

# Climate-Smart Agriculture in Moldova



## Climate-smart agriculture (CSA) considerations

**P** Agriculture is a mainstay of Moldova's economy. Despite the highly fertile soils, agricultural productivity and yields are constantly threatened by natural hazards such as drought, hails, frosts, severe storms, which multiply already existing processes of land degradation and erosion and volatile market conditions.

**P** Water resources for agriculture are scarce, and irrigation infrastructure is almost inexistent among small-scale farmers. Projections on climate change, manifested through increased rainfall variability and overall drop in rainfall, show an increased demand for irrigation water and a decline in available surface water resources. To sustain livelihoods and overall productivity, CSA investments would, therefore, need to target the development and accessibility of both irrigation and water treatment infrastructure, while improving water-use efficiency through adequate production technologies and knowledge capacity.

**P** Climate change is also expected to reduce crop yields across the three agro-ecozones by 10–30% by 2050 (relative to 2013 yields), considering no adaptation measure and given the current water challenges. However, higher temperatures could shift grape cultivation towards the country's northern border and may improve grape quality, by increasing sugar content, which could significantly boost wine quality.

**P** Conservation agriculture techniques, micro-irrigation systems, anti-hail and anti-frost systems, and investments in improved pastures are some of the key practices that farmers in Moldova are implementing in response to these climate and environmental threats.

**P** Despite the significant benefits of CSA practices to productivity, resilience, and mitigation objectives, many small-scale farmers are still reluctant to such investments.

**M** Limited access to relevant technical assistance and to adequate financial resources, insufficient water resources and technologies for irrigation are some of the main barriers to adoption of CSA practices. Moreover, long-term benefits from investing in CSA are generally unknown to farmers, which makes them skeptical about new agricultural paradigms.

**I** Developing policy and institutional mechanisms to deliver relevant extension and financial services to farmers in a timely and effective manner is key for developing a climate-smart agricultural sector in the country. A first step toward this is strengthening the early warning, weather, and hydrological information systems, accompanied by public-private mechanisms of compulsory insurance against natural hazards, accessible to small-scale farmers.

**I** Rural infrastructure development could help re-emphasize the importance of agriculture as an economic activity, especially since rural areas are the main providers of food for urban populations, and could bring a new agricultural development paradigm, where farmers and investors would have more incentives to invest into long-term solutions to climate-related threats.

**A** Adaptation      **M** Mitigation      **P** Productivity  
**I** Institutions      **F** Finance

The climate-smart agriculture (CSA) concept reflects an ambition to improve the integration of agriculture development and climate responsiveness. It aims to achieve food security and broader development goals under a changing climate and increasing food demand. CSA initiatives sustainably increase productivity, enhance resilience, and reduce/remove greenhouse gases (GHGs), and require planning to address tradeoffs and synergies between these three pillars: **productivity, adaptation, and mitigation** [1]. The priorities of different countries and stakeholders are reflected to achieve more efficient, effective, and equitable food systems that address challenges in

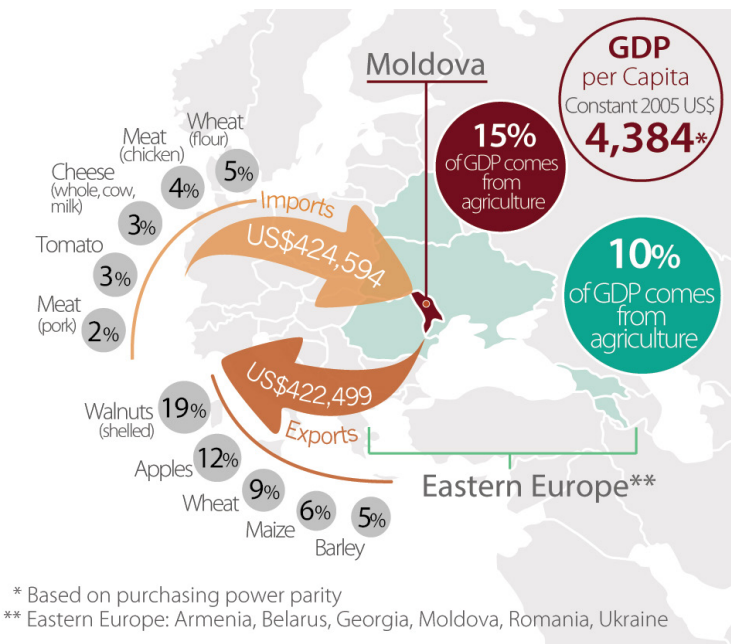
environmental, social, and economic dimensions across productive landscapes. While the concept is new, and still evolving, many of the practices that make up CSA already exist worldwide and are used by farmers to cope with various production risks [2]. Mainstreaming CSA requires critical stocktaking of ongoing and promising practices for the future, and of institutional and financial enablers for CSA adoption. This country profile provides a snapshot of a developing baseline created to initiate discussion, both within countries and globally, about entry points for investing in CSA at scale.

