Food and Agriculture Organization of the United Nations

Republic of Moldova drought response

Project - TCP/MOL/3802

Crop Assessment Report

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Acknowledgements

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The drought mission team also is grateful to the many farmers and other individuals who have shared their knowledge and experience during interviews.

Acronyms and Abbreviations

ACSA	National Agency for Rural Development
AEZ	agroecological zones
AI	agricultural insurance
AMP	Assistance Management Platform
ASI	Agriculture Stress Index
ASIS	Agricultural Stress Index System
CCAS	climate change adaptation strategy
CIAT	International Center for Tropical Agriculture
CRSI	Climate Risk Shift Index
CSA	climate-smart agriculture
CSOs	civil society organizations
CVA	crop visual assessment methodology
DAI	Drought and Aridity Index
DALA	FAO damage and losses methodology
DAR	Drought Assessment Report
DCRMP	Disaster and Climate Risk Management Project
DCRRP	Disaster and Climate Risk Reduction Project
DDSA	desertification and drought-sensitive areas
DLDD	desertification, land degradation and drought
DRAs	drought risk areas
DRM	disaster risk management
DRR	disaster risk reduction
DRSI	Drought Risk Shift Index
DSAs	drought-sensitive areas
DSTs	decision support tools
ES	environmental strategy
EU	European Union
EWS	early warning system
FAO	Food and Agriculture Organization of the United Nation
FAO AR	FAO Assistant Representative in the Republic of Moldova
FAO REU	FAO Regional Office for Europe and Central Asia
FFS	Farmer Field School
FVC	fraction of vegetation cover
GDP	gross domestic product
GIEWS	Global Information and Early Warning System
GWP	Global Water Partnership
ha	hectare [unit of land]
HTC	Hydrothermal Coefficient
ICAS	international crop assessment specialist
IDMP CEE	Integrated Drought Management Program for Central and Eastern Europe
IPPC	Intergovernmental Panel on Climate Change
LDN	land degradation neutrality
LGP	length of growing period
LPA	local public administration
LTA	long-term average
MARDE	Ministry of Agriculture, Rural Development and Environment of the Republic of Moldova

NBS	National Bureau of Statistics of the Republic of Moldova
NDP	national development plan
NDVI	Normalized Difference Vegetation Index
NGO	non-governmental organization
PRA	participatory rural appraisal methods
SCPESD	State Civil Protection and Exceptional Situations Department
SDG	Sustainable Development Goals
SHMS	State Hydro-Metrological Service
UNCCD	United Nation Convention to Combat Desertification
USD	United States dollar

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Sources: eadaily.com, ru.sputnik.md, btv.md

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Executive Summary

- The 2020 drought in the Republic of Moldova reduced the cereal harvest and conditioned crop failures, particularly spring maize and winter wheat, throughout the country. This drought was among the most severe in living memory of the Republic of Moldova, behind the 2007 drought.

- Abnormally warm weather (about 23 °C was observed in March), the spring frost (a low of -10 °C was registered in April) and the lack of precipitation, with low moisture reserves in the soil (noted during March and April), created unfavourable conditions for the growth and development of winter crops and perennials and for the sowing and growth and development of spring crops.

- Winter wheat and barley were at stage of grain development stage in spring when rainfall fell too low to support crop development. Important summer crops, such as maize and sunflowers, and vegetables also suffered from lack of precipitation and air temperature anomalies during the spring/summer vegetation period.

- The decline of wheat production was about 52 percent, 530 270 tonnes lower than the previous four-year average (the average from 2016 to 2019 was 1 038 050 tonnes). Barley declined by 35 percent, 59 440 tonnes lower than average (169 430 tonnes in 2016–2019), and maize production declined by 73 percent, 552 860 tonnes lower than the 2016–2019 average (758 880 tonnes).

- Reduced yields in winter crops (mostly wheat and barley) and summer crops (sunflowers, maize, etc.) affected overall production and drastically reduced returns on leased land and on labour for the majority of smallholders, who usually receive in-kind payments of wheat, corn and oil. Household production from home gardens, a mainstay of food supply for most rural families, also was down sharply.

- Livestock is a key component of household food security, by providing nutrition and income to the majority of rural households. About 90 percent of livestock are kept by smallholders, and a lack of fodder has forced the majority of households to sell a substantial share of their livestock – pigs and sheep, notably, but also cattle.

- With greater damage to summer crops, and in spite of the reduction of the national livestock herd, maize imports are likely to be much higher in 2021.

- Urgent measures to be taken include the provision of agricultural inputs for spring maize planting, in order to prevent any further de-stocking and to generate income to ensure food security for rural smallholders. Meanwhile, it is important that emergency assistance be linked with technical assistance for the government and methodological support for beneficiaries to upgrade food security monitoring and early warning tools/systems.

- Medium-term measures should focus on mainstreaming disaster risk reduction to support the establishment of community-based agriculture disaster risk preparedness and awareness systems and to improve the technical capacities of farmers by promoting climate-smart agriculture technologies and knowledge transfer through Farmer Field School demo plots. Informed advisories, alerts and robust early warning systems are essential for farmers and rural dwellers to prepare for and adapt to climate extremes.

1. Overview

Based on the request formulated by the Government of the Republic of Moldova, in close collaboration with the Ministry of Agriculture, Regional Development and Environment (MARDE); under the overall supervision of the Assistant FAO Representative in the Republic of Moldova; and in cooperation with service provider National Agency for Rural Development (ACSA), FAO launched a crop assessment mission on 7 August 2020. The main aims of the assessment were to:

1. review the current status of agriculture drought;
2. identify the actual impacts of the drought on the standing crops;
3. assess drought damage and losses of crop production;
4. envisage and recommend drought risk reduction coping mechanisms in the agricultural crop sector, with a view towards reducing future vulnerabilities; and
5. propose short- and medium-term measures to alleviate the impacts of the drought on crop and pasture production.

The FAO Regional Office for Europe and Central Asia (FAO-REU) assigned the drought mission team, which comprises one international crop assessment specialist and a service provider, to assess the impact of the drought on the agricultural crop production sector and to technically support the Ministry of Agriculture, Regional Development and Environment (MARDE) through training and guidance. In addition, the drought mission team was tasked with offering advice on immediate and medium-term rehabilitation measures to mitigate the impact of drought. MARDE officials accompanied the team, and a representative from the local public administration participated as an observer.

The assessment mission held extensive discussions with various relevant government institutions – in particular, the staff of MARDE, the National Bureau of Statistics (NBS), the Ministry of Economy and Trade, and the Department of Agro-meteorology. In addition, the team held extensive fieldwork and consultations with local public administrations and representatives of farmers' groups and NGOs, among others. The locally recruited service provider – the National Agency for Rural Development – was highly successful in assisting the team in its findings and recommendations.

Taking into consideration the COVID-19 pandemic, travel restrictions did not allow the international crop assessment specialist to undertake field visits, so all groundwork was completed by ACSA in the place. The crop assessment specialist supported MARDE and the service provider with training on the assessment methodology, the collection and processing of data, quantification of the damages, and identification of optimal mitigation or coping mechanisms in the short term.

Interactive online trainings on FAO crop visual assessment and damage and loss methodologies were provided to MARDE and the ACSA, complete with data collection instructions and a table prepared for data input. The ACSA team, in cooperation with MARDE staff, covered as many rayons (districts) as possible in the limited time available. The drought mission team visited at least three rayons in each of the three regions of the country (north, south and centre). In each rayon, two communities were visited to observe three field plots for crop visual assessment. ACSA staff conduct crop visual assessments and forecasts for all standing crops, and they collected district-level baseline data on field crop damage caused by drought. Their data inputs for crop forecasting and estimation were reviewed in each of the rayons visited. Though methodologically questionable, the overall forecasting was found to be sound and in line with crop estimates made by MARDE and the drought mission team spot-checks, using participatory rural appraisal methods.

The international crop assessment mission specialist communicated closely with MARDE, the FAO Assistant Representative, the ACSA team and other interested stakeholders from the agricultural sector, both through the Zoom online meeting platform and through phone conversations.

This document reports the findings of the rapid field assessment on agriculture crop damage caused by the 2020 drought in the Republic of Moldova.

2. Methodology

The methodology of the assessment was based on FAO standard crop assessment practices of standing crops by using crop visual assessment and damage and loss methodologies. It included the collection of data from national and local sources (in the form of official statistics) and the collection of statements from the local population. The obtained data were cross-referenced through visual assessments and field measurements.

Preliminary information on field crop affection was provided by MARDE, which collects from operatives information received at the district level. Additional information was collected from available sources at the National Statistic Agency and the National Agency of Hydrometeorology. Specific information on crop performance, production, protection, agriculture inputs and more was collected from the Ministry and relevant NGOs, institutions and agencies involved in this sector.

The bulk of the work by ACSA took place in the field through the observation of standing crops and visual assessments, complemented by interviews with district- and community-level officials and farmers.

Village fields were selected so as to represent the variety of situations present in the districts where the drought level was highest. For the selection of districts and villages, the drought mission team used the data on productivity affection rate provided by MARDE in addition to hydrothermal coefficient received from the State Hydrometeorological Service.

Taking into account that the above-mentioned information from MARDE usually contained large numbers of villages affected by the disaster, the assessment team considered a minimum of three districts and two villages to visit from each of the most-affected districts and two field plots to observe in each community.

2.1. Information collection

Preliminary drought information was collected from communities and rayons, with additional information sourced from the National Bureau of Statistics of the Republic of Moldova and the State Hydrometeorological Service.

Specific data and information on crop performance, production, protection, agriculture imputes, etc. was obtained at the district level through the assessment team established by the ACSA, in cooperation with MARDE staff and local public administration specialists during the field visits.

The collection of data was preceded by separate trainings for representatives of MARDE, the ACSA assessment team, and agricultural department specialists from all rayons in which field observation was conducted.

The mission team held extensive discussions with relevant staff of MARDE, at both central and rayon levels, to assess the efficacy and appropriateness of the methodology used for crop estimation. It was found that a great amount of data from the rayon level was collected without necessarily following a common methodology throughout the country. The sample size, though large, did not represent all farms, completely ignoring small farmers (the majority of data received was for acreage above 10 ha). It needs to be underlined that MARDE cannot collect data from all rayons, and the average figures for the rayons are fragmented for each crop. Another hitch was that the operative data provided by MARDE does not fully correspond with the data sourced from the National Bureau of Statistics. However, the mission team used all available data, aggregating them to produce more accurate figures for analysis.

2.2. Field surveys

Extensive field surveys were undertaken during the assessment. The rayons to be surveyed were selected on the basis of their ranking on the hydrothermal coefficient. The field surveys were conducted in 18 randomly selected communities in the south, centre and north of the country, as presented in Table 1.

Table 1: Selected communities for field surveys

Region	Rayon	Communities	
North	*Floreşti*	Japca	Gura Camencii
	Drochia	Chetrosu	Sofia
	Sângerei	Prepelita	Bilicenii Vechi
Centre	*Rezina*	Ciniseuti	Echimauti
	Străşeni	Străşeni	Greblesti
	Nisporeni	Nisporeni	Valea-Trestieni
South	*Vulcăneşti*	Etulia	Cismichioi
	Basarabeasca	Abaclia	Bascalia
	Ceadâr-Lunga	Chiriet-Lunga	Gaidar

The field surveys included semi-structured interviews with local authorities at village and rayon levels and with randomly selected residents and agricultural producers (leaders and small farmers) using participatory appraisal techniques.

In randomly selected plots, field measurements for maize and sunflowers were conducted using multi-stage random sampling techniques.

Observation records included entries on the number of plots and the number of affected and unaffected plants/tillers.

