farm animals, as well as for emergency response exercises in case of hydrodynamic accidents at dams, dykes and other engineering structures;
- preparation and inventory of anthrax cattle burial grounds;
- preparation and conduct of emergency response training at reclamation and water management facilities as a result of flooding;
- preparation and clarification of the mix and volumes of material resources for emergency response, inventory of these resources in the places of their storage;
- consideration at emergency situations collegiums, commissions, the readiness of management bodies and organizations for spring flooding, readiness for fire hazardous period, preparedness for the autumn-winter period.

¹⁰There is no access to documents for 2019 and 2020.

Action plans in the event of emergencies

The implementation of plans to protect the population and territories from emergencies, as well as plans for the prevention and elimination of emergencies, is carried out by the SUB SES of the Ministry of Agriculture in the event of the emergency regime. In addition to this activity, the SUB SES performs a number of other activities, the implementation of which depends on the operation regime of the SUB SES (Figure 11).

Figure 11. Main activities carried out by the SUB SES of the Ministry of Agriculture and Food in the case of three different regimes



Source: compiled on the basis of the order of the Ministry of Agriculture and Food of 19 November 2012 No. 415 On the sectoral subsystem of the State system for the prevention and elimination of emergency situations of the Ministry of Agriculture and Food of the Republic of Belarus.

Protection of farm animals and plants

The Republican Civil Defence Service for the Protection of Agricultural Animals and Plants (Civil Defence Service of the Ministry of Agriculture and Food) is designed to organize and carry out activities aimed at preventing and protecting farm animals and plants, as well as protecting livestock and crop products from hazardous emergency factors. In its practical activity, this service is guided by the Law of the Republic of Belarus dated 27 November 2006 No. 183-3 On civil defence, Resolution of the Council of Ministers of the Republic of Belarus dated 12 August 2008 No. 1151 On Civil Defence services, and local regulatory legal acts of the Ministry of Agriculture. The Civil Defence Service implements its tasks with the coordinating role of MES in conjunction with the structural divisions of the administration and organizations that are part of the Ministry of Agriculture, the Republican Civil Defence Service of trade and catering, and other organizations.

The coordinating bodies of the Civil Defence Service of the Ministry of Agriculture are:

- in the Ministry of Agriculture, the Civil Defence Service of the Ministry of Agriculture;
- in the agriculture and food committees of the regional executive committees, the Civil Defence Service of the Agricultural and Food Committees of the regional executive authorities;
- in the agriculture and food departments of the of the district (city) executive committees, the Civil Defence Service of Agricultural and Food Committees of the district executive authorities;
- in other organizations and institutions that are part of the Ministry of Agriculture and Food and implement measures for the protection of farm animals and plants, the Civil Defence Services at the facility (organization) level.

The Civil Defence Service is managed by the deputy minister of agriculture and food of the Republic of Belarus – the director of the Department of Veterinary and Food Supervision, head of the Civil Defence Service. The working body of the Civil Defence Service is the Department of Control over the Anti-Epizootic and Preventive Work of the Department of Veterinary and Food Oversight with the Agrochemistry and Crop Protection Sector of the Crop Production Directorate of the Main Directorate of Crop Production. The Civil Defence Service consists of two divisions: Service for the Protection of Farm Animals (whose head is deputy director of the Department of Veterinary and Food Oversight); and Service for the Protection of Agricultural Plants (whose head is the head of the Agrochemistry and Plant Protection Unit of the Horticulture Department of the Main Horticulture Division).

The functions of the Civil Defence Service of the Ministry of Agriculture and Food include:

- participation in the development of regulatory legal acts on the protection of the population and territories from emergencies and the development of regulatory legal acts to ensure the protection of farm animals and plants, livestock and crop production from hazardous factors of emergencies;
- formation of civilian-based civil defence units to ensure veterinary and phytosanitary treatment of affected farm animals and plants;
- accumulation of stocks of veterinary and phytosanitary drugs to ensure the completeness of civilian civil defence units;
- methodological guidance of structural divisions of the Civil Defence Service in the planning and implementation of measures to protect farm animals and plants;
- organization and conduct of exercises and training with structural divisions of the management apparatus and organizations that are part of the Ministry of Agriculture and Food.

Disaster risk assessment for the agricultural sector

At the moment, there is no system for assessing the risks of disasters in the agricultural sector in Belarus. However, there are prerequisites for the formation of such a system on the basis of existing EMFS, SUB SES, and system of interdepartmental document management of state bodies of the Belarus; as well as technical regulations on safety and security in emergency situations. It is also worth noting that one of the directions of the National Disaster Risk Reduction Strategy includes the improvement of emergency risk assessment and analysis, as well as methods for their prediction. The national strategy provided for the development of territorial strategies for disaster risk registration. At the end of 2019, local strategies were developed by the Emergency Situations Commissions and are already being implemented (P. Bebko, personal communication, 2021).

Risk assessment means the identification of a hazard and its possible sources, the study of the mechanism of their occurrence, assessment of the likelihood of occurrence of the identified hazardous events and their consequences. The basis for identifying and assessing the risks of emergencies (or disasters) is the EMFS, which covers natural and man-made emergencies thanks to an established system for collecting, processing and analysing information. The EMFS was established in 2004 by a resolution of the Council of Ministers and functions within the framework of the State Emergency Service. Before that, monitoring of emergencies was carried out within the framework of the NSEM. The directions of emergency prevention within the framework of the EMFS, both for prevention (reduction of the risk of occurrence) and for reducing losses and damage (mitigation of consequences), are as follows:

- monitoring of the environment and the state of potentially hazardous objects (should be carried out before the occurrence, at the time of occurrence, and after the emergency);
- prediction of emergencies and assessment of their risk (involves the determination of indicators of the degree of risk for the population in connection with possible accidents at potentially hazardous facilities).

In the technical code of common practice (TCP) 304-2011 (02300), “monitoring and forecasting emergencies, which expired in 2018. General Provisions. The procedure for the functioning of the emergencies monitoring and forecasting system” (no other TCP was adopted), natural emergencies are listed with a description under what conditions a particular natural event (for example, strong dust storms, large hail) is extremely dangerous. In accordance with it, the sources of emergencies monitored by the Ministry of Agriculture and Food are hydrodynamic accidents, accidents at treatment facilities, accidents of emissions of hazardous chemical compounds at facilities (except for transport), hazardous hydrological events, fires in natural ecosystems, epizootics, epiphytotics. Analytical materials about the above emergencies should contain generalised information about their sources, as well as quantitative and qualitative characteristics. A comparative analysis is carried out with the same period of the previous year for administrative-territorial units and for the country as a whole. Based on these analytical materials, a forecast of changes in the sources of emergency situations is prepared, as well as opportunities and proposals for improving the observation system, and long-term forecast of emergency situations for the next year, which is provided in January.

At the moment, no new TCP has been adopted in Belarus to replace TCP 304-2011 (02300), which is a good basis for the development of a new technical regulation for assessing the risks of emergencies (disasters caused by natural hazards). At the same time, there are a number of other important documents (technical normative legal acts) that could form the basis for the development of a new TCP, reflecting the main provisions and terms related to the assessment of disaster risks in agriculture.¹¹

¹¹GOST 22.0.03-97, GOST 22.0.04-97, GOST 22.0.06-97, GOST 22.0.11-2002, GOST 22.1.01-97, GOST 22.1.02-97, STB 1429-2003 (GOST R 22.0.02-94), STB 1404-2003 (GOST R 22.1.04-96), STB 1405-2003 (GOST R 22.1.06-99), STB 1406-2003 (GOST R 22.1.07-99), STB 1407-2003 (GOST R 22.1.08-99), STB 1408-2003 (GOST R 22.1.09-99), STB 1498-2004 (GOST R 22.2.03-97), STB 1518-2004.

International and regional documents can also serve as the basis for development.

It is important to note a set of measures planned for 2019–2030 for development of mechanisms for assessing the risk of emergencies in accordance with their prioritization in the National Disaster Risk Reduction Strategy. The successful implementation of these measures will result in the development of the methodology for assessing the risks of emergencies (through the development of standards for permissible levels of risks for territories and for the operation of critical facilities; development of a methodology for risk management in emergencies in order to form conceptual approaches to the scientific substantiation of the system for protective measures control).

The main activities for monitoring of the environment, adverse and hazardous natural events, processes and forecasting of natural emergencies include (TCP 304-2011 [02300], cancelled on 1 January 2018):

- creation, continuous improvement and development of appropriate systems for environment monitoring and natural emergencies forecasting;
- equipping state organizations that monitor the environment and predict natural emergencies with modern technical means to accomplish the tasks assigned to them;
- coordination of the work of state organizations at the local, territorial and central levels to collect and exchange information on the results of monitoring and control over the state of the environment;
- coordination of the work of sectoral and territorial supervision bodies on the collection and exchange of information on the results of monitoring and control over the situation at potentially hazardous facilities;
- creation of information and communication systems for monitoring and forecasting natural emergencies;
- creation of an information base on the sources of emergency situations, and the scale of natural emergencies;
- improvement of the regulatory legal framework for monitoring and forecasting natural emergencies;
- determination which bodies are authorised to coordinate the work of state organizations that monitor and forecast natural emergencies;
- provision with the established frequency of the data on environmental monitoring and forecasting of natural emergencies, respective analysis of the growth of hazards and threats and proposals for their reduction;
- timely consideration of the submitted data of environmental monitoring and forecasting of natural emergencies, taking necessary measures to reduce hazards and threats, prevent emergencies, reduce their possible scale, protect the population and territories in case of their occurrence.

Within the framework of the Emergency Management System (TCP 304-2011 [02300], cancelled on 1 January 2018), the following is envisioned as part of measures to prevent emergencies, the sources of which are hazardous natural processes:

- determination of natural and climatic conditions in the area of the facility location, which may be subject to emergency situations (territory, building, structure or equipment);
- necessary engineering surveys in order to assess the frequency and intensity of hazardous natural processes, as well as to establish the category of their hazard;
- measures for engineering protection of the site, buildings, structures and equipment from flooding, extreme wind and snow loads, wildfires, etc.;
- lightning protection measures;
- systems for monitoring hazardous natural processes and warning of natural emergencies.

In the area of emergency risk assessment, one can separately note the methodology for assessing natural and man-made risks in the territory of Belarus developed by the State Scientific Institution United Institute of Informatics of the National Academy of Sciences of Belarus (the methodology is of a general nature, specific risks for agriculture are not considered). This document is intended for use by MES, government bodies of all levels, as well as for insurance purposes (N.V. Karpovich, personal communication, 2020).

Within the framework of the project Forum of Eastern Countries on Climate Change, funded by the European Union, an interactive map was created that on a daily basis, reflects current adverse and dangerous events

(through the efforts of the Ministry of Emergency Situations, the Belarusian Red Cross Society and BelTA, available here – <https://101.belta.by/ru>).

A promising direction for risk assessment is the development of scientifically based approaches to risk zoning in view of the state of land, including the presence and condition of reclamation systems (N.K. Vakhonin, personal communication, 2020). The problem is the lack of methods and technical regulations for risk assessment in the agricultural sector. Solving this problem will contribute to the capacity development of the risk management system in agriculture, in all sectors and throughout the whole country.