# National context

## Economic relevance of agriculture

The Republic of Moldova is a small-sized, landlocked country in Eastern Europe, with a total land surface of 33,846 square kilometers and a population of 3.5 million. Agriculture is a mainstay of the national economy, contributing approximately 14.5% of Moldova's total gross domestic product (GDP)<sup>1</sup> [4] and employing less than a third (28%) of the country's population, half of which are women [5]. Approximately 70% of the population from rural areas depends on agriculture for their livelihoods [6]. Agro-food exports account for roughly 50% of the country's total exports.<sup>2</sup> Leading agricultural unprocessed export commodities are: walnuts, apples, wheat, maize, and barley [5]. Imports of wheat (flour), meat, dairy, vegetables (tomatoes) used for both human and animal consumption are meant to compensate for the agricultural production deficit.<sup>3</sup>

## Economic relevance of agriculture in Moldova [4, 5]



## People, agriculture and livelihoods in Moldova [4, 5, 8, 9, 10, 11, 12]

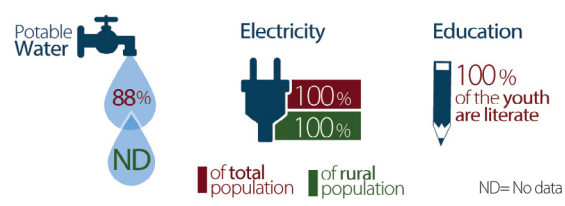
### Demographics



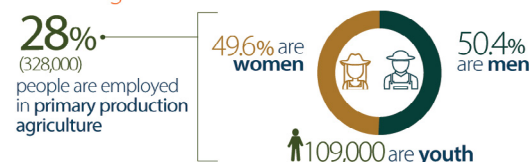
### Distribution of wealth (Index)



### Access to basic needs



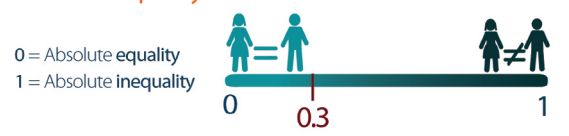
### Jobs in agriculture



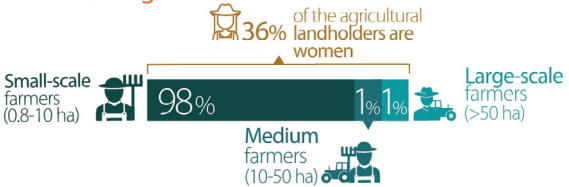
### People living below



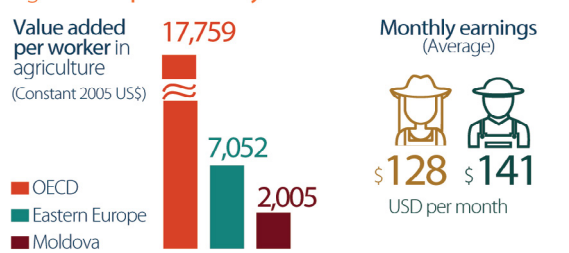
### Gender inequality (Index)