Visual observations were used for the assessment of the status and productivity of pastures, as well as for comparing the habitus, vegetation stage of the cultivated plants, and agriculture practices used, thus providing insight into the extent of preventable and unavoidable drought damages.

The field survey data were aggregated and verified by comparing them with official statistics and data from the rayons and from the MARDE agriculture department prior to being analysed. About 72 plots for two staying crops of maize and sunflowers (36 plots of each staying crop) in 18 communities of the three rayons most affected by drought were observed for crop performance visual assessment.

2.3. Data collection

To properly estimate damage and loss in the crop subsector, we use damage and loss assessment (DALA) methodology. It is important to first develop the baseline information (historical data) for each of the crops with respect to crop area, average crop yield, crop production and farm gate price for crop produce. In the absence of appropriate baseline information, it may not be possible to accurately estimate damage.

It also is important to obtain pre-disaster and post-disaster forecasts for crop area, crop yield and crop production. The accuracy of statistical information is essential for estimating production losses, and it is important to validate the information received.

The data obtained and information collected from reports, literature reviews and syntheses of secondary data are supplemented through surveys, field visits, satellite maps and interviews with farmers and cross-referenced.

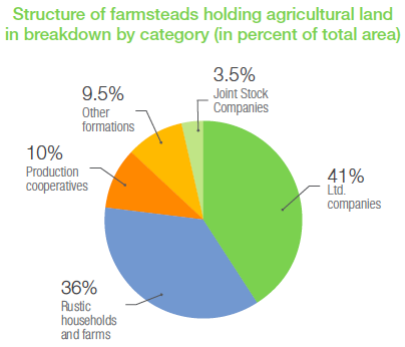
3. Performance of the Agriculture sector

The Republic of Moldova has a population of 3.5 million (2019), with almost 57 percent living in rural areas. Agricultural land constitutes approximately 74 percent of the country's total land area, of which 54 percent is arable for the production of such annual crops as maize, wheat, sunflowers, barley, oilseeds, soybeans and sugar beets. Most farmers (97.7 percent) operate on a small scale, with farm sizes ranging between 0.85 ha and 10 ha.

Agriculture remains the largest real sector of the economy, accounting for more than 17.7 percent of the gross domestic product and employing more than 32.3 percent of the labour force, according to 2017 estimates. By comparison, the services sector employs 55.7 percent of the labour force, with the industry sector employing 12 percent.[1] Agriculture plays an important role in the economy of the Republic of Moldova, particularly in terms of employment and exports, with the potential for reducing poverty.

Agricultural production and processing generate approximately 40 percent of the export revenues of the Republic of Moldova – second only to remittances – while at the same time employing more than 30 percent of the active rural population. Approximately 36 percent of the total land area is owned by 390 380 individual farmers, with 41 percent owned by private companies. About 59.6 percent of rural households are medium-sized households (with 3 to 5 persons) with at least one elder (older than 60) and one underage person (younger than 17).[2]

Figure 1. Structure of farmsteads holding agriculture land



Source 1: MARDE

Agricultural lands cover 2 496 000 ha in total – 74 percent of the country's entire territory – out of which 1 832 000 ha are arable land, 290 100 ha are perennial plantations (132 500 ha of orchards and 135 800 ha

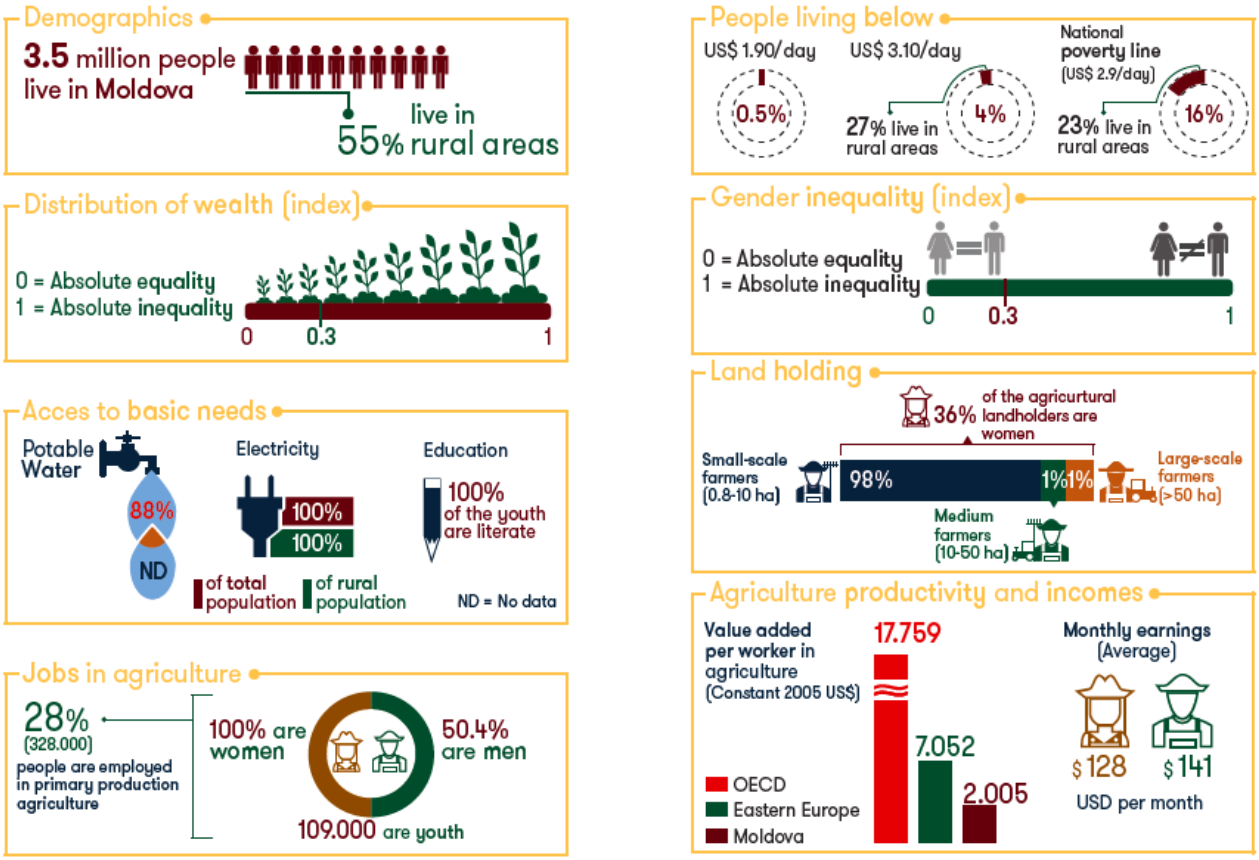
[1] **Index Mundi.** 2021. Moldova Economy Profile. In: *Index Mundi* [online]. http://www.indexmundi.com/moldova/economy_profile.html

[2] **Invest in Moldova.** 2012. Agriculture Report. (also available at: http://eba.md/uploaded/publications/Agiculture%20Report.pdf).

of vineyards), and 340 200 ha are pastures.[3] Black soils amount to around 75 percent of the overall territory of the country.

Highly fertile soils and annual precipitation averages provide generally favourable climatic conditions for cropping and provide significant opportunities for development of agriculture into an engine of economic growth.

Figure 2. Population, agriculture and livelihoods in the Republic of Moldova



Source 2: Adapted from WB and CIAT 2016

However, the frequency and severity of climate-related hazards such as hail, frost, floods and droughts have significantly increased in the past decade, impacting agricultural development.

The agricultural sector also suffers from policy uncertainty, lack of access to adequate farm inputs and extension services, and limited access to financial and insurance services. Inefficient farm sizes – with some exceeding 2 000 ha – and small farmers' continued lack of access to sufficient farm inputs (such as credit, farm power, improved seeds and extension services) and markets have contributed to the underperformance of the agricultural sector.[4]

[3] **National Bureau of Statistics of the Republic of Moldova.** 2021. Plant Production. In: *Agriculture* [online]. https://statistica.gov.md/pageview.php?l=en&idc=315&id=2279

[4] **FAO.** 2007. FAO/WFP Crop and food supply assessment mission to Moldova. Special report. (also available at http://www.fao.org/3/ah871e/ah871e00.htm).

3.1. Land used and management

Agricultural land in the Republic of Moldova is general divided into plots that average 2 ha in size (depending on the region, they range between 1.5 ha and 3.5 ha) that were distributed to rural families during the transition. The minimal area of ownership registered in the survey was 0.12 ha, while the largest reached 120 ha. In addition, almost all rural households own kitchen gardens varying from 0.02 ha to 0.9 ha in size.

As many rural residents were unable to cultivate their land (due to lack of knowledge, lack of mechanization, migration and ageing), significant areas of land lay idle or were leased to big farmer–leaders. With the emergence of the leader concept, a solution for severe fragmentation and the lack of professionalization was found. Many residents keep farming on small, segregated plots while renting most of their 1.5 ha to 3.5 ha to the leaders. Their production is often somewhat dependent on the leaders. The lease fees to the rural population are paid in kind through the provision of agreed-upon quantities of crops. The quantities of in-kind contributions vary by region and are estimated at 15–20 percent of the average harvest yields. The in-kind contribution agreement is verbal, and there are no "force majeure" provisions in the agreements.

The leaders – professional farmers and agricultural managers in the Republic of Moldova – are the major driving economic force in rural areas, accounting for a significant share of employment (permanent and seasonal) and investments. The leaders are mainly private companies run by local entrepreneurs, at times financially backed by investors. In the beginning, in order to assure the cost-effectiveness of the production, the leaders consolidated the land into large plots by leasing the usually idle land from rural residents. The approach was eventually accepted, and the set-up is now a dominant form of cultivation throughout the Republic of Moldova. It can be freely estimated that well over 55 percent of the cultivated land in the country is cropped by leader-type businesses.

Most of the land on which annual crops are planted is leased out for three years, since the regulations require notarization of longer lease agreements. For perennial crops, the leases extend up to 25 years, and the agreements are often verbal. Companies cropping on areas larger than 10 ha must report their activities to the local authorities, and general figures on leased land and the number of companies involved exist at the local level.

3.2. Crop production

The main staple food crops are wheat, barley, maize, potatoes and vegetables. The main cereal crops are wheat, barley and maize, and they are used as fodder for animals. The total agricultural land is estimated at about 1.521 million ha. The aggregate area planted with cereals in the 2020 cropping season was estimated at about 950 700 ha, including approximately 304 800 ha of wheat, 545 300 ha of maize, 53 700 ha of spring barley and 31 600 ha of pulses.[5]

Sunflowers, vineyards, fruits, sugar beets and vegetables are important cash and industrial crops, accounting for a large proportion of foreign exchange earnings. Sunflowers were planted on 382 400 ha this year compared with just over 16 000 ha, on average, over the past five years. This year, sugar beets were planted on some 14 300 ha, with soya on 28 900 ha, rape on 22 900 ha, vegetables on 39 600 ha, and potatoes on about 22 900 ha.[6] Expectations were for a bumper crop this year in view of the above-average planted area, but most of the planted area could not be harvested after the drought.

[5] **National Bureau of Statistics of the Republic of Moldova.** 2020. Global agricultural production in January-June 2020. In: *Press Releases* [online]. https://statistica.gov.md//newsview.php?l=ro&idc=168&id=6712

6 This comes from an information note on the food security of the country in the context of the 2020 drought, provided by MARDE on 12 August 2020.

According to the data, the average winter wheat yield of previous years was about 3.4 tonnes/ha, with barley at 2.15 tonnes/ha and maize at about 4.61 tonnes/ha. As a result of the prolonged drought, the aggregate cereal production is down from the average production of the past four years. According to information on the 2020 harvest provided by MARDE, this aggregate includes some 450 000 tonnes of wheat, 78 200 tonnes of barley and an expected harvest of about 600 000 tonnes of maize.