The existing DRR activities for agriculture are insufficient, and the exchange of best practices in DRR (including those related to climate change) for agriculture and food systems at the national and local levels is essential. The experience of insurance of agricultural risks in the United States of America is considered to be promising for study and implementation (A.V. Lensky, personal communication, 2020).

Increasing the capacity in this area is possible by including the agricultural sector in measures to implement one of the principles of the above-mentioned National Disaster Risk Reduction Strategy, namely the principle of development of emergencies risk assessment mechanisms (implementation of measures to create a methodology for risk assessment in agriculture).

Mapping of threats and GIS potential

Geodetic and cartographic activities in the Republic of Belarus are regulated by the Law of the Republic of Belarus On geodetic and cartographic activities dated 14 July 2008 No. 396-3. The main organization that is engaged in activities of mapping and compiling cadastral estimates of land is the State Property Committee of the Republic of Belarus and its subordinate design organizations. The following organizations are subordinate to the committee:

- land management (RUE Design Institute Belgiprozem and its regional branches);
- topographic-geodetic and cartographic companies (RUE Belgeodesia, RUE Belkartografiya);
- state registration and land cadastral agencies (RUE National Cadastral Agency and its regional offices);
- organizations carrying out appraisal and auction activities (RUE Institute of Real Estate and Appraisal and its regional branches);
- organizations providing real estate services (in Grodno and Mogilev);
- educational institutions (state educational institution Center for Advanced Training of Executives and Specialists of the State Property Committee).

The main activities of the committee include recording and disposal of property, reform and privatization of state unitary enterprises, regulation of land relations, geodetic and cartographic research and works.

RUE Design Institute Belgiprozem performs a wide range of work related to the study and monitoring of the state of land, their redistribution and the organization of rational use within the framework of land management activities. The main activities of Belgiprozem include ensuring the functioning of the information and analytical centre for land monitoring NSEM, topographic survey, soil survey and cadastral assessment of agricultural land, creation of digital soil maps, navigation maps, including for precision farming. The types of cartographic work performed, depending on the purpose, are divided into national and special purposes. Mapping of agricultural lands, threats and consequences of emergency situations, refers to the second type of work, carried out at the request of government bodies and other organizations.

Land monitoring activities are carried out jointly with the NSEM Information and Analytical Centre (R.V. Mikhalevich, personal communication, 2020). Belgiprozem monitors the structure of land resources, the state of the soil cover, and the chemical contamination of land. Environmental information obtained as a result of land monitoring includes data on the state, structure, composition and properties of the soil cover, assessment, trends and forecast of the distribution and condition of land in order to identify the negative impacts of natural and anthropogenic factors, as a result of which land degradation and environmental degradation occur. Collected information about the state of land, including agricultural land, is transferred to the NSEM Information and Analytical Centre, which publishes it in its own publications (NSEM, 2020b), and carries out information exchange with information and analytical centres for other types of NSEM monitoring, and also provides information at the request of other organizations and the population.

In addition to assessing the state of land, Belgiprozem prepares and manages the geoportal of the land information system (LIS) (SPC, 2020b), which is a full-featured GIS designed to automate the storage, processing and provision of spatial information to partners to support decision-making on the organization of effective work in the field of land management, geodesy, cartography, land, forestry cadastre. The LIS database of Belarus contains information on the current state and use of land resources and consists of spatial and attributive data of land cadastral and topographic content:

- land plots, their boundaries and administrative-territorial affiliation;
- zones of limited land use;
- information about landowners and land users;
- types, sub-types and varieties of land, their reclamation state and soil cover;
- distribution of land by categories, types of land rights and land-use restrictions;
- current changes in the composition and distribution of land.

The database is presented in the form of two separate services: the LIS Geoportal, and the Open Data Geoportal. The main difference between the two is the quantity and quality of publicly available information. An agreement with the Belgiprozem for access to the LIS is necessary for the work with the first service, while the second service is open, but its functions are severely limited. It is possible to work with the administrative-territorial division of Belarus and the boundaries of land plots, as well as with certain specialised sections, such as observation points for monitoring the NSEM land, health facilities of individual territorial units and zoning of some towns of the country (O. Antipenko, personal communication, 2020 year).

The main recent development achievements in LIS include the launch of the LIS Geoportal modules for assessing losses of agricultural and forestry production, and losses of forestry production with direct calculation of losses by the LIS itself. The calculation of agricultural production losses is carried out directly in the LIS with the help of built-in tools based on databases with standards for compensation for agricultural production losses, as well as coefficients taking into account the location of land plots, their area, ownership, the degree of land reclamation, and the intensity of agricultural production. The procedure for determining agricultural production losses, as well as calculation standards and coefficients, are regulated by the Resolution of the Council of Ministers of the Republic of Belarus dated 26 March 2008 No. 462 On some measures to implement the Decree of the President of the Republic of Belarus No. 667 dated 27 December 2007.

The assessment of losses in agricultural production is made on the basis of soil maps, data on the state of reclaimed lands, maps of the cadastral assessment of land and information on the agrochemical parameters of soils. The analysis can be carried out both by the staff of the institute upon prior request, and by the direct user with the help of the built-in LIS toolkit.

Currently, the LIS does not analyse the vulnerability of agricultural land to natural hazards. However, a well-developed EMFS, as well as an established exchange of information between this system, NSEM and social and hygienic monitoring, and the use by departments, including by the Ministry of Agriculture and Food, the Interdepartmental Document Management System of the state bodies of Belarus, can serve as a prerequisite for the development of a new module or other technological innovation of the LIS, which would make it possible to analyse and forecast the vulnerability of agricultural land to hazardous natural events.

RUE Belgeodesia carries out government and special purposes cartographic and geodetic works for the needs of economic sectors, in the interests of defence and security of the state, provides services to legal entities and individuals, as well as to self-employed persons. The main customer of geodetic and cartographic works for state purposes is the State Property Committee of the Republic of Belarus, which determines the procedure for their execution and implementation. The enterprise is engaged in direct surveying of land and drawing up a basic topographic base, which is later used by other organizations of the State Property Committee for their own purposes.

Post-disaster needs assessment

There are no post-disaster needs assessment (PDNA) guidelines in Belarus, no post-disaster recovery strategies that would be similar to the guidelines and framework strategies developed by the European Union, the UN Development Group, and the World Bank, such as the PDNA and the disaster recovery framework (DRF) strategy. However, a number of tasks are being carried out in the country to meet the basic needs of affected citizens, including workers in the agricultural and food sector.

Such tasks within the SUB SES include planning and implementation of a set of measures to protect employees of the Ministry of Agriculture, state associations and subordinate organizations affected by emergencies; as well as conducting humanitarian actions. The tasks of the Emergency Commission of the Ministry of Agriculture and Food include the implementation of measures for the social protection of the population affected by emergencies, as well as for exercising the rights and obligations of the population to protection from emergencies, including the persons directly involved in their elimination. Among other activities, the SUB SES implements measures to create, replenish and refresh the reserves of material resources for the elimination of emergencies in the course of its regular activity.

There is also TCP 268-2010 (02300), Support of the population in emergencies, which establishes general requirements for the organization of measures to protect and ensure life support for the population in emergencies. The priority needs of the population are met by the provision of water, food, housing, basic necessities; information, medical and sanitary-epidemiological, transport and communal services.

At the moment, there are no methodologies or technical regulations in the country aimed at a more extensive assessment of post-emergency needs, including elements such as a cross-cutting and comprehensive assessment of the emergency impact; a recovery strategy that would include specific activities for each sector in the affected region, expected results, timing, and estimated costs; a resource mobilisation tool to support the country's recovery; nor a description of the process for the recovery strategy implementation. The current objectives and activities, TCP 268-2010, as well as methodologies for assessing damage from disasters, can serve as the basis for the development of guidelines for assessing post-emergency needs, as well as strategies for recovery after them.

Assessment of damage and loss to agriculture and food systems

The Republic of Belarus has a *Methodology for assessing economic damage from natural and man-made emergencies* in agriculture (as well as in forestry and housing and the communal services sector). In 2020, it was improved as a result of the development of additional indicators and their testing (using damage data for the past period) as part of the activities under the National Disaster Risk Reduction Strategy and the International Technical Assistance Project of the World Bank, Improving Disaster Preparedness in the Republic of Belarus. There is also a practice of such assessment for insurance purposes (MES, 2020i).

The conditions and algorithm for calculating damage from emergency situations in agriculture are provided for in article 403 of the Decree of the President of the Republic of Belarus of 22 August 2006 No. 530 On insurance activities. On the basis of the Resolution of the Ministry of Finance of the Republic of Belarus dated 30 August 2007 No. 128 On the procedure for calculating damage in the event of loss of agricultural crops, the instruction was developed and approved, which determines the procedure for calculating damage in the event of the loss of agricultural crops subject to mandatory insurance under the state support for agricultural crops, livestock and poultry. This calculation is carried out by separate subdivisions of the Belarusian Republican Unitary Insurance Enterprise Belgosstrakh on the basis of documents, data or information specified in the instructions received from the policy holders, the Ministry of Agriculture and Food. The damage caused to the policy holder by the loss of agricultural crops is determined separately for each type of agricultural crop. The following serves as the basis for damage calculation:

- the value of state purchase prices or official statistical information on prices for the products of these crops (for those crops for which state purchase prices are not set);
- the area of the lost agricultural crop;
- the yield of an agricultural crop, calculated per hectare of the harvested area;
- the size of the reseeded area, determined on the basis of the documents provided by the policy holder.

The area of destruction of agricultural crops is determined on the basis of a survey report (conducted by a specially formed commission) of the areas under agricultural crops, drawn up in the manner prescribed by the Resolution of the Council of Ministers of the Republic of Belarus dated 5 June 2008 No. 813 On approval of the Regulation on the procedure for changing the area of agricultural crops that were lost or damaged as a result of force majeure and other circumstances.

In case of death of livestock and poultry, the calculation of damage is made in the amount of the book (residual) value of the dead livestock and poultry on the day of the insured event. In case of forced slaughter (destruction) of livestock and poultry, the damage is calculated in the amount of the difference between the book (residual) value of livestock and poultry on the day of the insured event and the value received from the sale of edible meat. In accordance with the regulation on insurance activities in Belarus No. 530 (dated 25 August 2006), the policy holder must provide the insurer with the following documents:

- an application for the payment of insurance compensation;
- documents confirming the cause of the insured event;
- document on the death of livestock and poultry drawn up by the policy holder, and in the case of forced slaughter in connection with the implementation of measures to combat epizootics, drawn up by a specialist in the field of veterinary medicine.

In case of death (damage) of agricultural crops, farm animals and forest resources, the Ministry of Agriculture and Food and the Ministry of Forestry will organize a collection from the lower bodies of agriculture and

forestry, certified by the regional executive committees, calculations on the amount of damage based on the area of lost crops and the number of dead animals, the amount of affected timber and tax value of the lost forest seed objects and the harvest of forest seeds, as well as calculations of the need for funds for the recultivation of these territories and the creation of new forest crops. On the basis of the submitted materials, the amount of losses from the disaster, accident or catastrophe is determined. Compensation for the property lost as a result of emergencies is paid to agricultural producers, regardless of their departmental affiliation and forms of ownership, from the following sources: funds of insurance authorities, local and central budgets, the republican fund for support of producers of agricultural products and food, the republican fund for financing expenses related to disasters, accidents and disasters, voluntary contributions and other receipts (in accordance with the regulation on the procedure for determining the volume of loss of agricultural crops, farm animals and forest resources as a result of disasters, accidents and catastrophes, the amount of losses and compensation for damage caused, approved by the Minister of Agriculture and food of the Republic of Belarus on 17 August 1998).