### Land holding



### Agriculture productivity and incomes



- Based on 2010–2014 averages, the agricultural GDP has declined significantly from the period of transition to independence (33% in 1995) due to a fragmentation of agricultural land, which influenced the economic efficiency of land, the inability of implementation of modern soil tillage technologies in conditions of small-sized farms, to obsolete or unproductive agricultural machinery, and lack of management, economic, and technological knowledge/training among farmers [3].
- During 2000–2011, the majority of agricultural products were exported to Russia, Ukraine, Belarus, Romania, and Germany. In 2014, the European Union and Moldova signed an Association Agreement that introduces a preferential trade regime – the Deep and Comprehensive Free Trade Area (DCFTA). Within the last 2 to 3 years, the export trade balance has been changing in favor of EU countries [7].
- Most of the Durum wheat (*Triticum durum*) is produced in quantities far from sufficient, therefore, the majority of products containing *T. durum* are imported. The deficit of meat and dairy products is also covered by imports. Vegetables are imported during the cold season due to the high energy costs for heating greenhouses [6].

## Land use

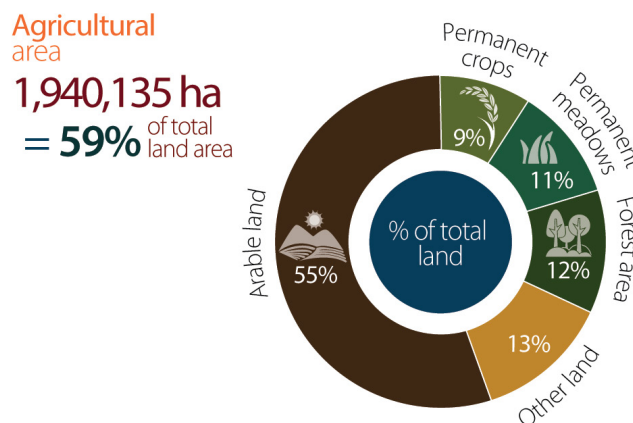
Agricultural land in Moldova constitutes approximately 59% (2 million hectares) of the country's total land area, of which 55% is arable land for annual crop production (maize, wheat, sunflower, barley, oilseed, soybean, sugar beet). The highly fertile black chernozem soils,<sup>4</sup> concentrated primarily in the North and the Dniester River Valley, offer adequate conditions for carrying out farming activities, especially the production of cereal grains, maize, fruits, and vegetables, among others. However, during the past decades, soils have degraded and eroded as a result of land fragmentation and low capacity of land management, inadequate practices that affect soil health (especially tillage), overgrazing, illegal logging of protective forest belts, including forests, and general inefficiencies in land-use planning, including crop rotation. Inappropriate storage and use of agrochemicals and manure and inadequate nutrient management practices have contributed to polluting surface and groundwater sources and even to increases in the agricultural sector's contribution to national GHG emissions (through inadequate management of nutrients and soil tillage mainly) [13].

In Moldova, most farmers (97.7%) are small-scale,<sup>5</sup> with farm sizes ranging between 0.85 and 10 hectares. The majority of them lease the land for three-year periods to private or corporate entities or leave it as fallow. Those who cultivate land usually grow sunflower, wheat, maize, vegetables, and orchards, characterized by low yields and high production costs. The harvested production is typically designed for animal feed and sale in unprocessed/raw form on the local market in order to cover production costs. In the Central and Southern Zones of Moldova, small-scale farmers are engaged in growing wine grapes, which they deliver to wineries. Only a small amount of small-scale farmers cultivate value-added crops, such as potatoes, strawberries, and raspberries.

Medium-scale farmers (10–50 ha) usually cultivate wheat, maize, sunflower, soybean, including perennial crops, fruits, table and wine grapes. They supply the majority of vegetables used in the processing industry. Large scale farmers cultivate field crops including sugar beet, orchards and vineyards (table and wine grapes) on areas larger than 50 ha. The application of advanced technology enables them to obtain higher yields per hectare compared to small- and medium-scale farmers.