3.3. Livestock sector

Livestock acts as a key component of household food security by providing nutrition and income to the majority of rural households. About 90 percent of livestock are kept by smallholders, with large livestock operations – part of the leader businesses – keeping up to 10 percent of the national herd. Most farmers have few animals, which are kept in household backyard systems: up to two cows, three to five pigs, and a few sheep. In terms of numbers and the composition of breeds, cattle are predominant, kept by about 20 percent of the rural population. Those are followed by pigs, kept by about 10 percent, and small ruminants, kept by about 3 percent (mainly in southern regions and the Autonomous Territorial Unit of Gagauzia). During recent decades, the cattle population has been slowly declining, while the poultry population has been increasing steadily.

Most households produce meat and process dairy products at home for self-consumption and sale at local markets. Smallholders with more than two cows or more than a few pigs generate part of their household income from the sales of milk, cheese and meat. When more animals are kept, livestock production accounts for a major part of the household income.

Animals are kept mostly extensively, and the main sources of livestock feed are grass, alfalfa, crop residues and feed concentrates. Grazing is complemented with additional animal feed during the grazing season. The latter is usually mixed with hay and dry alfalfa in winter. The 2020 drought caused severe shortages of alfalfa, grass, hay and crop residues, while feed concentrates are prohibitively expensive and inaccessible to many households. The Government estimates that about 20 percent of livestock will be slaughtered in distress sales by households.

As a result of distress brought on by the drought in 2020, meat production/selling has increased. This is reflected in reductions in livestock numbers. Beef prices decreased from MDL 30/kg to MDL 21/kg, while pork prices were reduced significantly, from MDL 36/kg to MDL 20/kg. However, the mission team found that meat prices have begun to rise on most markets, since de-stocking has peaked and most households are now trying to save whatever livestock is left.

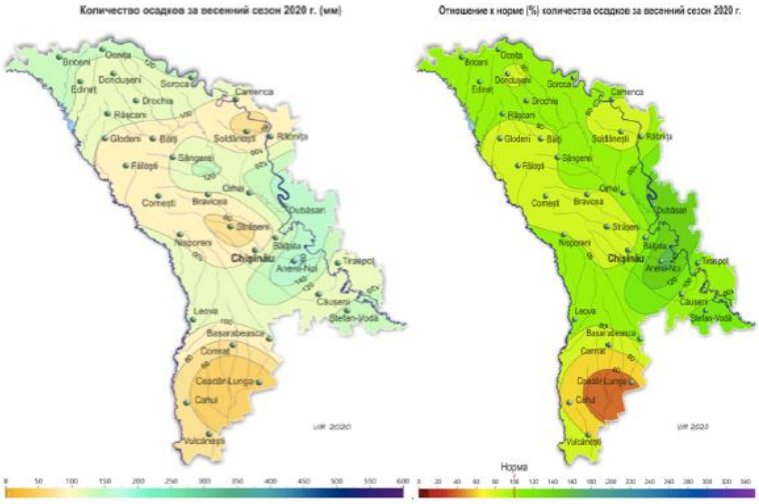
4. The 2020 drought

Droughts severely impact agricultural production in the Republic of Moldova. On average, the country experiences a drought once every five years in the north and once every three years in the southern and central districts. The most recent severe droughts took place in 2012, which followed droughts in 2007 and 2003. The string is continued in 2020, with the drought reducing cereal harvest and conditioning crop failures of winter wheat and maize throughout the country.

4.1. Rainfall and precipitation

The average monthly precipitation in the southern regions has been far below the long-term average since spring. The spring and early summer precipitations are crucial for the performance and yield of cereal and maize crops. Winter wheat and barley were at the stage of grain development in spring when rainfall fell below the levels necessary to support crop development.

Figure 3. LTA 2019

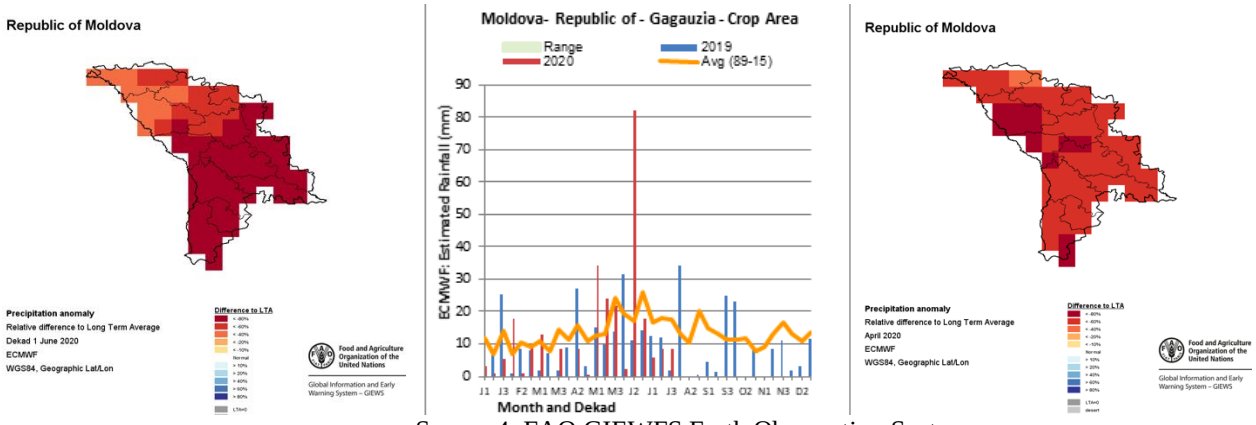


Source 3: meteo.md

Important summer crops (such as maize and sunflower) and vegetables suffered from a lack of precipitation and anomalies in air temperature during the spring–summer vegetation period. In addition to critically low precipitation, air temperatures have been, on average, 1.3 ºC to 2.5 ºC degrees higher than the 2019 long-term average.[7]

Since early April 2020, satellite imagery has shown a lack of precipitation, and the State Hydrometeorological Service reported average annual temperatures that were 5 ºC to 6 ºC over the norm in March 2020; that usually happens just once in 15 to 20 years. The maximum air temperature increased to 31 ºC in May, in the Kamenka, Faleshti, Ceadâr-Lunga and Cahul regions of the Republic of Moldova.

Figure 4. Precipitation anomaly images and graphics



Source 4: FAO GIEWFS Earth Observation System

[7] For more information, see http://www.meteo.md/images/uploads/clima/spring_2020_ru.pdf.

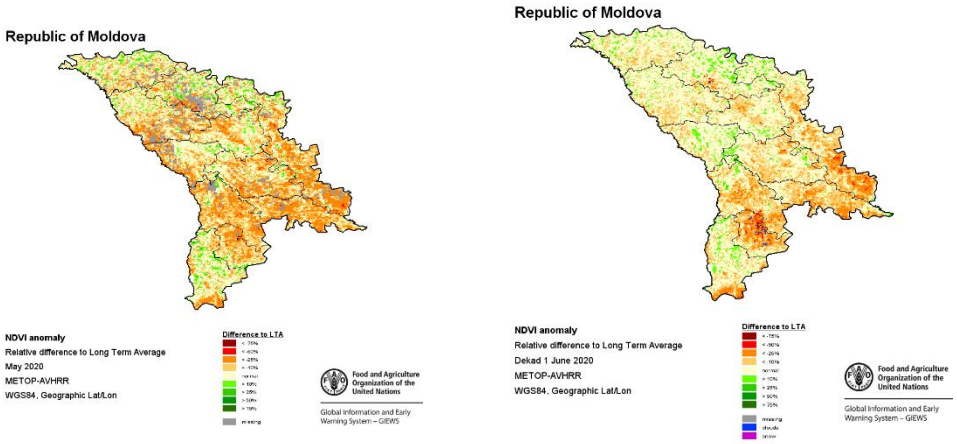
In over 45 percent of the territory of the country, precipitation in the same period accounted for 50–75 percent of the multiannual average. In Ceadâr-Lunga, precipitation was 41 mm, 35 percent of the multiannual average.[8]

As of 28 March 2020, the reserves of productive moisture in the soil under winter crops in the arable soil layer in the northern region of the Republic of Moldova was about 25–35 mm (70–105 percent of the norm), and in the southern regions it was about 5–20 mm (20–45 percent of the norm). In the metre layer, the reserves of productive moisture was about 75–120 mm (55–90 percent of the norm) in the northern regions and about 30–70 mm (25–50 percent of the norm) in the southern regions.

The lack of precipitation and low moisture reserves in the soil, noted during March and April, created unfavourable conditions for the growth and development of winter, spring and perennial crops and for the sowing, growth and development of spring crops. Winter wheat suffered from drought damage in the form of yellowing and drying leaves on the lower layer. In some places in the south, drying of the stems also was noted. Temperature declines and frost caused damage to flowering fruit crops.

Satellite imagery from the Normalized Difference Vegetation Index for the Republic of Moldova – which measures the "greenness" of the ground cover and is used as a proxy to indicate the density and health of vegetation – has shown a consistent deficit in vegetation in the southeastern portion of the country, compared to previous years.

Figure 5. Normalized Difference Vegetation Index (NDVI)



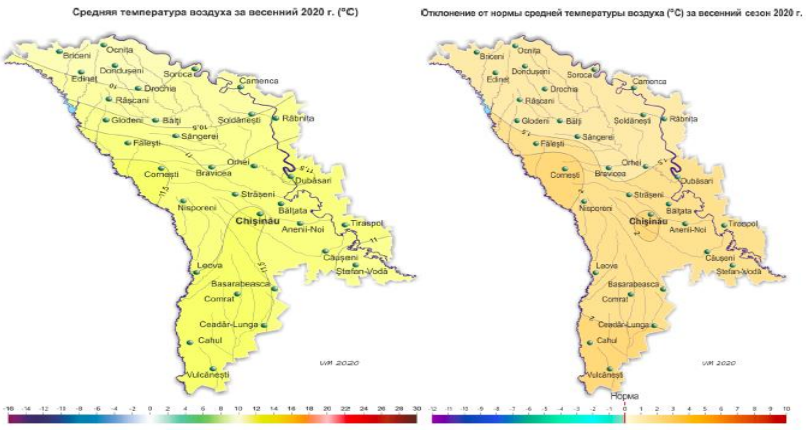
Source 5: FAO/GIEWFS Earth Observation System

4.2. Air temperature

The air temperature during the spring 2020 season was above normal by 5 °C to 6 °C, with a high of 31 °C in May, particularly in Kamenka, Felesti, Ceadâr-Lunga and Cahul. Abnormally warm weather – about 23 °C – was observed in March in Ceadâr-Lunga, and a low of -10 °C was registered in April in Balti, Rybnitsa and Bravicha.

[8] **State Hydrometeorological Service.** 2020. *SHS* [online]. http://www.meteo.md/

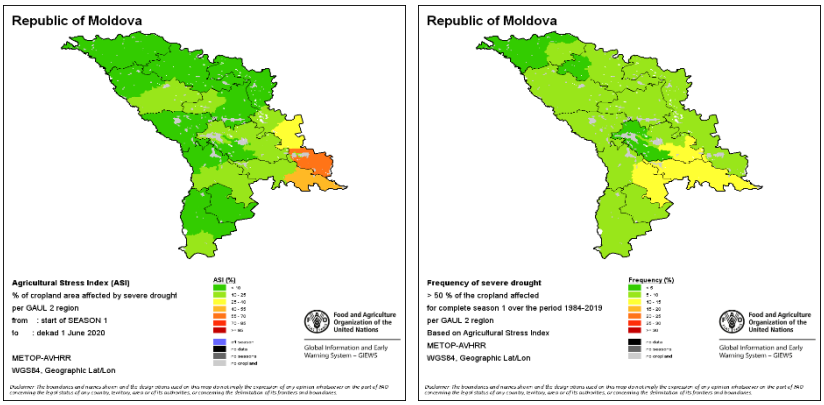
Figure 6. Air temperature



Source 6: FAO/GIEWFS Earth Observation System

The tillering of winter crops was noted in the first half of March in most of the territory of the republic, and in the last half of March it reached up to 70 percent, with plant height at the end of the month averaging 15–25 cm. The winter wheat head development (first node of steam and joining) phase registered a month earlier than usual.