This regulation contains a list of property subject to compensation in case of losses as a result of emergency situations – agricultural crops (except for hayfields and pastures) and perennial fruit plantations in the event of 70 percent or more loss of plants and trees in the established area; fruit and perennial plantations, nurseries, hop farms, farm animals, poultry, rabbits, fur animals, bee families, forest fund, harvest of forest seeds on permanent forest seed plots. The document includes the procedure for determining the amount of loss (damage) of property; the procedure for assessing the value of lost property; a list of sources of economic support for entities that have incurred losses as a result of disasters.

Until 2005, the Regulation On streamlining the use of the republican fund for financing expenses related to disasters, accidents and catastrophes, was in force (approved by the Resolution of the Council of Ministers of the Republic of Belarus on 1 April 1998, No. 521). The document provided for the procedure for reimbursing the cost of destroyed (damaged) buildings and structures, unfinished constructions, equipment, auto and motor vehicles, and other property. It ceased to be effective after the entry into force of the Resolution of the Council of Ministers of the Republic of Belarus of 11 January 2005 No. 23.

In accordance with the Resolution of the Ministry of Agriculture and Food of 6 August 2007 No. 55, a list of infectious diseases has been determined, as a result of which death (mortality), forced slaughter (destruction) of livestock and poultry will be recognised as insured events under mandatory insurance. The country also has a regulation on the procedure for organizing activity on the seizure of animals or products of animal origin, property, the use of which is associated with keeping sick animals, the procedure for determining the amount of damage to be compensated as a result of the seizure of animals or products of animal origin, and the value of the seized property, the use of which is associated with the maintenance of sick animals, during the elimination of foci of infectious animal diseases, as well as the procedure for compensation for damage caused as a result of such seizure (approved by the Resolution of the Council of Ministers of the Republic of Belarus dated 29 August 2013 No. 758).

Assistance in assessing damage from emergencies in the agricultural sector is provided by the Republican Unitary Enterprise Design Institute Belgiprozem by providing all interested parties with access to the Geoportal of the Land Information System of the Republic of Belarus. The following services are among those provided on the geoportal – calculation of agricultural production losses (BYR 26.40/month); calculation of losses of forestry production (BYR 21.60/month); calculation of losses of forestry production (BYR 21.60/month) (SPC, 2020b).

In general, currently damage and losses as a result of emergencies are assessed to one degree or another in crop production, animal husbandry and forestry. However, the fisheries sector does not collect data on losses due to disasters (Yakubovskaya and Poleschchuk, 2019). Among the main shortcomings of the existing system of damage and loss accounting, experts who participated in the FAO regional presentation workshop on the methodology for assessing losses attributed to disasters caused by natural hazards in agriculture, fisheries and forestry (held in 2019, in Kyiv, Ukraine), named the following – the quality of primary data, completeness of operational information, insufficient use of GIS technologies, lack of sectoral methodology for assessing damage and losses in fisheries, data visualization, data availability and integration, financing, absence of an interdepartmental working group on damage and loss assessment (Yakubovskaya and Poleschchuk, 2019).

Capacity development in the area of disaster damage assessment

The National Disaster Risk Reduction Strategy envisions the creation of a national mechanism for assessing damage from emergencies through the creation of a unified inter-departmental methodology for assessing damage from natural and man-made emergencies; and forecasting and assessing the medical and sanitary consequences of emergencies.

It is also worth noting that in 2017, research on the topic “to develop an integrated algorithm for assessing damage from natural and man-made emergencies in the Republic of Belarus” was carried out in the Belarusian State Economic University. Based on the results of this study, methodological approaches to assessing damage from natural and man-made emergencies in Belarus were substantiated, including the proposed logical structure of an integrated algorithm for assessing damage from natural and man-made emergencies in the country, which, among other things, includes damage in agriculture. At the moment, there are no technical regulations in Belarus which would enshrine the methodology for assessing damage from emergencies in agriculture. The assessment is carried out by the commissions created at the location of the incident. The author of the work proposes his own methodology for assessing the economic damage from emergencies as a result of the destruction or damage of fixed assets, including an economic assessment of damage as a result of the death of farm animals, and, separately, as a result of damage (flooding) of agricultural land (Lopachuk, 2018).

The implementation of measures to create a national mechanism for assessing damage from emergencies, taking into account various sectors, in particular agriculture, will contribute to the development of the capacity of the system for assessing damage and losses from emergencies in agriculture and food systems.

Agricultural insurance

Insurance activities in Belarus are carried out on the basis of the Decree of the President of the Republic of Belarus dated 22 August 2006 No. 530 On insurance activities. Agricultural insurance is reflected in Chapter 18 of this decree (“The procedure and conditions for the implementation of mandatory insurance with state support for the harvest of agricultural crops, livestock and poultry.”) State regulation of insurance activities, implementation of state policy on insurance activities, and supervision and control over insurance activities in Belarus, is carried out by the Ministry of Finance.

Mandatory insurance

For legal entities

The Decree of the President of the Republic of Belarus No. 764 of 31 December 2006, “issues of mandatory insurance of agricultural crops, livestock and poultry”, introduced mandatory insurance with state support of agricultural harvest, livestock and poultry from 1 January 2008, and made appropriate amendments to Decree No. 530 On insurance activities. Thus, since 2008, mandatory insurance of agricultural crops, poultry and livestock has been in force in Belarus, the only insurer for which is Belgosstrakh. The policy holders are legal entities whose main activities are the production of crops, livestock and poultry, processing of fiber flax, and also legal entities that have a separate balance sheet or current bank account for this type of activity. The latter are the organizations where agricultural production is not the main type of activity, but they have structural units that keep separate accounting as agricultural organizations and, in this regard, have the right to use all the benefits provided to agriculture. This approach is due to the fact that in recent years, restructuring has been carried out in agriculture, providing for the accession of agricultural organizations to commercial structures (I.A. Voitko, personal communication, 2021). The objective of this insurance is to cover both the loss of agricultural crops, and death, mortality and forced slaughter of livestock and poultry.

The list of such crops, livestock and poultry subject to mandatory insurance is approved annually by the president of Belarus in the form of a decree. This decree approves the list of crops, livestock and poultry, as well as insurance rates for mandatory insurance with state support for the coming year. It outlines the percentage of damage compensation and reseedling costs; the percentage of compensation for damage in case of death, forced slaughter of livestock and poultry. In 2020, the list included winter rapeseed, fiber flax, breeding stock, parent and grandparent herds of breeding hens in breeding farms, breeding stock of main sows (purebred and two-breed), with the exception of breeding stock of pigs (in accordance with the presidential decree of the Republic of Belarus dated 7 September 2020 No. 336 On insurance of crops, livestock and poultry in 2021. Agricultural machinery and crop seeds were not included in the list.

Insured events for mandatory insurance of agricultural products are as follows (in accordance with the regulation on insurance activities in the Republic of Belarus No. 530, dated 25 August 2006):

- insurance of agricultural crops (loss of crops as a result of fire, wetting, damping, freezing, drought, and other dangerous hydrometeorological events);
- insurance of livestock and poultry (death, forced slaughter as a result of infectious diseases included in the list approved by the Ministry of Agriculture and Food, fire, explosion, dangerous hydrometeorological events, damage of places where livestock and poultry are kept, as well as forced slaughter of livestock and poultry by order of the veterinary service in connection with the implementation of measures to combat epizootics, with the exception of bird flu).

The following is not subject to mandatory insurance (in accordance with the regulation on insurance activities in the Republic of Belarus No. 530, dated 25 August 2006):

- agricultural crops that the policy holder sowed for three to five years preceding the conclusion of a mandatory insurance contract for agricultural products, but did not receive products (harvest) in any year;
- agricultural crops affected by diseases;
- livestock and poultry, in respect of which the policy holder does not comply with the requirements established by law for keeping, feeding, growing, breeding, moving, as a result of which they are in danger of death, forced slaughter;
- sick livestock and poultry;
- livestock in the prenatal or postnatal condition;
- livestock and poultry in those localities or organizations where quarantine for an infectious disease is established, until it is cancelled, except for cases of insurance of livestock and poultry of such species that are not susceptible to this disease.

An annual payment of 95 percent of insurance premiums to Belgosstrakh is carried out at the expense of the funds provided in the central budget for the development of agricultural production, fish farming and processing of agricultural products (at the expense of the republican fund for supporting producers of agricultural products, food and agricultural science) in the manner determined by the Ministry of Agriculture and Food of the Republic of Belarus in agreement with the Ministry of Finance (in accordance with the Resolution of the Council of Ministers of the Republic of Belarus dated 30 August 2007 No. 1118). The remaining 5 percent of the insurance premium is paid by the policy holder (in accordance with Article 388 of Decree No. 530 On Insurance Activities, dated 25 August 2006). This 5 percent is used by the insurer to create a preventive measures fund.

To receive insurance compensation, the policy holder must provide a list of documents to the insurer – an application for payment of compensation, conclusion confirming the cause of the insured event, the document on death of livestock and poultry, documents confirming the amount of costs incurred by the insured for reseeded the lost agricultural crops. The policy holder should contact Belgosstrakh no later than three months following the date of the insured event.

It should be noted that the presence of one insurer (Belgosstrakh) in the system of mandatory insurance with state support in agriculture is a deficiency, since it does not provide agricultural organizations with the freedom to choose an insurer, conditions and insurance rates. In this regard, the experience of other countries, such as Canada and the Russian Federation, may be interesting (I.A. Voitko, personal communication, 2021).

For individuals

Mandatory insurance of crops, livestock and poultry is not provided for individuals. Nevertheless, Belgosstrakh carries out mandatory insurance of constructions used by individuals for accommodation and economic needs, as a result of insured events such as: loss (destruction) or damage to buildings as a result of strong wind (including a squall, tornado, hurricane), hail, heavy rain, heavy snowfall, severe frost, extreme heat and other dangerous natural phenomena, which, in terms of their intensity (strength), scale of distribution and (or) duration, can cause damage to buildings, high water level (during flooding, congestion, jamming), release of subsoil waters, ground subsidence, collapse, landslide, earthquake, lightning strike, fire. The objects of insurance include the following registered real estate: single-family residential buildings, apartments in a blocked residential building and buildings, structures that are not spatially separated from them, intended for household needs.

Voluntary insurance

In the case of agricultural crops, legal entities and individuals can voluntarily insure their livestock and poultry that are not included in the annual list of mandatory insurance.