Around 36% of the farmers are women who head 19% of the total agricultural farms in the country (425,324 ha). Women-headed farms are on average 0.81 ha in size. Men head 81% of the farms (1,818,216 ha, 1.2 ha on average per farm) and they outnumber women in terms of access to agricultural technology (women farmers own less than 12% of the existing agricultural machinery in the country)

## Land use in Moldova [5, 10]



and number of livestock heads owned (especially pigs and poultry). Most women-headed farms are dedicated to the cultivation of cereal crops (57%), industrial crops (26%), root crops for forage (3%), potato (2%), vegetables (2%), and other crops (8%) [10].

## Agricultural production systems

Three main agro-ecological zones (AEZs) can be found in Moldova: (i) the *Northern Zone* – along the Dniester River, also known as the forest-steppe, with high productivity rates for forages, pastures, and livestock, but also suitable for crops, such as maize, wheat, sunflower, soybean, barley, sugar beet, and pea, among others; (ii) the *Central Zone* – a hilly and forested area best suited for perennial crops (vineyards, orchards); and (iii) the *Southern Zone* – a mix of hills and plains which, due to higher temperatures and low rainfall, is less suitable for agricultural production<sup>6</sup> (Annex 1).

About 65% of the cropland is dedicated to wheat (for animal and human consumption) and maize cultivation (mostly for animal feed and export), followed by wine and table grapes, fodder plants (maize, wheat, barley, soybean, and sunflower meal), potatoes, apples, plums, peaches, and walnuts, among others. Vegetable production has declined significantly over the past years, as a consequence of low export market diversification and low adoption of new market production requirements, insufficient investments in capacity development of vegetable growers (technology development, production mechanization and procurement of production), natural hazards and absence of climate risk mitigation measures (irrigation systems, etc.).

<sup>4</sup> Black soils cover 75% of the country's territory.

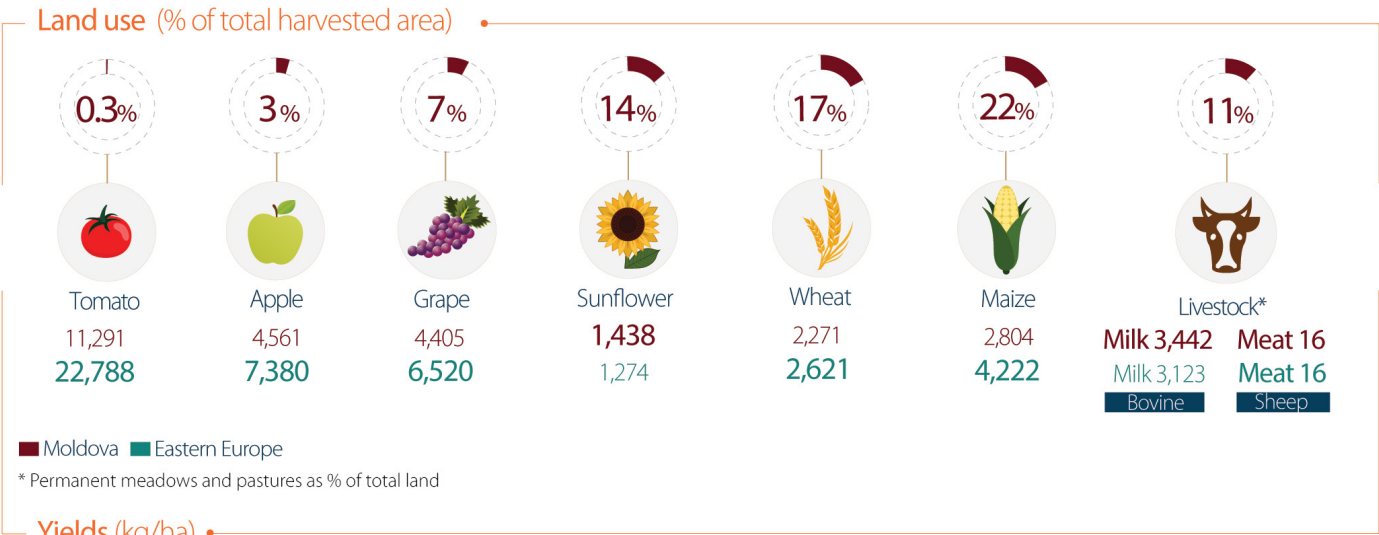
<sup>5</sup> After formally declaring independence from the Soviet Union in 1991, Moldova embarked on a process of de-collectivization, which meant the breakdown of collective and state farms and the formation of individual households on the basis of private ownership of land. As a result of excessive fragmentation of privately owned agricultural land, new types of corporate enterprises appeared (stock companies: cooperative of agricultural production, state enterprises, limited-liability companies) as well as small-scale farms [3].