Figure 7. ASI



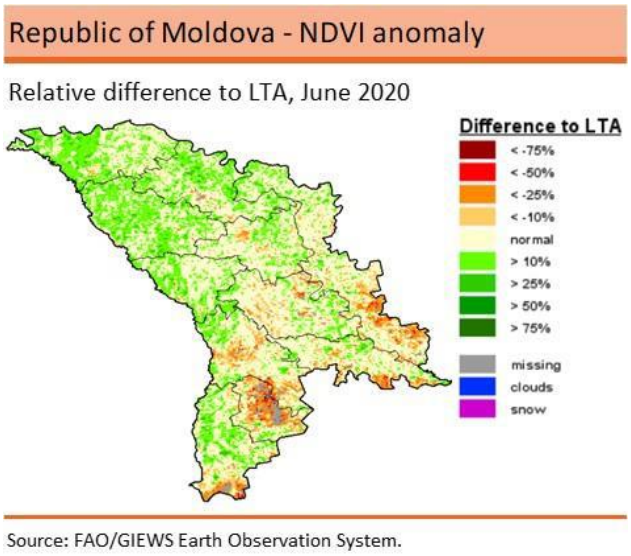
Source 7: FAO/GIEWFS Earth Observation System

Scarce rains during the season, particularly in April 2020, resulted in below-average crop conditions in the southern areas, as shown by satellite data from June, just before the beginning of the harvest (see Figure 8).

Due to the lack of precipitation and the high air temperature in spring, the majority of winter wheat crops in southern part of the country experienced stress in their growth and development.

The reserves of productive moisture under perennial plantations in a metre layer of soil was around 45–65 mm, which is 40–70 percent of the norm.

Figure 8. Normalized Difference Vegetation Index (NDVI) anomaly in June 2020, Republic of Moldova



Source 8: FAO/GIEWFS Earth Observation System

The Drought Management Centre for South-eastern Europe reported that the drought intensity in June 2020 was severe in the southern part of the Republic of Moldova (Figure 10). In addition, the fraction of vegetation cover (FVC) index increased in the period from mid-May to mid-July. Meanwhile, the agriculture stress index (ASI) shows high percentages of cropland affected by drought in the same southwestern part of the country (Figure 9).

Figure 10. Drought intensity of cropland, June 2020, Republic of Moldova

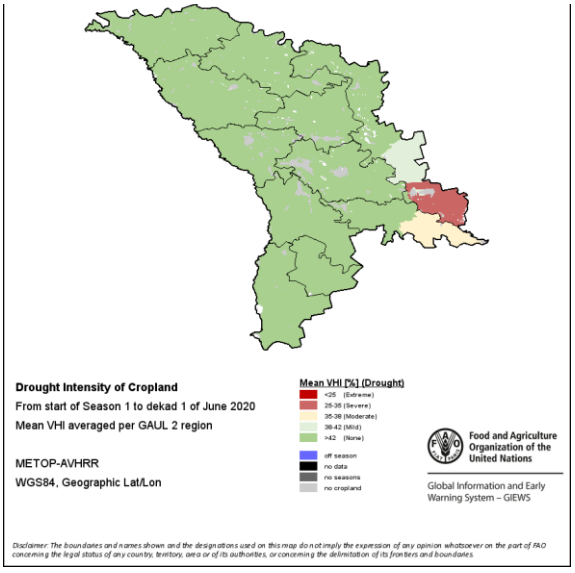
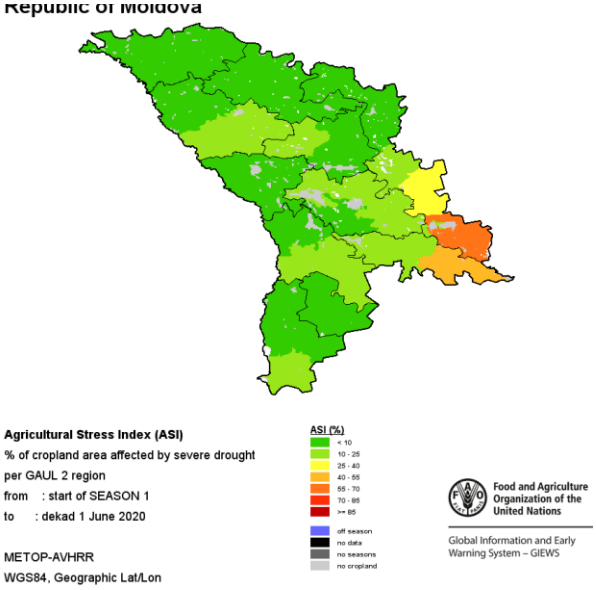


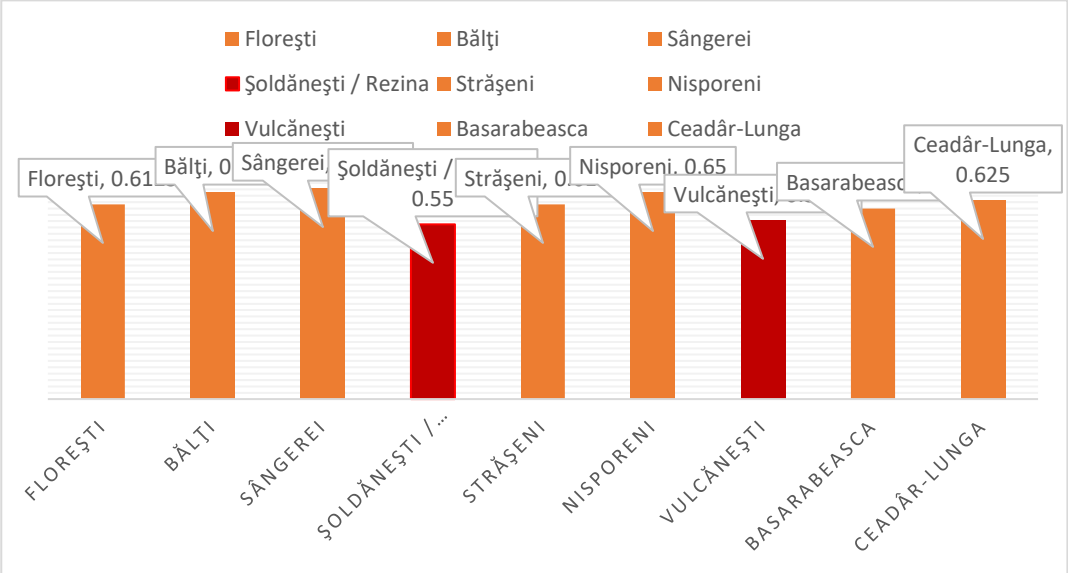
Figure 9. Agricultural stress index, June 2020, Republic of Moldova



The combination of insufficient precipitation and high air temperatures severely increased the crops' demand for water in large areas of the winter and spring crops in the southern region of the country.

The surface water flow has been reduced by 35–40 percent, compared to the multiannual average for the more substantial catchment areas (such as the Nistru and Prut rivers) and by 25–30 percent for smaller catchment areas/rivers.

Figure 11. Hydrothermal coefficient ranking for Republic of Moldova, 2020



The State Hydrometeorological Service of the Republic of Moldova has identified that during June and July, the hydrothermal coefficient[9] range was 0.5 to 0.7 over a large part of the territory of the country (Figure 11).

Based on the hydrothermal coefficient, the rayons most affected by drought include the following, out of which the most seriously affected were Şoldăneşti and Vulcăneşti:

Northern region: Floresti, Balci, Sangere
Centre region: Şoldăneşti, Străşeni, Nisporeni
Southern region: Vulcăneşti, Basarabeasca, Ceadâr-Lunga

All measurements indicate that the Republic of Moldova is experiencing a dry cycle. Other contributing factors, such as the low investment in sustainable agriculture production and irrigation infrastructure, exacerbate the impact of the drought.

[9] HTC = R / 0.1 ∑ T, where R is precipitations (mm) and T is temperature (ºC). An HTC value of ≥ 1.0 indicates sufficient moisture. HTC ≤ 0.7 indicates dry climate, HTC = 0.6 indicates slight drought, and HTC ≤ 0.5 indicates severe and very severe drought.

Droughts impose the heaviest share of costs on the Republic of Moldova, as they can harm a large share of agricultural production in the absence of a proper irrigation system. A drought occurs when agricultural production has suffered from lack of water. In that sense, it is highly dependent upon the possibilities of accessing supplementary water, such as from irrigation.

To add to the complication, droughts can have different magnitudes and geographical coverage – from ordinary droughts to exceptional ones and from local droughts to national ones. Meteorological droughts will become more common and intense.

According to all models available, the flow of the Dniester River is expected to decline by 5–10 percent until 2039, with the Prut River expected to decline 8–15 percent. The flow of small internal rivers is expected to diminish even more: by 19–36 percent until 2039. Hence, water scarcity is expected to become more frequent and intense.

Moderate and severe drought will deplete the Dniester and Prut by 35–50 percent and 50 percent, respectively, and 40 percent or fewer small rivers will be available even during moderate drought conditions. Groundwater levels are expected to decline by 3–7 percent in 30-year intervals, starting from 2010.[10]

4.3. Crop production sector

The cultivable area of the Republic of Moldova is estimated at some 1.521 million ha, which is about 61.1 percent of the entire agriculture of the country. From the total cultivated area, about 545 300 ha, or 38.8 percent, are planted with maize, followed by sunflowers (383 400 ha, or 25.2 percent) and cereals (358 000 ha, or 23.5 percent), of which winter wheat encompasses about 321 800 ha, or 21 percent of the total.

The main cereal crops produced in the Republic of Moldova are winter wheat, barley and maize. Wheat is used for human consumption, barley is mostly used for animal feed, and maize is used for both human consumption and for animal feed.

After the lack of humidity for the winter wheat seeds, which germinated in autumn 2019, and low temperatures during the winter wheat tillering period in May 2020, the severe drought hit the winter wheat in June, just before harvesting.[11] For maize crops, the lack of precipitation in spring 2020 and the extremely high temperatures during the silky and milking stage in July–August 2020 led to a drastic decrease in production.

During the assessment, data collected by MARDE mainly considered information provided by large-scale farms, while data related to small farmers (those with land sizes smaller than 10 ha) were left out. Hence, it needs to be noted that the sample size was very large but not representative of all farms, since it completely

[11] For more information, see http://www.meteo.md/images/uploads/clima/spring_2020_ru.pdf.

ignored the small farmers. However, inferences were made to estimate output on small farms from the data provided on large farms; the data were then aggregated, and forecasts were made accordingly.

The assessment team also found that over the years, the government estimates, while methodologically questionable, have been broadly close to the actual data. Therefore, the assessment mission used the data provided by the Government, which is rigorously checked with auxiliary remote sensing data and other relevant information, such as the type of varieties used, the amount of fertilizer application, precipitation, air temperatures and reports on pest and disease outbreaks.

The mission was fielded at a time when all winter crops were already harvested. Therefore, winter crops could not be directly measured on the ground, as is the usual DALA methodology, and the mission had to rely on information obtained from MARDE, which collected information from the local public authorities. Nevertheless, the mission was able to spot check all summer crops, such as maize and sunflowers.