For legal entities

Agricultural crops and perennial plantings

Belgosstrakh also provides voluntary insurance of agricultural crops and perennial plantations, which are not included in the list of agricultural crops subject to mandatory insurance against risks such as fire, drought, strong

wind (including a squall, tornado, hurricane), heavy rain, hail, soaking, high water level, damping, freezing, destruction by wild animals and insects. The insured value of agricultural crops is the estimated value of the harvest, based on the average yield per hectare and current prices, calculated for the entire area from which it is planned to obtain a crop or planted area; for perennial plantations, this is the actual value on the day of the conclusion of the insurance contract, taking into account the estimated cost of the crop for fruiting perennial plantations. Crop insurance rates are set individually in each case and depend on the type of crop, region of cultivation, selected risks, insurance terms, deductibles.

Farm livestock

The objects of insurance by Belgosstrakh in this case include cattle, pigs, fur-bearing animals and rabbits, poultry, sheep and goats, horses, camels, mules, donkeys, deer, service dogs, bee families in hives, commercial fish grown in ponds, pools, river and lake cages, other animals. It is possible to insure both all animals and a separate age group, a separate species, a separate animal. Belgosstrakh insures the above objects against the following risks: death, forced slaughter, caused by an accident; fire; direct lightning strike; dangerous hydrometeorological event; infectious and invasive diseases; death caused by the destruction of animals at the order of the veterinary service to combat epizootics. Tariffs are set individually and depend on the experience of the enterprise in this sector, availability of qualified specialists, including veterinarians, and other factors.

Insurance of fixed assets and inventory is provided for legal entities. These are fixed assets (buildings, structures, transmission devices, machinery and equipment, tools, production and household inventory) and working capital (production and inventory, work in progress, as well as finished goods). Insured events are dangerous and unfavourable hydrometeorological events; soil water impact; ground subsidence; trees falling; icicles falling; fire; direct lightning strike; any direct impact on the insured property caused by animals and birds; collapse of neighbouring buildings, structures, as well as their parts. Tariffs are set individually depending on the condition of the property, and the presence of hazardous industries in the neighbourhood, among other factors.

For individuals

Voluntary insurance of farm animals is carried out by Belgosstrakh in accordance with the document, “Rules No. 34 of voluntary insurance of animals owned by citizens” (approved by the Ministry of Finance of the Republic of Belarus dated 20 October 2017 No. 837, approved by order of Belgosstrakh dated 16 March 2020 No. 6-pr). Insurance is provided against deaths or forced slaughter of animals or bee families due to an accident or disaster caused by natural hazard, as well as costs incurred as a result of slaughter and transport. The objects of this type of insurance include cattle, horses, pigs, sheep and goats, bee families. Young animals (up to six months of age), as well as animals that are not provided with proper supervision which can result in risk of illness or death, are not accepted for insurance. In case the contract is concluded for the first time, the following are not accepted for insurance – cattle and horses over ten years old; pigs, sheep, goats over seven years old; sick, emaciated and sterile animals; animals in the quarantine zone; animals with a positive test result for leukaemia, tuberculosis, brucellosis, and other infectious diseases.

The sum insured for payment in case of an insured event occurrence is established by the agreement between the insurer and the policy holder. The amount of the insurance premium paid by the policy holder for each animal is calculated according to the basic insurance rates established as a percentage of the insured amount (Table 10) for each species and age group of animals, as well as insurance option (option II for cattle, horses, pigs, sheep and goats; option III for bee families).

Belgosstrakh does not provide voluntary insurance of agricultural crops and perennial crops for individuals.

Table 10. Basic insurance rates for voluntary insurance of animals by citizens

Animal species	Age group	Insurance rate, %	
		Option II	Option III
Cattle	6 months to 1 year	9.3	–
	1 to 2 years	9.3	–
	Older than 2 years	9.3	–
Horses	from 6 months to 1 year	6.9	–
	Older than 2 years	8.0	–
Pigs	6 months to 1 year	21.2	–
	Older than 1 year	21.2	–
Sheep and goats	6 months to 1 year	13.2	–
	Older than 1 year	17.1	–
Bee families		–	17.3

Source: adapted on the basis of Rule No. 34 of voluntary insurance of animals owned by citizens (approved by the Ministry of Finance of the Republic of Belarus dated 20 October 2017 No. 837, approved by order of Belgosstrakh dated 16 March 2020 No. 6-pr)

Main challenges

The main gaps in the disaster risk management system include:

- lack of a system and methodology for assessing the risks of disasters caused by natural hazards in the agricultural sector;
- absence of methodologies and guidelines for PDNA and post-disaster recovery strategies;
- insufficient statistical information on agricultural insurance, including data on the purchase of this service by farmers and owners of private plots, which complicates deeper and more detailed analysis;
- legal entities cannot choose an insurer (other than Belgosstrakh) and, therefore, nor can they choose the conditions and rates of insurance;
- agricultural organizations have no freedom of choice of crops subject to insurance with state support (the list of agricultural crops, livestock and poultry subject to mandatory insurance is approved annually by the president of Belarus);
- low efficiency of agricultural organizations, together with high insurance rates for agriculture, restrain the use of voluntary insurance as an effective tool to reduce losses from disasters;
- need to implement greater risk coverage by expanding the list of insured cases included in legislation.

Projects and programmes

Various state programmes have been implemented and are currently being implemented in Belarus for the period of 1994–2030 at both the national and regional levels (Figure 12).

The following programmes and projects have been and are being implemented at the national level:

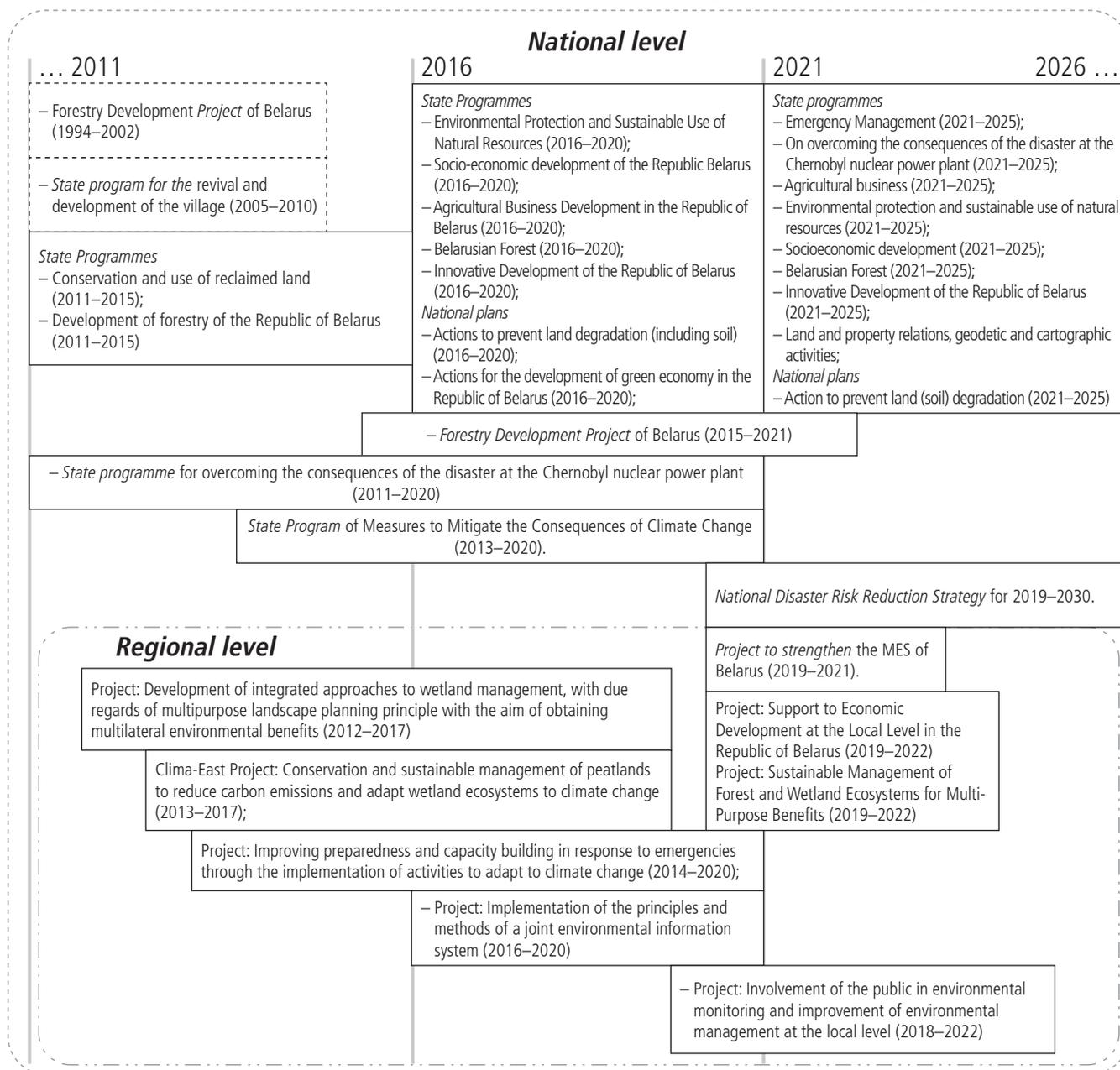
- forestry development projects of Belarus for 1994–2002, 2015–2021, additional financing from 2018 to present;
- State Programme Environmental Protection and Sustainable Use of Natural Resources (2016–2020);
- National Action Plan for the Development of a Green Economy in the Republic of Belarus until 2020 (2016–2020);
- Programme of Socio-Economic Development of the Republic of Belarus for 2016–2020;
- State Programme for Agricultural Business Development in the Republic of Belarus for 2016–2020;
- State Programme Belarusian Forest (2016–2020);
- State Programme for Eliminating the Consequences of the Disaster at the Chernobyl Nuclear Power Plant (2011–2015 and for the period until 2020);
- Action Plan for the Implementation of the National Disaster Risk Reduction Strategy (2019–2030);
- National Action Plan for the Prevention of Land (Including Soil) Degradation 2016–2020;
- State Programme for Innovative Development of the Republic of Belarus (2016–2020);
- State Programme of Measures to Mitigate the Consequences of Climate Change (2013–2020).

The following programmes and projects have been and are being implemented at the regional level:

- Development Plan for Individual Regions Lagging Behind in Terms of Socio-Economic Development (2019–2020);
- Support to Economic Development at the Local Level in the Republic of Belarus project (2019–2022);
- Sustainable Management of Forest and Wetland Ecosystems for Multi-Purpose Benefits project (Wetlands) (2019–2022);
- Clima-East project: conservation and sustainable management of peatlands to reduce carbon emissions and adapt wetland ecosystems to climate change (2013–2017);
- Development of integrated approaches to wetland management, with due regards of multipurpose landscape planning principle with the aim of obtaining multilateral environmental benefits project (Peatlands 2) (2012–2017);
- Involvement of the public in environmental monitoring and improvement of environmental management at the local level project (Ecomonitoring) (2018–2022);
- Implementation of principles and methods of a joint environmental information system project (ENI SEIS II EAST) (2016–2020);
- Improving preparedness and capacity building in response to emergencies through the implementation of activities to adapt to climate change project (2014–2020);
- Project to strengthen the Ministry of Emergency Situations of Belarus (2019–2021).

More detailed information on international projects, indicating strategic goals and objectives, deadlines, responsible executors, volumes and sources of funding, is presented in Annex IV.