<sup>6</sup> However, perennial and cereal crops, such as wheat, barley, and maize can still be found in this agro-ecological zone (AEZ).

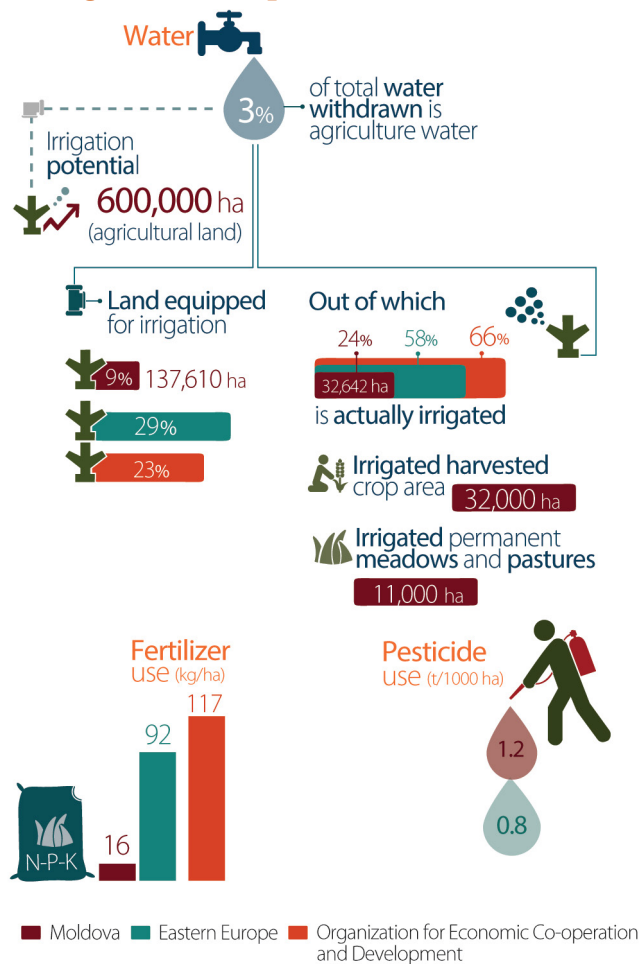
The following infographic shows a selection of agriculture production systems key for Moldova’s food security. The importance is based on the system’s contribution to economic, productivity, and nutrition quality indicators. For more information on the methodology for the production system selection, consult Annex 2.

Agricultural production yields, lower than the average yields in the region, are generally affected by natural hazards (drought, hails, frosts, severe storms, and in some cases floods), low level of knowledge among farmers, insufficient technical and technological level.