The assessment team found that the decline of wheat production in 2020 was 51.08 percent from the four-year (2016–2019) average – 530 270 tonnes lower than the four-year average (Table 2). The decline in barley was 35.14 percent, or 59 440 tonnes lower than the four-year average, while maize production declined by 72.85 percent, or 552 860 tonnes lower than the four-year average.

Table 2. Output of main cereal crops, 2016–2020

Crop	Output, thousand tonnes						Decline (2020/over 2016–2019), %
	2020	four-year average	2019	2018	2017	2016	
Wheat	507.78	1 038.05	1 035.83	980.36	1 045.64	1 090.35	**51.08%**
Barley	109.89	169.43	147.63	133.85	195.52	200.74	**35.14%**
Maize	206.02	758.88	976.81	915.11	686.24	457.36	**72.85%**

Maize, cultivated for fodder and grain, is a good source of carbohydrates, vitamins, minerals and dietary fibre. It is one of the main staple food crops, used for human consumption and also extensively for livestock feed.

The maize plants phenological phases can be described in two aspects: qualitative and quantitative. Qualitative development comprises distinct stages of the plant life cycle: emergence, seedling development, tasselling, silking and maturity. Quantitative development, or growth, includes the rate of dry matter accumulation, which may be assessed by leaf area index (LAI), leaf area duration (LAD), total dry matter/g-m2 (TDM), crop growth rate/g-m2-day (CGR), and net assimilation rate/g-m2-day (NAR).

The visual assessment of maize crops in the field (Table 3) shows that the most of the maize plants were affected by drought from the eighth leaf vegetative grown stage (39–40 days after seedling), due to the lack of precipitation, and during the silking stage (about 65–72 days) and milking stage (90–95 days), due to high temperatures.

The 2020 maize grain yield was decreased by lack of precipitation in the spring germination stage and by extremely high temperatures during the summer silking and milking stages. Most plants were formed with one, rarely with two rudimental cobs with few grains, while the vegetation size was reduced by some 96 percent, on average, in the most-affected regions of the central part of the country, and by 78 percent in the north. In some areas, the maize plants died out prior to the dough and cob maturity stages.

Table 3. Maize crop damage visual assessment

DESCRIPTION	Centre	North	South
Crop phenological stage	**Cob**	**Cob**	**Cob**
Medium height of crop (m)	1.376	1.247	0.919
Number of corns on plant	1.04	0.75	0.50
Number of plants per m2	5.148	5.363	6.237
Number of undamaged plants	0.185	1.139	0.744
Number of damaged plants	4.963	4.198	5.493
The average harvest in the last 3 years, t/ha	4.994	4.17	3.535
Loses at vegetative growth, % failure	96.41%	78.28%	88.07%
Average damage from drought (t/ha)	4.08	3.31	3.73
Average yield expected (t/ha)	0.15	0.92	0.50

Maize production was registered as having been heavily affected by drought, especially in the southern and central parts of the country, where output declined by 72.85 percent, on average. In some areas, such as Besarabeasca and Nisporeni, the registered output decline was up to 89 percent.

As a result of the maize crop field assessment data analyses and the aggregated output data, the mission indicated that the loss of vegetative growth was about 96.41 percent in the central regions, while overall maize yield reduction in the Republic of Moldova in 2020 was estimated at about 87.5 percent.

A similar phenomenon was observed in sunflower and rape development, mainly in the southern and central parts of the country. Sunflower is mainly a cash crop – with a more direct impact on the incomes of smallholders – with a limited use as animal fodder. Rape is mainly a cash crop.

Table 4. Output of main industrial crops, 2016–2020

Crop	Output, thousand tonnes					Decline (2020/over 2016-2019), %
	2020	2019	2018	2017	2016	
Sunflower	320.00	705.70	672.32	689.99	575.09	**51.57%**
Rape	40.84	77.25	85.61	71.43	43.19	**41.13%**

Source 9: MARDE (operative information on 2020 crop harvest) and National Bureau of Statistics (statistical information).

Sunflower production was affected by drought especially in the southern and central parts of the country, where yields declined up to 51.57 percent, on average, based on aggregated data from field visual observation. In some northern areas, like Nisporeni and Besarabeasca, the registered decline was up to 83 percent.

The sunflower crop field assessment data analyses presented in

Table 5, along with the results from the statistics data aggregation, indicate that the overall maize yield reduction in the Republic of Moldova in 2020 was estimated at about 63.31 percent, while the registered average output decline was 51.57 percent.[12]

[12] The output decline was 67 percent in the southern regions, 57 percent in the central regions and 33 percent in the northern regions.

Table 5. Sunflower crop damage visual assessment, Republic of Moldova

DESCRIPTION	Centre	North	South
Crop phonological stage	***Seed Filling***	***Seed Filling***	***Seed Filling***
Medium height of crop	1.273	0.828	0.789
Number of plants per m2	5.667	5.417	6.833
Number of undamaged plants)	1.296	2.074	1.593
Number of damaged plants	4.37	3.343	5.241
Loses at vegetative growth, % failure (dead plants or plants that will not reach maturity)	77.11%	61.71%	76.70%
Average damage from drought (t/ha)	1.16	0.93	1.15
Average yield expected (t/ha)	0.34	0.57	0.35

Source 10: ACSA

According to the aggregated data from statistics and field observation, sunflower damages were less dramatic compared than maize damages. The sunflower yield decreased due to the lack of precipitation during the vegetative stage of leaf initiation in spring and the extremely high temperatures during the reproductive stage of flowering and setting in summer.

Drought stress, mainly during flowering or early seed fill, leads to fewer set seeds or lower seed weight and oil content. The vegetation size was reduced by some 72 percent, on average, in the most-affected regions of the southern and central parts of the country.

Table 6. Estimated damage and loss averages

Crop	Four-year average output	Damage output decline		Average farmgate price	Loss
	tonnes, thousands	%	tonnes, thousands	USD/tonne	USD, thousands
Wheat	1 038	51.08%	530.27	177	93 982
Barley	169.43	35.14%	59.54	154	9 197
Maize	758.88	72.85%	552.86	159	88 067
Sunflower	592.62	51.57%	272.62	389	106 031
Rape	32.10	41.13%	28.53	383	10 939

Based on the 2020 operative data provided by MARDE and field visual assessments of crop output, the assessment mission found that the wheat average production quantity was reduced to 507 780 tonnes from the four-year average (2016–2019) of 1.038 million tonnes.[13] The output decline was about 51.08 percent, or about 530 220 tonnes. The estimated barley output decline was about 35.14 percent, or 59 540 tonnes. The average decline of maize was estimated at about 72.85 percent, or about 552 860 tonnes, while the declines for sunflowers and rape were registered at 51.57 percent and 41.13 percent, respectively, or about 272 620 tonnes and 28 530 tonnes.

[13] **National Bureau of Statistics of the Republic of Moldova.** 2021. https://statistica.gov.md/

Hence, the estimated total loss for winter wheat was about USD 93 982. For barley, the loss was about USD 9 197, for maize USD 88 067, for sunflowers USD 106 031, and for rape USD 10 939. The total losses of the main cereal and industrial crops, in terms of damage, may be estimated at about USD 308 217.

From field observation records, it can be concluded that cereal production in the Republic of Moldova suffered not only from the 2020 drought but also from the collapse of land fragmentation, the inadequacy of agricultural technology, reduced use of fertilizers and plant protection, lack of agriculture knowledge, lack of cereal seed varieties resistant to drought, and seed quality.

Field indications indicate that, due to the low quality of the 2020 yields, mostly low-quality seeds will be planted next season, likely influencing the 2021 harvest.

4.4. Seed sector

Similar to the other sectors, the seeds subsector of the Republic of Moldova suffered from drought. The main reasons for the collapse of the seed sector due to drought include seed quality, seed availability, land fragmentation, collapse of the irrigation systems, improper use of fertilizers and chemicals, dilapidated agricultural machinery, inadequacy of modern equipment, land management, low labour productivity and lack of innovations in seed science and seed breeding. Seed requirements for the 2020/21 year, according to the seed loss assessment information compiled by MARDE, are presented in Table 7.

Table 7. Detailed seed needs and costs of crops affected by drought in 2020/21

Agriculture crop	Total area to be planted, (ha)	Norm for sowing (tonnes/ ha)	Total necessary volume of seeds per year (tonnes)	Seed need		Cost of one tonne of seeds		Total cost
				Available quantity (tonnes)	Need for additional quantities (tonnes)	MDL/kg	USD/tonne	USD
Winter Wheat	320 000	0.22	70 400	64 000	6 400	5.3	312	1 995 294
Total Barley	70 000	0.22	15 400	7 600	7 800	5.86	345	2 688 706
Peas	35 000	0.22	7 700	2 500	5 200	11	647	3 364 706
Sunflower	380 000	0.01	2 280	784	1 496	250	14 706	22 000 000
Corn	492 100	0.02	9 842	3 780	6 062	35	2 059	12 480 588

Soya beans	46 000	0.1	4 370	3 450	920	27.5	1 618	1 488 235
Total							-	44 017 529

From the data presented in Table 7, it is clear that there is a seed shortage; without urgent assistance, many farmers will not be able to plant spring maize and barley.

4.5. Impact of drought on farmers

The negative impact of severe drought on agriculture is reflected in population livelihood, income generation and food security. By analysing the data, the mission team come to the conclusion that affected farmers generally can be divided into three main categories:

1. Small-scale farmers who own at least one livestock and lost more than half of their crop because of drought. This group is estimated to encompass about 30 percent of the total drought-affected population. In addition to dealing with reduced and lost yields, they will have to invest in next season's production and/or in animal feed in order to sustain their production. The majority of smallholders who own cattle have an average yearly income of about USD 900 to USD 1 200 that contributes significantly to household food security. These smallholders may spend around USD 500/ha from their earnings for field crop production but will still need additional investment for the next production season for both crop production and animal breeding. Most householders in this category have access to credits, though agriculture extremities generate difficulties with credit payments and the receiving of new loans, with usually extreme interest rates. Therefore, it is estimated that that most of the de-stocking and land abandonment might occur within this group.

2. Rural smallholders who rent out their land to the big farmers/leaders. This category of rural residents encompasses about 50 percent of the drought-affected rural population. They are not actually engaged in farming, excluding backyard cultivation for home consumption, instead benefiting from the rental of the land and from employment. Considering the fact that the majority of the people in this group have no official agreement with the leader – the agreements are all verbal – they cannot complain and request support. In return for the rented plots, they usually receive from the leader about USD 100 to USD 200 or in-kind payments in the form of grain, maize or other crops. In the event of disasters, those smallholders are paid by leaders in-kind or by volume up to 50 percent of the originally agreed-upon quantity, which is unlikely to have a significant effect on the livelihoods of the people in this category.

3. Leaders, or so-called "corporate farms," who cultivate large areas or keep large numbers of livestock. Economically, these have been strongly affected by drought. This category encompasses about 20 percent of the rural population who have suffered more because they obtain reduced yields and still must cover rent costs and invest in the next season. Leaders have large amounts of credit, usually with high interest rates, and are indebted to the providers of inputs, such as seeds, fertilizers and pesticides. The next agriculture season will be decisive for large farmers and will determine how the agricultural sector will be shaped. Many leaders will not be able to survive, and the eventual withdrawal of the leaders will significantly affect the agricultural sector and the rural populations who have received in-kind benefits from the leaders' activities.

5. Conclusions and recommendations

In addition to the challenges facing agriculture in the Republic of Moldova, the main challenge nowadays is the COVID-19 pandemic, which is hitting immunocompromised, poor and vulnerable people hardest. There is clearly an economic, social and moral imperative to help poor rural people and find an adaptation methodology to COVID-19 in a sustainable way.