Figure 12. Programmes and projects related to disaster risk reduction, early warning systems, and agrometeorology services



Source: own development

Conclusions and recommendations

Disaster risk reduction regulatory framework

Belarus has a legislative framework on disaster risk management, including in the agricultural sector. Since the end of 2018, the National Disaster Risk Reduction Strategy has been in effect in the country, according to which the National Platform for Disaster Risk Reduction has been created on the basis of the existing State Emergency Service and Civil Defence. The legislation focuses on specific natural hazards without considering their interconnection and mutual influence. Risk management in agriculture is provided for in a number of regulations. Belarus has developed and is implementing the Strategy for Agriculture Adaptation to Climate Change (2019), as well as the State Programme of Measures to Mitigate the Effects of Climate Change for 2013–2020. The main issues in the regulatory and legal framework of the DRR system are the lack of a single compilation of existing legislation on natural and man-made risks, including the agricultural sector, which makes it difficult to analyse the existing problem; and insufficient adaptation of the strategy (lack of sub-strategies) to its implementation at all levels (territorial, sectoral, and facility).

Recommendations for strengthening the regulatory framework for disaster risk reduction in agriculture and food security:

- Promote the classification and codification of legislation on emergency situations in the agricultural sector in the form of a compilation (code), as well as a database of laws.
- Add to the activities of the National Disaster Risk Reduction Strategy the development of sector-specific activities (if needed, strategies), addressing both sectoral (including in agriculture) and object (organizations) levels in accordance with the existing coordination mechanisms.
- Develop a new state DRR programme in agriculture or supplement the state programme, Agrarian Business for 2021–2025 as a sub-programme of DRR in agriculture.
- Expand the list of natural hazards, in addition to fires, in the state programme Emergency Management for 2021–2025.
- Harmonise the national terminology for DRR or emergency situations with international standards.
- Develop and implement a national strategy or a programme on digital agriculture.
- Consider supplementing government programmes and policies in agriculture and emergency management with gender equality and the needs of particularly vulnerable populations.

Institutional framework for disaster risk management

Belarus has developed an institutional structure for DRR, which includes the National Platform for Disaster Risk Reduction (which is part of the Global Platform for Disaster Risk Reduction) and the State system for the prevention and elimination of emergency situations (SES). The Commission on Emergency Situations under the Council of Ministers performs the coordinating role, while the managing role is played by the Ministry of Emergency Situations (MES). The president of Belarus, as well as the Council of Ministers, carry out general guidance of the bodies and departments for emergency situations. The minister of emergency situations exercises direct control over the emergency bodies and departments. In the agricultural sector, there is a SUB SES of the Ministry of Agriculture and Food. The coordinating role in this system is played by the Emergency Situations Commission of the Ministry of Agriculture and Food. In carrying out its activities on disaster risk management, the Ministry of Agriculture and Food actively interacts with other entities of the national platform and the State Emergency Service, including MES and the Ministry of Natural Resources. The main challenges of the institutional structure of disaster risk management functioning include the lack of statistics of MES on the number of cases of emergencies; statistics on the type of emergencies that lead to the death or injury of people, as well as the destruction of buildings, structures, equipment and livestock; incompatibility of data on

the number of fatalities and injured people as a result of emergencies on the official MES website and on the website of the national platform (reporting on sustainable development indicators); lack of a unified systematic policy on budget allocations for the implementation of the DRR strategy, including in the agricultural sector.

Recommendations for strengthening the institutional framework for disaster risk reduction in agriculture and food security:

- Improve the quality of statistical reporting, to conciliate the information displayed in various sources (on the MES website and on the website of the national platform for sustainable development).
- Expand the list of statistical indicators for emergencies, including agriculture-related (the number of people who become ill as a result of an emergency, to divide all statistics on emergencies by the type of origin of a disaster in order to analyse man-made and natural emergencies separately, to expand and deepen the profile of disasters caused by natural hazards, to specify not only fire emergencies, but also other types of emergencies).
- Facilitate the creation and development of voluntary public associations, such as the search and rescue squad "Angel", PA Belarusian Federation of Fire and Rescue Sports, in order to involve civil society in activities to prevent and prepare for disasters, recovery and rehabilitation in agriculture.
- Promote the participation of non-profit and non-government organizations (NGOs) in the prevention, recovery and rehabilitation from natural and man-made emergencies, as well as their work with the population, namely to bring the legislation on NGOs in line with international standards of freedom of association, as well as to develop and adopt a law on the interaction between government bodies and NGOs (in close consultation with interested NGOs).
- Promote compliance with the Aarhus Convention by ensuring access of all categories of citizens to environmental information and participation in the decision-making process related to the environment, as well as the protection of their rights on these issues.
- Establish a budget for the implementation of measures in the National Disaster Risk Reduction Strategy, and to coordinate it with the state annual budget until 2031.

Early warning systems

The EWS in Belarus is presented in the form of monitoring, forecasting and emergency warning. The Ministry of Agriculture and Food, along with some other departments, monitors, analyses and evaluates the state and changes of such sources of emergencies as accidents with the release of potent toxic substances, accidents at treatment facilities, hydrodynamic accidents, hazardous hydrological events, fires in natural ecosystems, epizootics, damage of agricultural plants and forests by diseases and pests. The Ministry of Agriculture and its subordinate structures are notified about emergencies on the same basis as other departments by the EMFS system. The instructions on the classification of emergency situations indicate emergencies of a natural and man-made nature in the agricultural and forestry sectors. There is no unified national market information system in Belarus. However, there are prerequisites for its formation on the basis of already existing individual elements and organizations, including the Ministry of Agriculture and Food. Scattered market information provided by various sources is currently not widely disseminated in the EWS. Currently, there is no specialised climatic information system in Belarus aimed directly at providing up-to-date climate information for the agricultural sector. The main problems of EWS include the lack of unified national market and climate information systems, as well as the low level of openness and adaptation of the available information to the needs and perceptions of various categories of users (participants in agricultural activities).

Recommendations on early warning systems:

- Create an institutional global emergency monitoring system, planned in the National Disaster Risk Reduction Strategy.
- Develop a market information system for the agricultural sector, and adapt it to the needs and perceptions of all categories of citizens involved in agricultural activities, both representatives of large enterprises and owners of peasant farms and private subsidiary farms.
- Adapt the existing climate information system to the provision of information by it for the needs of representatives of the agricultural sector (to develop separate tabs on weather portals, which highlight the most important indicators and observations with possible comments and recommendations).

- Develop a methodology for collecting data on the market for agricultural raw materials and food, as well as ways of prompt dissemination and presentation of the data to partners.
- Create training courses and guidelines based on established agricultural climate and market information systems.
- Organize the use of available information on the agricultural market (and in the long term, information provided by the national market information system) in the activities of the EWS and services providing agrometeorology services.
- Increase the awareness of agricultural specialists, including representatives of peasant farms and private subsidiary plots, about possible risks, increase their literacy on and readiness to anticipate emergencies and their consequences.
- Expand the variety of compulsory training programmes on natural emergencies in view of their impact on agriculture, for students in higher educational institutions specialising in agriculture and food.
- Examine the demand for educational services on DRR in agriculture.
- Conduct sociological polls of representatives of agro-industrial complexes, agricultural enterprises, peasant farms and private subsidiary farms in order to obtain feedback on the existing challenges in the preparation for and response to natural emergencies.
- Adapt the interfaces of sites presenting information about risks to the perception of a wide audience, and provide this information in a form convenient for representatives of the agricultural sector, including owners of private subsidiary plots.
- Ensure consistent upgrade of the technological equipment and production technologies at potentially hazardous facilities, as well as at agricultural facilities.
- Introduce modern technical means of informing and alerting the population in crowded places, including in rural areas.

Agrometeorology services

Agrometeorological observations in Belarus are carried out by the hydrometeorological service (Belhydromet) to study the influence of meteorological conditions on the development of agricultural crops and the formation of crops. Belhydromet provides actual and forecast information to all interested parties. Agrometeorological information is presented in the form of an agrometeorological yearbook, as well as a reference book, *Agroclimatic Resources of the Republic of Belarus in the Context of Climate Change* (provided on a paid basis). The hydrometeorological service provides the information resources POGODA.BY and METEOINFO.BY. The target audience of Belhydromet, for which agrometeorological information is prepared, includes the agro-industrial complex and authorities. The most accessible and easy-to-read source of information for citizens is the 'Weather in your pocket' application with free information and the "agro" section, which provides up-to-date agricultural information. Information from the sites POGODA.BY, METEOINFO.BY, agrometeorological reviews from the Belhydromet website, as well as information from the 'Weather in your pocket' application are provided free of charge. In addition, a number of paid agrometeorology services are available for interested parties, including the provision of information on agrometeorological conditions that caused damage and loss of crops, as well as expert advice. The country is training specialists in agrometeorology and agriculture; there are advanced training courses. The challenges of existing agrometeorology services are related to the sporadic provision of relevant information to peasant farms and private subsidiary farms, and its poor adaptation to the needs and perception of farmers.

Recommendations on agrometeorological activities:

- Increase the density of the observation network (to increase the number of observation points and stations, including automatic ones).
- Better equip the entire observation network with modern agrometeorological devices (there is a shortage of humidity sensors, etc.), and increase the number of specialists (there is a shortage of labour for some types of work, for example for soil drilling).
- Create regional hydrometeorological distance learning centres.
- Ensure greater information content and completeness of information regarding the implementation of state programmes and their results.
- Organize refresher courses, events for the exchange of international experience, forums for agrometeorological specialists.

- Use the capacities of the existing climate information system to create a separate section or a unique portal aimed at the information and consumer interests of representatives of agriculture (information should be focused on the needs of this target audience, the site interface should be easy to understand, the list of goods and services provided with tariffs should be easily accessible to find it on the site).
- Develop forecasts of agrometeorological conditions with specific recommendations, tailored to farmers and representatives of agricultural activities, which would ensure the uptake of information and drive climate-informed decisions in the field.
- Facilitate the processing of online applications on the Belhydromet website for the purchase of an information product or service.
- Create a more detailed list of provided agrometeorological services with the cost for each item in the list.
- Simplify the method of obtaining agrometeorological yearbooks (if possible, reduce the number of documents to be drawn up when purchasing an information product, to automate the process of applying for the purchase, purchase and receipt of a product, provide an opportunity to review the content of the product).
- Develop a climate services community that engages both the producers of climate information, and recipients.
- Study the reasons for a lack of interest on the part of agricultural producers in agrometeorological information (only fishers are interested);
- Raise awareness about the importance of climate information, including agrometeorological information, among agricultural workers.
- Provide assistance to farmers and owners of private subsidiary plots to become familiar with agrometeorological information.
- Co-production and co-design climate services: map the climate services market to clearly define the responsibilities on the production and delivery of climate services.
- If possible, as well as with the aim of increasing the capacity of the Belarusian hydrometeorological service, study the existing demand on the market for climate and agroclimatic information products and conduct user needs assessments to make sure that the last-mile needs and preferences are taken into account when developing these services. Develop a commercial offer for interested users, which presumably, will create opportunities to improve such products and develop new ones.