### Key crops for food security in Moldova<sup>[5]</sup>



### Agriculture input use in Moldova<sup>[4, 5]</sup>



### Food security and nutrition

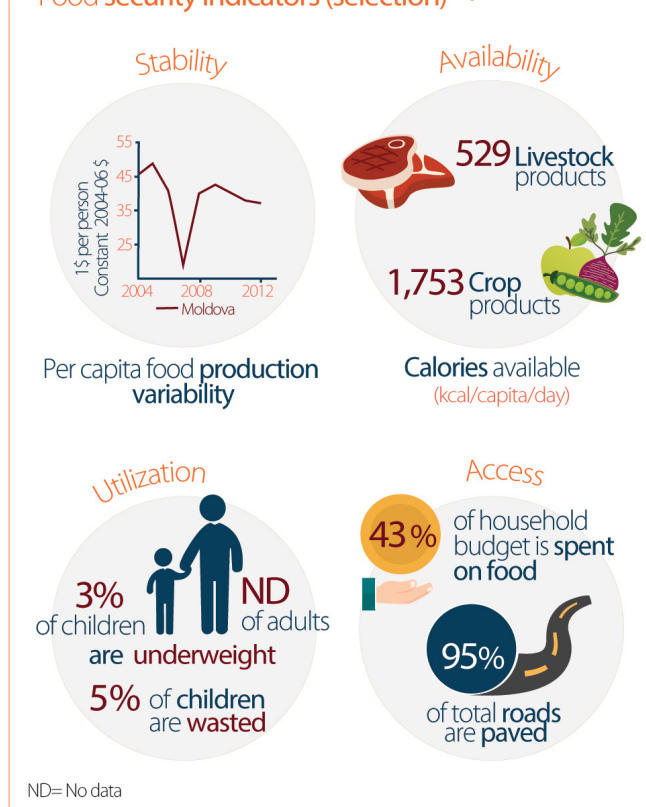
Malnutrition levels among the Moldavian population are low in all categories: stunting, wasting, underweight. Food insecurity is not a major challenge for the country, but can still be felt in low-income households, when high production and price volatility affect food availability and access. Research has shown that, overall, food insecurity is highest during the off-season (January-June) and increases with household size. Most food-insecure households are men-headed and located in vulnerable urban areas [14, 15].

### Food security, nutrition, and health in Moldova<sup>[5, 16, 17, 18]</sup>





## Food security indicators (selection)



## Health

### Access to clean energy sources

91% of the population has access to clean energy sources (non-solid fuels) for cooking