Considering the extreme climatic conditions experienced in the Republic of Moldova, it is expected that COVID-19 may decrease food production and increase food price fluctuations. Hence, we can confirm clearly that the rural agriculture sector is the most vulnerable part of the national economy. Meanwhile, it is the most important sector to ensuring the food self-sufficiency and food security of the country.

According to the World Bank, natural disasters impact up to 3 percent of the region's GDP each year, leading to a potential loss of USD 66 million. These events can damage arable land, create food shortages that leave people hungry and cause people to suffer from injury or loss. Environmental challenges can significantly impact the lives of citizens and drag the most vulnerable people in the Republic of Moldova into poverty.[14]

The impact of the drought on crop production is moderate at the national level, ranging from mild in the northern region to severe in the central and southern regions.

Natural hazards, particularly droughts, significantly affect agriculture in the Republic of Moldova on a regular basis. Despite efforts in previous years and recommendations to the Government to undertake efforts for long-term mitigation, there have been no systematic approaches to disaster risk reduction. In the Disaster Risk Reduction Strategy and Framework for the Republic of Moldova, action plans for mitigation response are identified and important recommendations regarding cropping mechanisms provided. However, there are few indications that the information on temperatures, soil moisture, planting periods, etc. reach farmers.

The limited knowledge on drought risk reduction and coping methodologies on plant production has been identified at all levels, from MARDE staff to farmers. Promoting simple mitigation interventions – such as drought-resistant crop production, seed variety improvement, agronomic techniques, drip irrigation technologies, and climate-smart intensive agriculture methodologies – may help significantly reduce losses.

As a conclusion, we can note how climate change and the COVID-19 pandemic have made it more difficult to predict weather patterns and agriculture activities at the appropriate time. The frequency of weather hazards such drought and floods, as well as soaring food prices due to COVID-19, have had negative impacts on rural livelihoods.

5.1. Conclusions

- Considering the frequency of natural climatic calamities in previous years, particularly the severity of droughts and their significant effects on the Republic of Moldova on a regular basis, the Government and MARDE are undertaking efforts for mitigation through promoting no-tillage cultivation and conservation agriculture methodologies, development of irrigation infrastructure, promotion of drip irrigation, improvement of seed sector development, though these efforts are fragmented and cannot contribute significantly to the improvement of the situation in the short term.

- The Government of the Republic of Moldova and MARDE are providing important information and recommendations regarding temperatures, planting periods, hail, storms, etc. through branch offices and

[14] The poverty rate in the Republic of Moldova is much higher in rural areas (about 40 percent) than it is nationwide (about 13.3 percent). https://www.macrotrends.net/countries/MDA/moldova/poverty-rate#:~:text=Moldova%20poverty%20rate%20for%202018,a%202.2%25%20decline%20from%202014.

primaries, though there are few indications that this information reaches farmers and no indications of disaster risk management strategies and action plans for mitigation response. A few simple and cost-effective measures can be adopted and used, with available resources, to limit the impacts of drought on agriculture and on the livelihoods of vulnerable population groups.

- Several activities and projects have been implemented to improve the knowledge of farmers and members of the private sector in agriculture, though there is a lack of innovative mitigation interventions such as agronomic techniques, drought-resistant variety improvement, simple feed preparation and coping methodologies for drought response. Those activities and projects will have the direct effect of reducing losses; hence, technical assistance and awareness are key for sustainability of the small farmer sector.

- Considering that the livestock sector provides basic and additional income and more growth/investment opportunities for rural smallholders, with minimum investments and risks compared to the plant production, it may be considered a crucial part of rural livelihoods. Considering that the national herd is decreasing, even without compounding weather-related problems, more attention should be focused on its preservation. The preservation of the livestock sector further provides for the balancing of the food prices for the urban population. In this context, the status of the pastures, especially in southern regions such as Besarabeasca, Nisporeni, Vulcănești, Taraklia and Gagauzia, are severe and doubtless would affect the livestock development sector and livelihoods as well.

Through the sustainable management of agriculture and forestry, the Republic of Moldova has great potential to mitigate the impacts of climate change. This means that poor rural people – as managers of land, water and forests – could have an important role to play in mitigation measures: i) by adopting better land use practices, such as conservation agriculture, conservation tillage, agroforestry, and rehabilitation of degraded crop and pasture land; ii) by improving livestock management and crop practices, coupled with adaptive management of forests; iii) by improving the seed sector and using good agriculture practices, which could help reduce the impacts of harsh climatic conditions (drought, frost, hail, flood) and support reducing the magnitude of the long-term soil degradation process; and iv) by using better agricultural practices and nurturing and protecting forests, contributing to the absorption of carbon dioxide.

5.2. Recommendations

Based on the above conclusions, and taking into consideration that the predominance of the agriculture sector makes the country's economy highly dependent on meteorological-climatic conditions, attention should be given to the findings outlined below, which are recommended for future consideration and in order that appropriate action be taken to:

- Review existing policy and plans, review information on climate change and agriculture, and review European Union regulations, in order to transform the agricultural and rural sector from a subsistence orientation to a more diversified, climate-smart and sustainable agriculture with a system more oriented to the export market.

- Establish institutional mechanisms to promote the sharing and application of climate information in agriculture that will support the better integration of agriculture sectors into climate change policies, plans and strategies.

- Strengthen disaster risk management strategies and action plans for mitigation response and institutionalize ASIS (Agriculture Stress Index System), in close collaboration with the National Bureau of Statistical (NBS) and in coordination with MARDE, to support identification of the best ways to collecting and analyse data on damage and loss for major crops and agricultural assets, either by upgrading existing information systems with dedicated damage and loss modules or establishing a new information system. Enhance the building of capacity through the provision of trainings to government staff on damage and loss assessment methodology.

- Improve knowledge on coping methodologies in agriculture in drought-prone areas. This has been identified at all levels (leaders and small farmers) in both the livestock and plant production sectors. Innovative mitigation interventions that have a direct effect on reducing losses should be promoted and supported. These include new crops, drought tolerant varieties, agronomic techniques, feed preparation, and storing and silage. Technical assistance and awareness rising are key for the sustainability of the small farmer sector.

- Develop a national irrigation and drainage strategy to enhance water resource management, irrigation and drainage development, and scope for further development. Improve technical capacity and knowledge transfer to promote water accumulation and drip irrigation for small-scale farmers.

- Advance crop–livestock integration and pasture grazing land management strategies that focus on soil health. The goal of these strategies would be to help improve the sustainable management of reserve pastures and the productivity of grazing lands and to increase and organize the production of winter forage, thereby improving livestock productivity and small-scale livestock farm household income.

6. Required assistance and response

6.1 Short-term immediate measures

Emergency assistance of maize seeds to small-scale farmers in the identified regions severely affected by drought for the spring seedling campaign and strengthening the capacity of MARDE on drought-related early warning information to the agriculture sector.

Considering that maize is one of the main staple food crops used for human consumption and livestock feed, and that it is the crop most affected by drought, it is clear that with household budgets already stressed, food access is likely to decrease for the poorer part of the population. That is why, as an immediate, short-term

response measure, it is recommend that small-scale farmers be supported through the provision of maize seed to ensure the production of maize. This would enhance livelihoods and increase food security, preventing desertion of the land and supporting livestock herds in the target areas.

It is imperative that emergency assistance be linked with technical assistance for the government as well as technical assistance for beneficiaries.

Hence, parallel with targeted support in the form of emergency seed distribution, there is a need to increase the resilience of the agriculture sector to climate change and challenges faced by COVID-19. This can be done by enhancing the knowledge and methodological capacities of mid-level managers in government/food policymaking units and rayon agriculture officials through the strengthening of the analysis and provision of climate-related data for early warning. Thereby, it is recommended that FAO support MARDE with technical assistance for sustainable agriculture by establishing a drought risk preparedness and awareness system that will address the need to strengthen capacities of public institutions to identify, analyse and disseminate actionable drought-related early warning information to the agriculture sector. It will comprise the training on crop assessment and forecasting (by using crop visual assessment and damage and loss assessment methodologies) and technical assistance to adopt the innovative Agricultural Stress Index System (ASIS).

6.2 Medium- and long-term adaptation measures

Technical assistance to support the methodological capacities of local public administrations on disaster risk reduction and to improve the technical capacities of farmers by promoting climate-smart agriculture technologies through Farmer Field School demo plots.

For more sustainable, climate-resilient agriculture development, it is essential to establish an institutional mechanism to promote climate adaptation strategies to transform the agricultural and rural sector from a subsistence orientation to a more diversified orientation that will support the better integration of agriculture sectors into climate change policies, plans and strategies.

To promote climate adaptation strategies, FAO and the developing partners should support the enhancement of the knowledge and methodological capacities of mid-level managers in government/food policymaking units and rayon agriculture officials by strengthening the analysis and provision of climate-related data for early warning, on one hand, and improving the technical capacities of farmers, on the other hand.

This technical assistance will support the establishment of a community-based agriculture disaster risk preparedness and awareness system and knowledge transfer to improve the technical capacities of farmers by promoting climate-smart agriculture technologies through Farmer Field School demo plots.

Farmers should be further assisted with educational and awareness-raising technical support on improved climate-smart agriculture practices and crop management for drought-prone areas by introducing shorter vegetation and stem height varieties of hybrid maize and drought-resistant varieties of winter wheat, kitchen garden vegetable production that uses water accumulation and drip irrigation technologies, and small-scale silage production, in addition to the sustainable use of already existing resources.

Assistance in piloting drought-resistant varieties of agriculture crops – together with climate-smart, conservation agriculture and small-scale, modern, on-farm irrigation technologies – will help accumulate knowledge among farmers. The provided support can significantly contribute to the lowering of future drought-related damages and to the preservation of household livestock herds, without relying on future support from the government, and also can contribute to minimizing climatic risks associated with water constraints.

The system should include appropriate monitoring and evaluation mechanisms. Actions plans for timely response, with clearly set intervention thresholds, should complete the preparedness system for MARDE and the local authorities.

Annex 1. Table on crop output decline caused by drought in 2020

Type of crop	Region	Area planted, thousand ha					Production, thousand tonnes					Decline 2020/over 2016–2019 (%)
		2020	2019	2018	2017	2016	2020	2019	2018	2017	2016	
Wheat	North	200.53	112.18	111.99	97.58	113.99	290.48	454.97	376.27	384.18	411.94	28.60%
	Centre	67.32	68.49	63.92	56.38	64.18	78.29	217.46	180.18	191.49	223.57	61.47%
	South	119.71	134.21	136.37	120.23	127.90	139.02	363.41	423.91	469.98	454.83	67.52%
Subtotal wheat		387.56	314.89	312.28	274.19	306.07	1.26	450.00	1 140.90	1 152.80	1 235.10	51.08%
Barley	North	22.36	17.35	31.97	31.00	32.41	57.88	65.11	52.80	77.04	65.27	11.03%
	Centre	12.60	8.02	12.96	16.83	21.46	14.80	23.85	16.08	29.17	37.61	44.51%
	South	21.68	20.96	43.36	49.09	53.32	37.21	58.68	64.98	89.30	97.86	52.12%
Subtotal barley		56.64	46.33	88.30	96.93	107.19	1.83	109.89	147.63	133.85	195.52	35.14 %
Maize	North	64	80	66	68	54	90.18	442.19	436.99	287.93	193.71	73.49%
	Centre	86	62	55	53	35	44.67	248.39	234.22	166.92	115.05	76.63%
	South	69	73	50	45	45	71.17	286.22	243.91	231.39	148.60	68.72%
Subtotal maize		219.11	213.80	170.83	165.12	133.55	0.99	206.02	976.81	915.11	686.24	72.85%
Sunflower	North	131.02	122.83	116.55	124.89	119.60	181.98	319.27	283.88	270.94	220.99	33.53%
	Centre	79.14	67.57	65.89	72.08	61.74	55.87	146.25	128.54	133.95	117.37	57.52%
	South	116.20	124.85	123.79	122.94	110.53	82.15	240.19	259.90	285.10	236.73	67.84%
Subtotal sunflower		326.35	315.25	306.23	319.91	291.86	0.93	320.00	705.70	672.32	689.99	51.57%
Rape	North	9.78	11.67	18.13	10.33	7.54	22.76	25.93	40.49	28.45	15.94	17.86%
	Centre	3.60	6.65	5.43	1.20	1.47	5.50	14.78	10.14	3.31	3.54	30.73%
	South	9.55	20.00	19.43	17.32	9.22	12.58	36.54	34.97	39.66	23.71	62.70%
Subtotal rape		22.93	38.32	42.98	28.85	18.23	1.72	40.84	77.25	85.61	71.43	41.13%

Annex 2. Project profile: Emergency distribution of maize seed to drought-affected farmers in the Republic of Moldova and strengthening the capacities of public institutions on climate-related, early warning information to the agriculture sector.