Disaster risk management in the agricultural sector

The disaster risk management system is represented by SES, and at the sectoral level by SUB SES (in the agricultural sector, by SUB SES of the Ministry of Agriculture and Food). At the moment, there is no system for assessing the risks of disasters caused by natural hazards in the agricultural sector. However, there are prerequisites for the creation of such a system on the basis of existing systems and technical regulations. There is no uniform, nationally recognised, risk assessment methodology in Belarus. There are no post-disaster needs assessment guidelines in Belarus, nor post-disaster recovery strategies, which would be similar to the guidelines and framework strategies developed by the European Union, the UN Development Group, and the World Bank. However, a number of tasks are being carried out in the country to meet the basic needs of affected citizens, including workers in the agricultural and food sectors. In general, damage and losses as a result of emergencies are currently assessed to one degree or another in crop production, animal husbandry, and forestry. The conditions and algorithm for assessing damage from emergency situations in agriculture are set forth by law. Mandatory insurance of crops, livestock and poultry covers only legal entities, while individuals (farmers and owners of private subsidiary plots) can get insured on a voluntary basis. The main challenges of the disaster risk management system include the lack of a disaster risk assessment system in the agricultural sector, and the absence of corresponding uniform nationally recognised methodologies; a lack of methodologies and guidelines for assessing post-emergency needs, as well as recovery strategies; the inadequacy of existing interventions for DRR in agriculture; the presence of only one insurer for mandatory insurance (Belgosstrakh), which deprives policy holders from a free choice of insurance conditions and rates; an insufficient number of Belgiprozem modules for automated damage calculation.

Recommendations on disaster risk management in the agricultural sector:

- Create a separate disaster risk management system as part of the SUB SES of the Ministry of Agriculture and Food.
- Create a system for assessing disaster risks in agriculture.
- Develop methodologies and guidelines for a comprehensive post-disaster needs assessment in the agricultural sector (with elements such as a cross-cutting and comprehensive disaster assessment) and similar to those developed by the European Union, UN Development Group, and the World Bank (such as the PDNA guidelines).
- Develop a national disaster recovery strategy that includes specific activities for each particular sector (including agriculture) in the affected region, expected results, timing, and estimated costs (similar to the disaster recovery frameworks).
- Adapt the existing resource mobilisation tool to support the country's recovery in accordance with the developed (in the future) methodology for assessing needs and strategy for post-disaster recovery in the agricultural sector.
- Based on the available list of activities to be implemented in case of different emergency regimes, develop a similar list of sector-specific activities for agriculture.
- Promote the development of the insurance market for insurance of agricultural property.
- Raise awareness of farmers and owners of private subsidiary plots about insurance measures as a way to reduce risks from weather emergencies.
- Develop new technological solutions using the land information system (LIS) to analyse the vulnerability of agricultural land to natural hazards.
- Expand the list of agricultural crops subject to insurance with state support.
- Create conditions for engaging other insurance companies (in addition to Belgosstrakh) in the process of agricultural insurance with state support.
- Organize tenders, contests for the provision of insurance services in agriculture with state support.
- Ensure a gradual transition from the practice of mandatory agricultural insurance with state support to voluntary insurance.
- Consider the possibility of using budget funds not only in terms of compensation for a part of insurance premiums, but also for compensation for damage from disasters caused by natural hazards in the agricultural sector.

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Annexes

Annex I. List of interviews

№	Name, position State bodies and institutions	Organization
1	Elena Stanislavovna Kaminskaya , Head of the Department of Analytical Work, Science and Information	Ministry of Natural Resources and Environment of the Republic of Belarus
2	Olga Antipenko , Head of the Scientific Support and International Cooperation Department of the Department for Liquidation of the Consequences of the Disaster at Chernobyl Nuclear Plant	Ministry of Emergency Situations of the Republic of Belarus
3	Pavel Bebko , Head of the Department for Coordination and Control of the Activities of Ministries and Local Authorities MD SES and Civil Defence	
4	Lenskaya Tatyana Ivanovna , Head of the Department of Reforms, Entrepreneurship and Small Businesses	Ministry of Agriculture and Food of the Republic of Belarus
5	Evdaseva Tatyana Petrovna , Deputy Head of the Analytical and Science Service	State Institution Republican Centre for Hydrometeorology, Radioactive Contamination Control and Environmental Monitoring (Belhydromet)
6	Ekaterina Valerievna Istomina , Deputy Head of the Hydrology and Agrometeorology Service	State Institution Republican Centre for Hydrometeorology, Radioactive Contamination Control and Environmental Monitoring (Belhydromet)
7	Mikhalevich Ruslan Vasilievich , Director	Republican Research Unitary Enterprise Belarus Research Centre Ecology
8	Batov Vladimir Mikhailovich , insurance agent, Representative Office in the Frunzensky district of Minsk	Belarusian Republican Unitary Insurance Company Belgosstrakh
Scientific and educational institutions		
9	Khasenevich Irina Mikhailovna , Chief Specialist of the Department of Agrarian Sciences of the National Academy of Sciences of Belarus	National Academy of Sciences of the Republic of Belarus. Department of Agricultural Sciences
10	Vakhonin Nikolay Kirillovich , Doctor of Science, Associate Professor, Head of the Laboratory for Monitoring and Modelling of Natural Systems	Republican Scientific Subsidiary Unitary Enterprise Institute of Land Reclamation
11	Rak Mikhail Vasilievich , Doctor of Agricultural Science, Associate Professor, Deputy Director for Scientific and Innovation Activity	Republican Scientific Subsidiary Unitary Enterprise Institute of Soil Science and Agrochemistry
12	Leonovich Irina Stanislavovna , Doctor of Agricultural Science, Associate Professor, Head of Pomiculture Technology Department	Republican Unitary Enterprise Scientific and Practical Centre of the National Academy of Sciences of Belarus for Potato Farming and Horticulture
13	Karpovich Natalia Viktorovna , Ph.D. in Economics. Head of Food Markets and Foreign Economic Activity Section	Republican Unitary Enterprise Institute of Systems Research in the Agroindustrial Complex of the National Academy of Sciences of Belarus
14	Lensky Alexander Vladimirovich , Ph.D. in Economics, Head of Operational and Economic Evaluation of Machinery Section	Republican Unitary Enterprise Scientific and Practical Centre of the National Academy of Sciences of Belarus for Potato Farming and Horticulture

№	Name, position	Organization
State bodies and institutions		
15	Teterkina Alla Mikhailovna , Ph.D. in Economics, Head of Pricing and Antitrust Regulation Section of Macroeconomic and Financial Policy Department	State Scientific Institution Institute of Economics of the Republic of Belarus
16	Shcherbina Natalya Mikhailovna , Head of the Social and Demographic Policy Section of the Human Development and Demography Department	
17	Rakovich Vyacheslav Alexandrovich , Doctor of Science, Head of Biogeochemistry and Agroecology Laboratory	State Scientific Institution Institute of Environmental Management of the National Academy of Sciences of Belarus
18	Kozlovskaya Irina Petrovna , Doctor of Agricultural Sciences, Professor, Head of Department of Basics of Agronomy	Educational institution Belarusian State Agrarian Technical University
19	Natalya Vladimirovna Kireenko , Head of Innovative Development of Agroindustrial Complex Department of the Institute for Advanced Studies and Retraining of Agro-Industrial Complex Personnel	
20	Voytko Irina Aleksandrovna , Associate Professor, Department of Innovative Development of Agroindustrial Complex, Institute for Advanced Studies and Retraining of Agro-Industrial Complex Personnel	
Non-governmental organizations		
21	Sachek Petr Vladimirovich , PhD in Economics, Associate Professor of the Department of Management of the Belarusian National Technical University; Coordinator of Environmental Initiatives of the United Nations Development Program Office in the Republic of Belarus	Representative Office of the United Nations Development Programme in the Republic of Belarus
22	Kurilovich Alexandra , Project Manager of Capacity Building for Strategic Planning and Management of Regional Structural Transformations in the Republic of Belarus in the Context of a Circular Economy project, executed on behalf of the German Agency for International Cooperation (GIZ) and the German Federal Ministry for Economic Cooperation and Development (BMZ) by the limited liability company <i>Internationales Bildungs-und Begegnungswerk gemeinnützige Gesellschaft mit beschränkter Haftung</i> in the Republic of Belarus	Johannes Rau Minsk International Educational Center
23	Sysoev Sergey Aleksandrovich , investment analyst of the Green Economy project under the Development Project of the BEROC Economic Research Center, funded by SIDA	BEROC Economic Research Center
24	Porechina Natalia Ivanovna , expert	Center for Environmental Solutions (CES)

Annex II.

Agricultural market information provided by various partners

Entity the information is provided to	Type of information provided
Ministry of Antimonopoly Regulation and Trade	Analytical material on the price situation in the consumer market of the country in the form of information on the monthly consumer prices dynamics (MART, 2020). Normative legal acts on price regulation, methodological material, as well as reference information on pricing issues.
Ministry of Agriculture and Food	Price information for agricultural products (purchase prices for crop products; markups for agricultural products, etc.) (Ministry of Agriculture and Food, 2020c). Annual information is provided on purchase prices for a certain type of agricultural product, as well as on price markups for such products; information on the number of hides is provided on a quarterly basis; information on sale prices for flax fiber is published monthly.
National Statistics Committee	Static information for the annual period in the form of annual collections. Operative monthly information on average consumer goods prices, including agricultural products (Belstat, 2020i).
Belarusian Universal Commodity Exchange	Reviews of the exchange and over-the-counter commodity market are monthly information and analytical publications that are issued exclusively in electronic form and are distributed among subscribers on a paid basis (for example, the annual Standard Agro subscription costs BYR 621.96 (about USD 257.83)). ¹² The exchange market review consists of thematic blocks, one of which is Agro Review, which presents trading volumes for the respective market segment by product type, quotes and price results of trading, ratings, indices, structure of transactions by goods, buyers, sellers, etc. The OTC Market Review covers three product areas, including agricultural products (BUCE, 2020).

Source: own development based on data from official sites.

¹²The official exchange rate of the Belarusian rouble to the dollar was BYR 2.4123 as of 1 July 2020, according to the National Bank of the Republic of Belarus.

Annex III.