### Child Mortality rate

Under-five mortality rate (per 1,000 live births): 16

### Adolescent fertility rate

23 births per 1,000 women, ages 15-19

### Prevalence of HIV infections

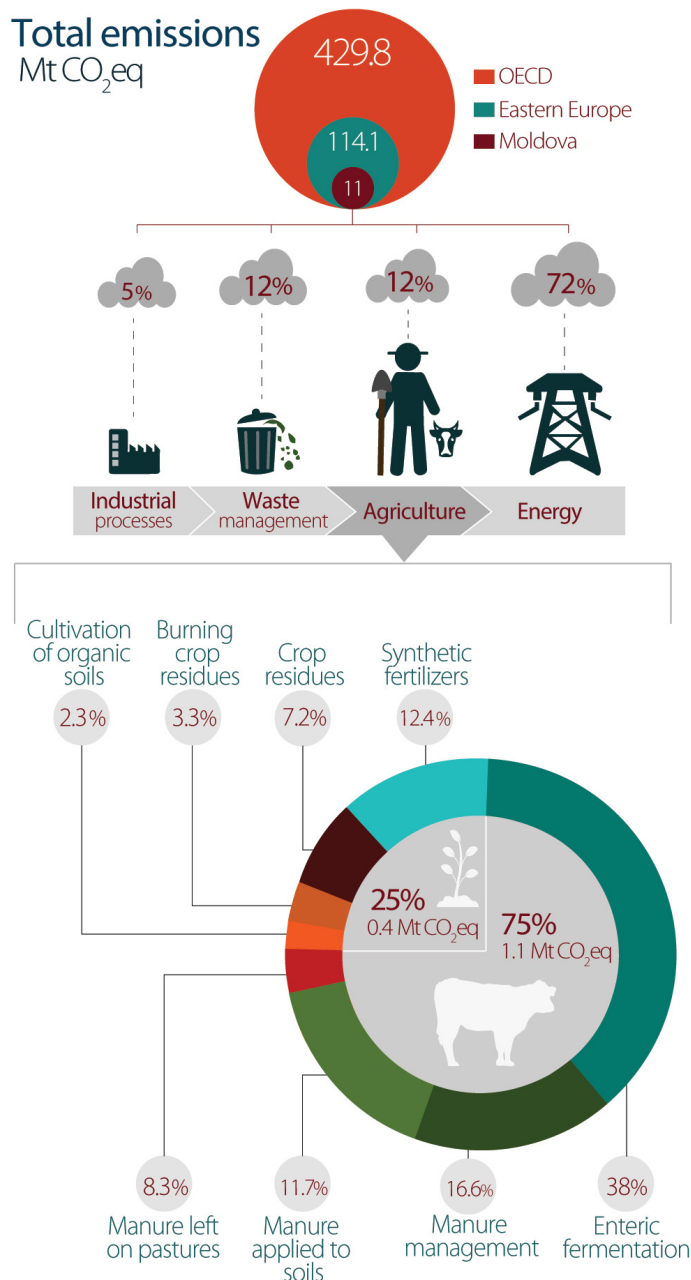
0.6% people infected with HIV

## Agricultural greenhouse gas emissions

Greenhouse gas emissions in Moldova average 10.8 Metric tons CO<sub>2</sub> equivalent (Mt CO<sub>2</sub> eq), much less than the average emissions in Eastern Europe and OECD countries. Approximately 71.7% of the country's emissions are attributed to the energy sector, while agriculture, waste management, and industrial processes contribute 11.6%, 11.5%, and 4.9%, respectively, to the total emissions [19]. Most agricultural emissions come from livestock production.

The integration of livestock and agriculture sectors is key for ensuring climate change mitigation benefits. Any improvement in agriculture land management, such as conservation agriculture and improved pastures, will protect below-ground carbon stores, contributing to climate change mitigation. A significant mitigation potential of the agricultural sector could also be achieved in the forestry sector, through reforestation, improved forest management practices, and reduced rates of illegal logging [20].

## Greenhouse gas emissions in Moldova [5, 19]



## Challenges to the agricultural sector

A number of challenges hamper the efficiency and productivity of the country's agricultural sector.

**Water resources.** The total available water resources in the country amount to 5.6 km<sup>3</sup>, including 4.3 km<sup>3</sup> of surface water and 1.3 km<sup>3</sup> of groundwater.<sup>7</sup> The main groundwater reserves are located in deep confined aquifers,<sup>8</sup> whose natural recharge capacity is limited [21]. Irrigation has been considered a valuable measure to mitigate drought risk, increasing yield by 25–50% in normal years, while avoiding losses in drought years. Irrigated land has diminished drastically compared to the Soviet period, due to the aging and deterioration of the equipment, the rising cost of energy for the pumps, the farm restructuring process – older pumping systems not adapted to the new size of plots – and the overall collapse of the agriculture sector since the 1990s. Water resources for agriculture are scarce, and irrigation infrastructure is almost inexistent among small-scale farmers (high costs especially). Due to the uncontrolled use of water from wells and short boreholes for irrigation in households and small farms, the water table depth in these aquifers has dramatically increased, leading to the depletion of aquifers in many regions of the country [22].

**Water quality.** Even though water resource quality has improved since 1990,<sup>9</sup> some of the inner rivers, especially in the southern region, have high salt content, making waters unsuitable for direct use. Moreover, water quality in wells does not comply with the national standard for drinking water due to excessive water hardness and concentration of nitrates. Approximately 12% of the total population has no access to potable water [4], which is primarily polluted by nutrient runoff from farm fields, storage and use of manure, agrochemicals, and waste [23].<sup>10</sup>

**Erosion.** Water and wind erosion are on-going processes that cause significant damages to agriculture in Moldova. About 43% of the agricultural land is eroded to some degree, with about 6.4% considered highly eroded (up to 30 tons of soil loss per hectare). The eroded area increases by about 7,700 ha per year on average. Landslides are most common during winter and spring months, as a result of increased rates of precipitation, snow melt, and soil saturation, and can be triggered by intensive agriculture and deforestation that lead to compaction, subsidence, and rising groundwater [24].