Objective	To increased food security and enhanced livelihoods through the provision of maize seed to 50 000 small-scale farmers severely affected by drought. Strengthening the methodological and analytical capacities of about 20 mid-level managers of public institutions to identify, analyse and disseminate actionable, climate-related data and drought-related early warning information by using the ASIS system and DALA methodologies.
Beneficiaries	Small-scale farmers highly affected by the 2020 Moldovan drought and public institutions.
Partners	Government at central and local levels, United Nations agencies, NGOs
Duration	March 2021 – December 2022
Budget	**USD 1 152 546**

Background

Agriculture plays an important role in the economy of the Republic of Moldova and remains the largest real sector of the economy, accounting for more than 17.7 percent of the GDP and employing more than 32.3 percent of the labour force. By comparison, the services sector employs 55.7 percent of the labour force, with the industry sector employing 12 percent.[15] Agriculture plays an important role in the economy of the Republic of Moldova, particularly in terms of employment and exports and with the potential for reducing poverty.

More than 36 percent of the total land area is owned by 390 380 individual farmers and is used to produce approximately 72 percent of the total agricultural product. Of the total production of agricultural crops, 34.3 percent comes from household gardens. About 59.6 percent of rural households are medium in size (consisting of 3 to 5 persons), with at least one elder (older than 60) and one underage person (younger than 17).[16] The average plot size after privatization was about 1.65 ha, out of which 1.42 ha (86 percent) was ploughed field, 0.13 ha (8 percent) vineyard and 0.09 ha (6 percent) fruit garden.

Drought is one of the most common and devastating extreme climate events in the Republic of Moldova, which is located in a water insufficiency climate zone. A major part of the country (74.5 percent) is dry sub-humid (UNCCDAI = 0.50–0.65) or semi-arid (UNCCDAI < 0.50) lands. In dry lands, agricultural ecosystems are more vulnerable to climate change, and the balance of production and consumption often depend on water resources. Accounting for 13 percent of the total number of hazards, droughts in the Republic of Moldova make up 67 percent of economic losses from weather and climate-related risks. On average, the country experiences a drought once every five years in the north and once every three years in the southern and central districts. The most recent severe droughts took place in 2012, which followed droughts in 2007 and 2003. The string is continued in 2020, with the drought reducing cereal harvest and conditioning crop failures of winter wheat and maize throughout the country. Insufficient and highly variable precipitation are the main drivers of drought and of the significant failure of water resources and agriculture production, creating a challenging environment for all sectors of human activity. In some years, water deficiency acquires a national scale of socio-economic and environmental disaster.

[15] **Index Mundi.** 2021. Moldova Economy Profile. In: *Index Mundi* [online]. http://www.indexmundi.com/moldova/economy_profile.html

[16] **Invest in Moldova.** 2012. Agriculture Report. (also available at: http://eba.md/uploaded/publications/Agiculture%20Report.pdf).

Maize, the main cereal, is a good source of carbohydrates, vitamins, minerals and dietary fibre. It is cultivated both for fodder and for human consumption. According to the drought assessment mission data, maize production declined by 73 percent, 552 860 tonnes lower than the 2016–2019 average (758 880 tonnes). It is registered that maize production has been heavily affected by drought, especially in the southern and central parts of the country. In some areas, such as Besarabeasca and Nisporeni, the output decline was up to 89 percent.

The 2020 maize grain yield was decreased by lack of precipitation in the spring germination stage and by extremely high temperatures during the summer silking and milking stages. Most plants were formed with one, rarely with two rudimental cobs with few grains, while the vegetation size was reduced by some 96 percent, on average, in the most-affected regions of the central part of the country, and by 78 percent in the north. In some areas, the maize plants died out prior to the dough and cob maturity stages.

With greater damage to summer crops, and in spite of the reduction of the national livestock herd, maize imports are likely to be much higher, perhaps as much as 270 000 tonnes, while the maize seed shortage may be up to 6 000 tonnes. Most of the maize imports will be for livestock feed. Even with adequate overall supply, food prices will remain high or rise further. With already stressed household budgets, food access is likely to decrease for the poorer part of the population.

Without additional assistance, ordinary peasant households and small-scale farmers in the most-affected regions that lost more than 70 percent of maize crops will be unable to capture the benefits of normal crop weather in 2021.

It is important that emergency assistance be linked with technical assistance for the government as well as technical assistance for the beneficiaries.

Informed advisories, alerts and robust early warning systems are essential for farmers and rural dwellers to prepare for and adapt to climate extremes.

Justification

Considering that maize crops – one of the main staple food crops for both human consumption and livestock feed – have been so severely affected by drought, it is clear that with already stressed household budgets, the poorer members of the population are likely to see their food access decrease.

The assessment team recommended that small-scale farmers be supported with provision of maize seed for the spring 2021 season to ensure the production of maize and to improve food security in drought-affected households.

It is an imperative that emergency assistance be linked with technical assistance for the government as well as technical assistance for beneficiaries.

Hence, parallel with targeted support in the form of emergency seed distribution, there is a need to increase the resilience of the agriculture sector to climate change and challenges faced by COVID-19. This can be done by enhancing the knowledge and methodological capacities of mid-level managers in government/food policymaking units and rayon agriculture officials through the strengthening of the analysis and provision of climate-related data for early warning. Thereby, it is recommended that FAO support MARDE with technical assistance for sustainable agriculture by establishing a drought risk preparedness and awareness system that will address the need to strengthen capacities of public institutions to identify, analyse and disseminate actionable drought-related early warning information to the agriculture sector. It will comprise the training on crop assessment and forecasting (by using crop visual assessment

and damage and loss assessment methodologies) and technical assistance to adopt the innovative Agricultural Stress Index System (ASIS).

This project profile was built taking into consideration that inaction would have several consequences: increased vulnerability, deterioration in nutrition and other socio-economic indicators, resorting to such harmful coping strategies as selling off productive and other assets, forced migration, and acceleration of the downward spiral into permanent destitution.

Given that most of the farmers are former members of the *kolkhozes* (collective farms in place during soviet rule), it is easy to understand that they keep old habits and use soviet agricultural methods, including the use of hybrid maize with longer vegetation periods.

For example, most countries south of the Republic of Moldova use maize hybrids with significantly shorter vegetation periods, ranging from 85 to 100 days. Farmers in drier areas select short vegetation hybrids, and farmers in more humid areas select longer vegetation hybrids. In the Republic of Moldova, most farmers use maize varieties with vegetation exceeding 130 days – surprisingly, even when they are planting it as a second crop.

By promoting the cultivation of registered shorter vegetation local hybrid maize and semi-till conservation agriculture technologies, the drought resistance of crops can be improved. It is true that shorter vegetation hybrids yield somewhat less; however, experience in the south shows that continuous low production is better than higher yield every second year, since it enables sustainable production and efficient farm management.

This approach calls for knowledge transfer in the field of agronomic technical practices, important for home consumption and fodder crops such as hybrid maize. The main objective can be achieved through the provision of good quality maize seeds to small-scale farmers who have little or no resources, helping to ensure the timely planting of the main subsistence crop for the spring 2021 season.

Objective

The project has two main objectives:

i) To support the transfer of technology to farmers by promoting local or imported hybrid maize with shorter vegetation and stem height. This would help improve the food security of drought-affected households in the Republic of Moldova by ensuring the planting of maize, the main subsistence crop, for the spring 2021 season.

ii) To strengthen analytical capacities on crop assessment and the provision of climate-related data for agricultural drought early warning.

Project input

Moldovan farmers the from most-affected nine regions[17] of the Republic of Moldova will benefit from the provision of training on semi-till conservation agriculture technologies and the distribution of shorter vegetation hybrid maize seeds to improve the drought resistance of the crops.

The proposed drought relief package under this project will be focused on small-scale farmers. It is suggested that about 10 kg of good quality maize seeds[18] will be sufficient to plant 0.5 ha, ensuring the planting of the main subsistence crop for the spring 2021 season. Through the project, about 50 000 peasant

[17] Ranking by percent of damage level mentioned by the assessment mission.

[18] The grain maize sowing rate is about 20 kg/ha, and the current market price is about USD 1713 per tonne.

households[19] in the central and southern regions of the country will receive about 500 000 kg of maize seeds so they can plant 0.5 ha of maize on time, thereby improving their food security situation. This aid will account for only about 35 percent of planting costs, but it is considered to be a sufficient catalyst to lift the majority of peasant households over a critical threshold and place the peasant economy on a recovery path. The success of the project will be monitored at the harvest stage, at which point the initial distribution of about USD 17 per beneficiary is expected to deliver about USD 1 250[20] to the household economy.

In parallel with emergency maize seed distribution, FAO will support MARDE with technical assistance for sustainable agriculture through the provision of training on crop damage and loss assessment (DALA) methodology and technical assistance to adopt the Agricultural Stress Index System (ASIS), addressing the need to strengthen the capacities of public institutions to identify, analyse and disseminate actionable, drought-related early warning information to the agriculture sector.

Crop assessment methodology and training will introduce basic principles on DALA as instruments for policy analysis and decision-making. It will help participants obtain hands-on experience in assessing potential crop harvests using FAO methodology.

Based on the experience of supporting national early warning systems during the past three decades, one lesson learned is the importance of national staff for executing monitoring and forecasting models and passing the alerts on time to mitigate drought impacts. Trained staff have high mobility in the national institutional context in most developing countries. The next generation ASIS takes advantage of new capabilities and progress in computer science. Automated calculation of different vegetation indices is a large advantage for the sustainability of the methodology proposed. The national staff will have more time to dedicate to confirming alerts, contacting the field and communicating confirmed alerts to the decision makers.

The results can be used to monitor trends over time within a country.

Project outputs

In the case of hybrid maize, drought-affected farmers would be able to plant about 0.5 ha of maze and produce about 2 500 kg of grain maize, which would provide about 500 kg for home consumption; about 1.5 tonnes for use as fodder for at least one cow, one pig and six chickens; and about 500 kilos to sell for cash. As a result, farmers would benefit from this assistance in the first year. In the case of open-pollinated varieties, they would benefit mainly in the second year. The only disadvantage of hybrid maize seed is that farmers cannot have seed stock to multiply.

The crop assessment course for 20 identified specialists will be delivered in class, making appropriate use of audiovisual aids, presentations and the distribution of written handouts during the course to all participants. The course will be designed for adult in-service training, with the learning process essentially taking place during the training sessions. The course will be concluded by a test, to assess trainees' acquisition of knowledge, and an evaluation of the course by participants. This will be followed by one session of feedback on the tests and the evaluations.