Internet services (sites) operating, to varying degrees, on the principles of market information systems

Site	Description
Agricultural market Fermer1.by Farmers Notice Board (http://market.fermer1.by)	It was created by the Belarusian Public Association of Farmers and is an information resource and a trading platform for farmers and buyers of farm products. Both buyers and sellers have the opportunity to register on this resource, as well as place a notification on purchase or sale of products. Registration on the site is free. The main purpose of the resource is to strengthen inter-farm contacts, establish a comprehensive exchange of information, provide a trading platform for peasant farmers who need to buy or sell farm products, seeds, machinery, etc. In addition to the product sections, the site also contains the "Community", "Jobs", and "Services" sections. The site provides contact details of the sellers.
Electronic trading platform ArgoPK (https://agropk.by)	Private electronic trading platform of the limited liability company Web Studio Itnit, which positions itself as the largest agricultural trading platform in the CIS. In addition to the catalogue of goods, the resource contains the sections "Tender Procurements", "Organizations", "Jobs" and "Agreements". The site user can register and test the site services free of charge for 30 days, after which the use of the site becomes paid. So, for 12 months, the cost of use, depending on the tariff, is as follows – from "Start" (BYR 100.8, or USD 42.98), to "Ultra" (BYR 792, or USD 337.68). An important feature of the site is that only legal entities can register on it.
Multifunctional web platform for agriculture and industry AGRONEWS (https://agronews.com/by/ru)	The platform was created by the limited liability company European Agricultural Agency, according to which it serves the mission of bringing together producers and consumers, buyers and sellers, employers and specialists. The advantages of the platform include the possibility to sort the catalogue of goods by region and heading; availability of advertising service; creation of a personal website and selling pages, their integration into an international catalogue; online communication with clients; industry news. There are four main sections in the catalogue: "Companies", "Goods and Services", "Demand and Procurement", "Associations". A supplier can place information about its products on the platform. Registration on the site is free; however, there are also paid information services on the portal, mainly related to advertising.
Electronic trading platform of the information Republican Unitary Enterprise National Centre for Marketing and Price Study (http://goszakupki.by)	It is intended to facilitate the organization and conduct of public procurement procedures using an electronic auction and request for quotations, as well as electronic auction to make purchases from own funds. It provides information about customers, potential suppliers of goods (works, services). As of 15 June 2020, the cost of placing an offer for participation in an electronic auction, a request for quotation procedure, an open tender (for one placement) is BYR 23 (USD 9.67); ensuring the holding of an electronic auction by the organizer (for one electronic auction) is BYR 30 (USD 12.62). The site also provides consulting services for representatives of business entities on the organization and conduct of procurement procedures, as well as participation in them. Registration is free.

Site	Description
Internet centre of electronic commerce IceTrade http://www.icetrade.by	<p>It is an internet version of the “Tenders” information system, an information resource, which adheres to the principle of information openness and transparency and provides information about the needs and purchases of enterprises and organizations of the Republic of Belarus. The resource contains the following information: procurement procedures for goods (works, services) carried out by Belarusian customers, documentation for them for the preparation and submission of proposals by participants, as well as information on the results of the carried out procedures; overseas purchases, including UN tenders; the number and total cost of contracts for the purchase of goods (works, services) at the expense of the organizations' own funds; register of disreputable suppliers; register of persons accredited on the official website, etc. Registration on the site is free of charge. As of 15 June 2020, the cost of providing electronic access to subscribers to the information on procurement and bidding (including consulting on participation, preparation of analytical data) held in EAEU member states (within a year) is BYR 192.96 (USD 81.14), in CIS countries (within a year) BYR 256.32 (USD 107.78), European Union countries (up to five countries, within a year) BYR 340.56 (USD 143.21). In addition to this service, the resource provides many other services, such as e-mailing information about purchases and tenders to the subscribers, targeted search and provision of information on procurements of Belarus, monitoring of legislation on the procurement of goods (works, services), etc.</p>
Electronic trading platform of the open joint stock company Belarusian Universal Commodity Exchange http://zakupki.butb.by	<p>Designed to facilitate the organization and conduct of electronic auctions, open tenders, limited tenders, two-stage tenders and request for quotes procedures. It provides information about customers, potential suppliers of goods (works, services). The cost of the service for organizing and conducting the procurement procedure in electronic format on this site is BYR 20 (USD 9.75) as of 1 November 2019. An accreditation procedure is required for registration on the site. It implies obtaining electronic digital signatures, special certificates at the centres, as well as filling out a special form.</p>

Source: developed based on the sources presented in the table.

Annex IV.

Programmes and projects related to disaster risk reduction, early warning systems and agrometeorology services

Name of the programme or project	Financing party	Implementing party	Implementing period	Allocated Budget	Main components and project objective
Forestry Development Project	International Bank for Reconstruction and Development	Ministry of Forestry	2015–2021	USD 40.71 million	The goal is to improve forestry activities, reforestation, afforestation, increase the use of felling, increase the contribution of public goods received from forests in targeted forest areas. The project has three components, the first of which is improving forestry and sustainable forest management. The second component includes improvement of activities for the prevention, monitoring, detection and elimination of forest fires. The third component includes capacity development for sustainable forestry. (https://projects.worldbank.org/en/projects-operations/project-detail/P147760)
Forestry Development Project + additional funding	State of the Republic of Belarus (loan from the World Bank in 2018)	Ministry of Forestry; Bellesexport	2015–2021	USD 14.04 million	The purpose of the additional funding is to finance costs of the scaling-up of certain activities (for example, investments in nurseries and forestry equipment and entrepreneurs) started under the parent project (Forestry Development Project 2015–2020). Additional financing does not envision the implementation of additional activities. (http://documents.vsemirnyjbank.org/curated/ru/720741468207551372/Belarus-Forestry-Development-Project)
Strengthening the Ministry of Emergency Situations of the Republic of Belarus	European Union (under the European Neighbourhood Instrument programme)	Ministry of Emergency Situations	2019–2021	EUR 1.20 million	The twinning project will help to strengthen the capacity of the Ministry of Emergency Situations on effective elimination of existing and emerging disaster risks in the Belarus. The project is aimed at improving the activities of the Ministry of Emergency Situations on civil protection and emergency risk management by using the best practices of the European Union Civil Protection Mechanism. (https://euprojects.by/ru/projects/peace-and-security/strengthening-the-ministry-for-emergency-situations-of-the-republic-of-belarus/)

Name of the programme or project	Financing party	Implementing party	Implementing period	Allocated Budget	Main components and project objective
Project, Support to Economic Development at the Local Level in the Republic of Belarus (2019–2022);	European Union	UNDP, Ministry of Economy	2019–2022	USD 9.50 million	The project aims to support economic initiatives, competitiveness and innovations for inclusive development at the local level in the Republic of Belarus. At the local level, the project is being implemented in 12 pilot regions of the country. Agriculture itself, disaster risks and climate change issues are not mentioned in this project. (https://www.by.undp.org/content/belarus/ru/home/operations/projects/poverty_reduction/spring.html)
Sustainable Management of Forest and Wetland Ecosystems for Multi-Purpose Benefits (Wetlands) project (2019–2022)	Global Environment Facility (GEF), UNDP	UNDP, Ministry of Natural Resources	2017–2022	USD 4.30 million	The aim of the project is to introduce environmental and financially sustainable approaches to forest and wetland management in order to preserve biodiversity and improve land use. The objectives of the project include assistance in the development of the draft law On the protection and use of peatlands, which is one-and-only in Europe; rehabilitation of more than 12 000 hectares of degraded and ineffectively drained peatlands to prevent their further degradation; restoration of disturbed habitats of globally threatened species (aquatic warbler, great spotted eagle, great snipe, great spindle). (https://www.by.undp.org/content/belarus/ru/home/operations/projects/environment_and_energy/Wetlands.html)
EU4Youth – School Garden for Agricultural Entrepreneurship	European Union	Belarusian Green Cross, Fondazione Giovanni Paolo II ONLUS per il Dialogo, Cooperazione e Sviluppo (Italy), Ukrainian Green Cross, National Environmental Center (Moldova)	2018–2022	EUR 1.58 million	The project aims to stimulate employment and active participation in public life and the economy of young people living in disadvantaged rural areas (including the area around Chernobyl) by developing modern work skills, helping them become leaders and entrepreneurs and by creating new professional opportunities (participating countries Belarus, Moldova, Ukraine). The objectives of the project are as follows: to promote the integration of young people in disadvantaged rural communities into the economy and society; to promote modern agricultural skills in disadvantaged rural communities to counter outdated agricultural technologies and labour organization, low wages, etc.; to integrate local communities and educational institutions with regional and national vocational guidance institutions, the broader economic market and civil society, as well as with each other. (https://www.euneighbors.eu/ru/east/stay-informed/projects/eu4youth-shkolnyy-sad-dlya-selskokhozyaystvennogo-predprinimatelstva)

Name of the programme or project	Financing party	Implementing party	Implementing period	Allocated Budget	Main components and project objective
EU4Climate	European Union	UNDP	2018–2022	EUR 8.8 million (1.1 million specifically for Belarus)	<p>The programme supports the development and implementation of climate policies by EaP countries that promote low emissions and climate resilient development and their commitments under the 2015 Paris Agreement on Climate Change. The overall goal is to promote climate change mitigation and adaptation, and the development of a low-emission, climate-resilient economy. The programme also focuses on mainstreaming climate in other policy sectors, such as energy, transport, agriculture. (https://www.euneighbors.eu/ru/east/stay-informed/projects/eu4climate)</p>
Clima-East Project: Conservation and sustainable management of peatlands in the Republic of Belarus to reduce carbon emissions and adapt wetland ecosystems to climate change (2013–2017); (Clima-East)	UNDP	Ministry of Natural Resources	2013–2017	EUR 1.5 million	<p>The goal of the project is to demonstrate innovative approaches to ecosystem-based climate mitigation and adaptation in peatlands; prevent the colonisation of open bogs with shrubs and reed to provide conditions for the ecosystem conservation and reduce fire hazards; organize sustainable use of produced vegetal biomass from the Zvaniec and Sporava reserves in energy and construction sectors. Within the project, low-lying bogs are regularly cleaned from excess vegetation, special equipment has been purchased for this purpose, plans have been developed for the regular bog mowing; and the received biomass is used as a fuel in local boiler plants. The local population is trained in groundwater level regulation techniques, which are an effective measure to reduce greenhouse emissions. The project has successfully carried out controlled burning of dry vegetation on an area of more than 4 918 hectares in order to prevent accidental fires in peat bogs. (https://euprojects.by/ru/projects/Green-Economy-Environment-and-Sustainable-development/Clima-East%3A%20Conservation%20and%20sustainable%20management%20of%20peatlands%20in%20Belarus%20to%20minimize%20carbon%20emissions%20and%20help%20ecosystems%20to%20adapt%20to%20climate%20change/)</p>

Name of the programme or project	Financing party	Implementing party	Implementing period	Allocated Budget	Main components and project objective
Project, Development of integrated approaches to wetland management, with due regards of multipurpose landscape planning principle with the aim of obtaining multilateral environmental benefits (Peatlands 2) (2012–2017);	GEF	Ministry of Natural Resources	2012–2017	USD 3.38 million	The project aims to preserve biodiversity, reduce greenhouse gas emissions and promote soil conservation. The project supports Belarus in increasing the area of protected areas and their representation in the national system of Specially Protected Natural Areas (PAs); contributes to the restoration of the hydrological regime of peatlands, which were previously used in forestry and agriculture. The objectives are to develop integrated approaches to wetland management in view of the principle of multipurpose landscape planning, and their further testing in pilot areas in order to obtain multilateral environmental benefits. The project contributed to the development of the National Strategy and Scheme for the Rational Use of Peat Deposits and the Protection of Peat Bogs for the period up to 2030. (http://www.minpriroda.gov.by/uploads/files/Proekt-4.doc)
Implementation of the principles and methods of the Shared Environmental Information System in the Eastern Partnership countries (ENI SEIS II East)	Eastern Partnership countries, European Union	European Environment Agency, Ministry of Natural Resources, Belstat	2016–2020	EUR 6.95 million (6.6 million from the European Union)	The project aims to support regular environmental reporting by improving the efficiency of environmental management. The implementation of the principles and methods of the Shared Environmental Information System (SEIS) improves the quality of environmental information and promotes effective knowledge-based policy development. Participating countries: Armenia, Azerbaijan, Belarus, Georgia, Moldova, Ukraine. (https://www.euneighbors.eu/ru/east/eu-in-action/projects/vnedrenie-principov-i-metodov-sovmestnoi-sistemy-ekologiceskoi)
Project, Involvement of the public in environmental monitoring and improvement of environmental management at the local level (Ecomonitoring) (2018–2022);	European Union	UNDP, Ministry of Natural Resources	2018–2022	EUR 3.5 million	The project is aimed at effective and inclusive (with broad participation of civil society) environmental management at the local level, monitoring of environmental risks, exchange of environmental information, in particular, on air quality. The priorities of the project are the development of environmental monitoring, increased involvement of civil society in environmental decision-making process, and the development of “green schools”. An environmental monitoring platform is planned to be launched within this project with the help of Belhydromet experts. Schoolchildren, under the supervision of teachers, will be able to enter atmospheric air monitoring data there. (http://aarhusbel.com/ekomonitoring/)

Name of the programme or project	Financing party	Implementing party	Implementing period	Allocated Budget	Main components and project objective
Programme on Prevention, Preparedness and Response to Natural and Man-made Disasters in the Eastern Partnership Countries	European Union	PPRD East 2 Implementation Consortium – MWH, Danish Emergency Management Agency, Finnish Crisis Center, CIMA Research Foundation and Austrian Red Cross	2014–2019	EUR 5.5 million	The programme is aimed at strengthening civil protection capacities in six countries of the Eastern Partnership (Azerbaijan, Armenia, Belarus, Georgia, Moldova, Ukraine), improving the efficiency of risk management at the national level, strengthening the protection of the population from possible negative consequences of natural and man-made disasters. An important part of the programme is to strengthen regional cooperation in the participating states and interaction with the European Union Civil Protection Mechanism. The programme provides targeted assistance to countries to improve legislative, administrative and operational capacities in civil protection and disaster risk management. A roadmap was developed with a list of specific measures in such areas as: disaster risk assessment and management; collection and processing of disaster loss data; inclusion in the state budget of expenditures to reduce such risks; volunteer work to inform the population about disasters. An Electronic Regional Risk Atlas (ERRA) has been created to monitor hazards and assess information on disaster risk in specific countries, as well as at the regional level. (https://www.euneighbors.eu/ru/east/stay-informed/projects/pprd-east-2-programma-po-preduprezhdeniyu-gotovnosti-i-reagirovaniyu-na/)
Clima-East Project: Supporting Actions Aimed at Climate Change Mitigation and Adaptation to the Consequences of Climate Change in the Eastern Partnership Countries and Russia	European Union	Ministry of Natural Resources	2012–2016	EUR 8.2 million	The project aims to facilitate the reduction of greenhouse gas emissions and development of state-of-the-art approaches to the climate-change policy in the partner countries; promote dialogue between the European Union and the project participants; reinforce regional cooperation; provide access to the European Union climate change legislation. The Belarusian party was supported in the development of a concept of adapting agriculture to climate change. The Intended Nationally Determined Contribution (INDC) in greenhouse gas reduction was defined in accordance with the Climate Change Agreement adopted by the United Nations Climate Change Conference (Paris, 2015). The initiative aims to limit global warming to less than 2 °C and pursue efforts towards the 1.5 °C limitation. (https://euprojects.by/ru/projects/Green-Economy-Environment-and-Sustainable-development/Clima%20East%20Project%3A%20Support%20to%20Climate%20Change%20Mitigation%20and%20Adaptation%20in%20Russia%20and%20Eastern%20Partnership%20Countries/)

Name of the programme or project	Financing party	Implementing party	Implementing period	Allocated Budget	Main components and project objective
The project Supporting the Transition to a Green Economy in the Republic of Belarus	European Union	Ministry of Natural Resources, UNDP	2014–2017	EUR 5 million	The project supports the idea of the economic growth of Belarus based on “green” principles, and it facilitates the development of local environmental initiatives. Under the project, a number of pilot initiatives in the field of green economy have been supported; new ways of interaction between the authorities, NGOs and business have been found. One of the principles of “green economy” for the country is the expansion of the organic agriculture sector, introduction of certificates for organic products in the country, and increase in imports of organic products. (https://euprojects.by/ru/projects/Green-Economy-Environment-and-Sustainable-development/Supporting%20the%20Transition%20to%20a%20Green%20Economy%20in%20the%20Republic%20of%20Belarus/)
Technical Assistance Project to Support the Development of Green Economy in Belarus	European Union	A consortium led by Hulla & Co. Human Dynamics KG (Austria), Ministry of Natural Resources	2014–2017	EUR 1.47 million	The project aims to develop key mechanisms of the green economy development in Belarus, improve skills of professionals of central public authorities in the area of green economy; develop a programme of actions for the reduction of pollutant emissions in accordance with the Gothenburg Protocol. (https://euprojects.by/ru/projects/Green-Economy-Environment-and-Sustainable-development/Technical%20Assistance%20to%20Support%20the%20Development%20of%20Green%20Economy%20in%20Belarus/)
European Union Water Initiative Plus for the Eastern Partnership	Eastern Partnership countries, European Union	OECD, UNECE, European Union Consortium composed of Austrian Environment Agency, International Water Office	2016–2020	EUR 24.6 million	The aim of the project is to enhance water resources management in Eastern Partnership countries, especially with regard of transboundary rivers; aligning of water policy and strategies of the EaP countries with the European Union Water Framework Directive, multilateral environmental agreements and the principles of integrated water resources management. (https://euprojects.by/ru/projects/Green-Economy-Environment-and-Sustainable-development/european-water-initiative-plus-for-the-easter-partnership-euwi-4-eap-/)

Name of the programme or project	Financing party	Implementing party	Implementing period	Allocated Budget	Main components and project objective
Cross-border Water Inspectors: Towards Joint Monitoring and Development of Water Resources of the Pripyat River Basin	Belarus and Ukraine, European Union	Interakcia Foundation, Pinsk regional executive committee, Ukrainian partners	2018–2019	EUR 0.28 million (0.25 million from the European Union)	The project aims to develop a cross-border system for monitoring small rivers of the Pripyat basin; promptly identify and address problems. This project is focused on the Pinsk region of Belarus and the Lyubeshiv region of Ukraine. (https://euprojects.by/ru/projects/Green-Economy-Environment-and-Sustainable-development/cross-border-water-inspectors-towards-joint-monitoring-and-development-of-water-resources-of-the-pri/)
Together for Community and Nature: Miory region	Belarus and Ukraine, European Union	Miory regional executive committee	2019–2022	EUR 1.09 million (0.98 million from the European Union)	The project is aimed at developing the Sustainable Development Strategy of Miory district, focused on developing the initiative and responsibility of the local community, supporting biological and cultural diversity, developing social infrastructure and the green economy. (https://euprojects.by/ru/projects/Green-Economy-Environment-and-Sustainable-development/together-for-community-and-nature-miory-district/)
Belarus Emergency COVID-19 Response Project	International Bank for Reconstruction and Development	Ministry of Health Care	2020	USD 100 million	The goal of the project is to respond to the threat posed by COVID-19 in Belarus through prevention, detection and regulation, as well as through strengthening the national public health preparedness system. (https://projects.worldbank.org/en/projects-operations/project-detail/P173828)
Belarus COVID-19 Social Safety Nets Response	International Bank for Reconstruction and Development	Ministry of Labour and Social Protection	2021	USD 85 million	The project development objective is to mitigate the economic impact of the COVID-19 crisis on poor and vulnerable families and strengthen the state targeted social assistance programme (GMI) in Belarus. (https://projects.worldbank.org/en/projects-operations/project-detail/P174400)
COVID-19: Civil Society Resilience and Sustainability	European Union	IREX Europe, Human Rights House Foundation	2020–2024	EUR 4.22 million (4 million from the European Union)	The project aims to foster the resilience and sustainability of civil society in order to mitigate the immediate and longer-term impact of COVID-19. It aims at providing access to protection and assistance, especially to the most vulnerable groups, as well as accurate information about the pandemic. (https://www.euneighbors.eu/ru/vostok/stay-informed/projects/covid19-zhiznesposobnost-i-ustoychivost-grazhdanskogo-obschestva)
Civic engagement in environmental monitoring and improving environmental management at the local level	European Union	Ministry of Natural Resources	2017–2022	EUR 14.5 million	The project is aimed at efficient and inclusive environmental management at the local level, monitoring of environmental risks, environmental information exchange. The project prioritizes development of environmental monitoring, building the capacity of the civil society in environmental decision-making, development of “green schools”. (https://www.by.undp.org/content/belarus/en/home/projects/ecomonitoring.html)

Name of the programme or project	Financing party	Implementing party	Implementing period	Allocated Budget	Main components and project objective
Shared initiatives for increasing security of the cross-border area in the event of ecological and chemical disasters (EcoChem)	European Union	Grodno Regional Department of the Ministry of Emergency Situations	2019–2021	EUR 2.07 million	The aim of the project is to modernize the equipment of fire brigades in the border regions of Belarus and Poland, as well as to conduct joint exercises to combat large-scale fires and chemical pollution of border rivers. (https://www.pbu2020.eu/en/projects2020/182)
Clean River is Major Priority (Mukhavets)	European Union	Municipal Unitary Multiple Productive Enterprise of Communal-Housing Economy "Zhabinkovskoe ZhKCh"	2018–2021	EUR 2.62 million	The aim of the project is to modernize water treatment facilities in Poland and Belarus located in the Mukhavets river basin to prevent environmental disasters and improve the environmental situation in the river basin. (https://www.pbu2020.eu/en/projects2020/153)
ClimaAdapt: Capacity Improvement in Emergency Preparedness and Response through Climate Adaptation Actions	European Union	Republican Special Response Team of Ministry for Emergency Situations of the Republic of Belarus	2020–2021	EUR 1.09 million	The aim of the project is to improve the preparedness of rescue services and local authorities to respond to natural emergencies in the border areas of Latvia and Belarus, as well as to develop cross-border cooperation in adaptation to climate change by creating and using new tools for adapting to climate change and increasing preparedness for response to natural emergencies; increasing the technical capabilities of rescue services, local authorities and other partners in the management of natural emergencies and their consequences; raising public awareness of the consequences of global climate change and the rules of behaviour in case of extreme weather conditions. (https://www.eni-cbc.eu/1lb/ru/proekty/klimaadapt-povyshenie-gotovnosti-i-narascivanie-potenciala-v-reagirovanii-natczrezvytchainye-situacii-posredstvom-provedenija-meroprijatii-po-adaptacii-k-klimaticheskim-izmenenijam/4582)
EU4Environment	European Union	Not specified	2019–2022	EUR 20 million (19.5 million from the European Union)	The aim of this initiative is to help Eastern Partnership countries conserve their natural capital and improve the environmental well-being of people by supporting environmental action, demonstrating and identifying opportunities for greener growth, and establishing mechanisms to manage better environmental risks and impacts. (https://www.euneighbors.eu/ru/east/stay-informed/projects/eu4environment)

Source: own study based on the reviewed information.

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