The ASIS will be implemented in collaboration with the State Hydrometeorological Service. FAO will provide technical assistance to install the system and the required training for staff, which will include

[19] The main criteria for beneficiary selection may consider those households that possess no more than 2 ha, with losses of maize production of over 70 percent, and with prepared land ready to plant maize seed. The additional criteria may include: a) loss of livestock and fodder crops; b) families with at least one child younger than 5; and c) rural families with at least one disabled member.

[20] With an average yield of 5 tonnes per hectare and a market price of USD 250 per tonne.

installation, calibration, operation, interpretation of the different vegetation indices, and maintenance of the system. FAO also will provide the historical satellite archive (1984–present). This 30-year record guarantees that the time series contains an extreme drought event, which is not necessarily the case for shorter time series. FAO also will supply update images every 10 days through file transfer protocol (FTP) and will also explore the possibility of making ASIS outputs available through State Hydrometeorological Service map rooms.

Budget

The project's overall implementation will be coordinated with MARDE, in conjunction with assistance from local NGOs and local public authorities for beneficiary identification and seed distribution

Description	Unit	Quantity	Unit cost	Total cost (USD)
Project personnel				**161 900**
International staff				
FAO programme coordinator/agronomist	person month	**10**	**7 500**	**75 000**
Consultant on crop assessment	Daily rate	**70**	**450**	**31 500**
GIS and ASIS calibration	Daily rate	**70**	**350**	**24 500**
National staff				
National agronomist	person month	**10**	**1 300**	**13 000**
National agro-meteorologist	person month	**3**	**1 300**	**3 900**
National programme assistant	person month	**10**	**800**	**8 000**
National programme driver with car	person month	**10**	**600**	**6 000**
Travel				**14 420**
International				
Flights for two people	round trip	**2**	**1 000**	**2 000**
DSA for two people	days	**40**	**198**	**7 920**
Technical backstopping mission	person month	**0.5**	**5 000**	**2 500**
National staff	person month	**10**	**200**	**2 000**
Expendable equipment				**856 500**
Maize to cover 5 000 sq. m	Mt	**500**	**1 713**	**856 500**
Non-expendable equipment				**6 500**
Server and other IT resources	item	**1**	**5 000**	**5 000**
Computer	item	**1**	**1 500**	**1 500**
Contracts				**25 000**
Letters of agreement with implementing partners for (i) distribution, (ii) training and (iii) monitoring activities	per beneficiary	**50 000**	**0.5**	**25 000**
Distribution				**16 000**
Transport 300 km/tonne	region	**9**	**1 500**	**13 500**
Warehouse (including loading, unloading and storekeeping)	tonne	**250**	**10**	**2 500**
Training				**16 250**
In-country trainings, workshops and study tours	per beneficiary	**25 000**	**0.25**	**6 250**
In-country trainings on crop assessment and ASIS	item	**2**	**2 500**	**5 000**
Opening and closing workshops	item	**2**	**2 500**	**5 000**
General operating expenses				**13 757**
Project operational costs in the field				**13 757**
Technical support services				**42 219**
Standard reporting costs				**2 700**
TSS LTO (OCB)	days	**10**	**909**	**9 090**
TSS (EST/GIEWS) - data processing and distribution	days	**10**	**750**	**7 500**
Technical support and supervision				**22 929**
TOTAL				**1 152 546**

Annex 3. Project concept note: Mainstreaming disaster risk reduction into community agriculture development through Farmer Field School (FFS) demo plots.

Objective	To support the establishment of a community-based agriculture disaster risk preparedness and awareness system to improve the technical capacities of farmers by promoting climate-smart agriculture technologies and knowledge transfer through Farmer Field School demo plots.
Beneficiaries	60 identified disaster risk vulnerable communities in the central and southern regions of the Republic of Moldova
Partners	Government at central and local levels, United Nations agencies, donors, NGOs
Duration	2.5 years (starting from July 2021)
Budget	**USD 3 499 200**

Problem statement

Climate changes hits the poorest and most vulnerable people hardest. There is clearly an economic, social and moral imperative to help poor rural people adapt to climate change in a sustainable way. The recent drought – combined with underdeveloped market infrastructure, inefficient supply chains and market distortions – has reduced farm gate prices and, hence, the incomes of rural households. The extreme climatic conditions experienced in the Republic of Moldova in 2020 confirmed clearly that the rural sector is the most vulnerable part of the national economy.

The severity of the situation following the 2020 drought has shown that the rural livelihoods system in the Republic of Moldova is not capable of recovering from such crises without external support. This, in turn, has exacerbated the already difficult living conditions of the rural population, already disturbed by COVID-19. The 2020 Moldovan drought assessment mission team recommendations for medium-term activities underline that there is a need to design and implement a set of measures to build up the necessary coping mechanisms, to improve the resiliency of the existing system of agriculture production and rural livelihoods, and to better prepare for further droughts and extreme weather events.

Justification

For more sustainable, climate-resilient agriculture development, it is essential to establish institutional mechanisms to promote climate adaptation strategies for transforming the agricultural and rural sector from a subsistence orientation to a more diversified orientation that will support the better integration of agriculture sectors into climate change policies, plans and strategies.

It is essential to support enhancing the knowledge and methodological capacities of rayon agriculture officials by strengthening the analysis and provision of climate-related data for early warning, on one hand, and to improve the technical capacities of farmers to another hand.

Main objective

The main objective of the project is to support the establishment of community-based early warning and agriculture disaster risk reduction systems to contribute to the prevention and mitigation of potential negative consequences of climate change, including future droughts and other natural disasters, through building community capacity to mainstream disaster risk reduction into community agriculture development.

Specific objectives

This project focuses on assisting the poorest Moldovan citizens by responding to the priorities established in the regional development strategies. It will support the achievement of the Sustainable Development Goals and other goals set forth in the draft national development plan.

In this respect, to increase the resilience of rural communities to climate change through community empowerment, the diversification of rural livelihoods and the promotion of partnerships in agriculture and rural development, the project specific objectives and interventions are presented as follows:

- Increase the levels of understanding of early warning systems and improve opportunities to respond to climate change and to reduce the level of risk associated with extreme weather conditions by developing specific regional and community programmes that focus upon appropriate and good practices.
- Strengthen the capacity of local administration via facilitating the participation of local communities in early warning and disaster risk reduction actions.
- Improve the technical capacities of farmers by promoting climate-smart agriculture technologies through Farmer Field School demo plots.
- Support the identification and implementation of demand-driven community agriculture development projects focused on disaster risk mitigation and reduction.

Project input

Farmers should be further assisted with educational and awareness-raising technical support on improved climate-smart agriculture practices and crop management for drought-prone areas by introducing drought-resistant varieties of main cereal crops and kitchen garden vegetable production, that includes water accumulation and drip irrigation technologies, as well as small-scale silage production, in addition to the sustainable use of already existing resources.

Actions plans for timely response, with clearly set intervention thresholds, should complete the preparedness system for MARDE and the local authorities, entirely with appropriate monitoring and evaluation mechanism.

Expected outcome:

The project will strengthen the capacities of local public administrations to support the building of community competence regarding early warnings and to mitigate the future impacts of natural disasters.

The project will undertake social mobilization and the formation and support of community organization mechanisms to improve disaster risk reduction. It will provide assistance, both technical and financial (in terms of small grants), to community-led development projects, considering the agriculture initiatives reducing the disaster risk. The project will develop capacities among community members for sustainable local development processes. The project will seek to facilitate collaborative relationships among members of the community, civil society, the private sector and representative local authorities.

To support climate-smart agriculture development, the project will:

- serve as a pilot/demonstration project that can be replicated by other communities;
- contribute to strengthening participatory governance;
- be financed primarily through public–private partnership, a cost-sharing arrangement between beneficiaries, partner communities/municipalities/rayons, and other public and private sponsors;
- be feasible (technically, socially, economically environmentally);
- improve local living conditions;
- be sustainable in that the beneficiaries can and will maintain the project's continuation; and

- address the actual needs of community-based disaster rick reduction via environmentally friendly agriculture development.

Project targeting and beneficiaries:
The project will target 60 rural communities of three regions, based on the deprivation index and the recent 2020 drought-affection rate. Approximately 120 officials and representatives of farmers' associations, local public administration and the private sector and 1 800 villagers in drought-affected communities will benefit from project activities.

Indicative activities
The project will develop capacities among community members and local authorities for community-based early warning systems and agriculture disaster risk reduction mechanisms to identify and prioritize major hazards and to establish preparedness measures that will contribute to the development of strategies to address identified problems, mobilize resources to implement community development projects, and sustain the outputs. The project will seek to facilitate collaborative relationships among community members, civil society, NGOs, members of the private sector and representative local authorities.

Step 1. Provide training, capacity development and transfer of knowledge for ministry officials, local public administration and community actors

i) Organize national and local training and workshops for the main actors on early warning and agriculture disaster risk reduction.
ii) Elaborate community disaster risk reduction and early warning system development modules.
iii) Develop and conduct awareness-raising and training activities on positive parenting practices based on rights and responsibilities.

Step 2. Target communities mobilized for community-led development

i) Conduct train-the-trainers courses for facilitators on early warning system and disaster risk management and develop planning processes.
ii) Organize community meetings to sensitize communities on disaster risk reduction and early warning systems. Special attention will be paid to information collection, management, analysis and the relationship of community-based disaster risk reduction with food security and poverty reduction.
iii) Establish action groups at the local level to ensure the representative membership of community organizations and groups (women, youth, civil society, media and the private sector) through awareness-raising, coordination and planning activities.
iv) Provide basic equipment and library for community information/support centres.

Step 3. Support the development of an information, monitoring and evaluation system to be managed locally, based on indicators

i) Select/elaborate/adjust the methodology for community-based monitoring and evaluation.
ii) Implement methodologies for a community-based monitoring and evaluation system, including an elaboration of indicators, the collection of information, and the use of the results of monitoring and evaluation for decision-making.
iii) Review results and formulate proposals for further capacity development.

Step 4. Improvement of the technical capacities of farmers by promoting climate-smart agriculture technologies through Farmer Field School demo plots, particularly:

i) crop management for drought-prone areas, by introducing drought-resistant varieties of winter wheat, barley, oats and shorter vegetation hybrid maize;

ii) kitchen garden vegetable production by using water accumulation and drip irrigation technologies;
iii) training of farmers in water-saving and energy-efficient irrigation technologies by demonstrating modern small-scale sprinkler and drip irrigation technologies, such as hand-moved, linear and centre pivot sprinkler irrigation systems;
iv) integrated pasture management demo plots; and
v) training and practical exercise on small-scale silage production.

Step 5. Ensure coordination and coherence in approaches to community development by all partners.

i) Support workshops and meetings for decision makers from different ministries, districts and partners to develop and update criteria for the selection of needy districts and communities.
ii) Support meetings between national NGOs, concerned ministries and institutions to sustain a network on community-based development.
iii) Support meetings and workshops to review and harmonize early warning/disaster risk management and development concepts to develop a Moldovan common approach to community development.

Tentative budget

No.	Activities	Cost estimate (USD)
1.	Project formulation mission, project proposal and approval	50 000
2.	Target communities mobilized for community-led development	150 000
3.	Provide training, capacity development and transfer of knowledge for community actors	80 000
4.	Support the development of an information, monitoring and evaluation system to be managed locally and that is based on indicators	60 000
5.	Improve the technical capacities of farmers by promoting climate-smart agriculture technologies through Farmer Field School demo plots	1 800 000
6.	Evaluate and identify project initiatives for support and initiation	600 000
7.	Ensure coordination and coherence in approaches to community development by all partners	50 000
8.	Project implementation staff	450 000
9.	General operating cost in the field (3 percent)	97 200
10.	Technical support service, backstopping and reporting cost (5 percent)	162 000
	Total	3 499 200