**Forest cover and illegal logging.** Moldova is the least forest-covered country in Europe. The inadequate forest management<sup>11</sup> in the past caused a decline of forest quality,

increased vulnerability to pests and diseases, and decrease in biodiversity. Despite afforestation activities conducted between 2002 and 2008, the country still has a very low level of forest cover (12% of the country's land area), which explains in part the frequency and severity of soil erosion, flood, and landslide events [25].

**Overgrazing.** The unauthorized and often uncontrolled grazing has a negative impact on pastures. The area under improved pastures is six times lower than the number of livestock heads in Moldova (625,000 heads), which increases pressure on improved pastures [21].

**Social and economic vulnerability.** Overall poverty rates in Moldova have decreased significantly, from 26% in 2008 to 11.4% in 2014. Yet, Moldova remains one of the poorest countries in Europe and faces challenges in sustaining the progress. Poverty is most severe in rural areas. Low wages, limited numbers of jobs, natural hazard shocks, and poor infrastructure and livelihood conditions in rural areas have led to rural-urban migration. Moldovan labor markets contributed to a decline of poverty, but mostly through productivity increases rather than job creation – in fact, employment has steadily declined.

**Technological investments and added value.** Between 1995 and 2007, the total area of orchards and vineyards decreased by 30% and 20% respectively, while the grain land area increased from 50% of the total area of crops in 1994 to 65% in 2004. These developments are a consequence of farmers' decreasing incomes, since they cannot finance needed investments in higher value-added crops. High value-added crops require more sophisticated technologies and better protection against unfavorable climate conditions [21].

## Agriculture and climate change

Moldova's climate is characterized by warm summers and dry and mild winters. Both intense periods of rains and long dry periods are common in the summer [26]. Around 90% of crop production in the country is rain fed, which makes the agricultural sector highly vulnerable to changes and climate variability.

Drought is a major risk in the country, with an estimated annual loss in crop production of US\$20 million, assuming catastrophic drought effects every 7 years [27]. It is also a major determinant of human development in Moldova, and can compromise progress in health and nutrition due to the dependency of the majority of the country's population on agricultural income. Between 1990 and 2015, 11 droughts (especially in late summer) were registered in Moldova.

7 Surface waters are represented by Nistru and Prut River Basins, inland rivers and natural lakes, and manmade reservoirs. Reservoirs in the northern and central regions play the role of seasonal regulation of water, while in the South they mainly serve for inter-annual distribution due to the region's greater water deficit.

8 There are approximately 7,000 boreholes for groundwater withdrawal.

9 A lower use of water for agriculture and industry has been observed ever since.

10 Groundwater is the main source of drinking water for more than 50% of the population [23].

11 Wood illegally logged in Moldova between 2009 and 2014 amounted to 142,300 cubic meters, of which 24.6% was logged in state-managed forests. The total amount of revenue loss was over 10 million Moldovan lei.

In 2007’s catastrophic drought, 90% of the country’s territory and 80% of the rural population that depended on agriculture was affected by the reduced harvest. The savings and incomes of the rural population were lost, with total losses amounting to US\$1 billion [28]. The average annual income from agricultural activity in 2008 was 19% lower than in the previous two years [6]. The 2012 drought severely affected crop production in the Central and Southern AEZs: winter wheat crop yields decreased on average by 16% compared to 2009–2011 yields (31% decrease in the Southern AEZ); maize yields decreased on average by 30% (86% in the South and 49% in the Central AEZ); sunflower yields decreased on average by 41% (88% in the South and 51% in the Central AEZ) [7].

Additionally, Moldova is also affected by hail events, given the country’s location between the Black Sea and two mountain ranges. Hail tends to cause severe localized yield losses. For instance, crop yield losses amounted to 70–100% in April 2016 in the Stefan Voda raion. About only

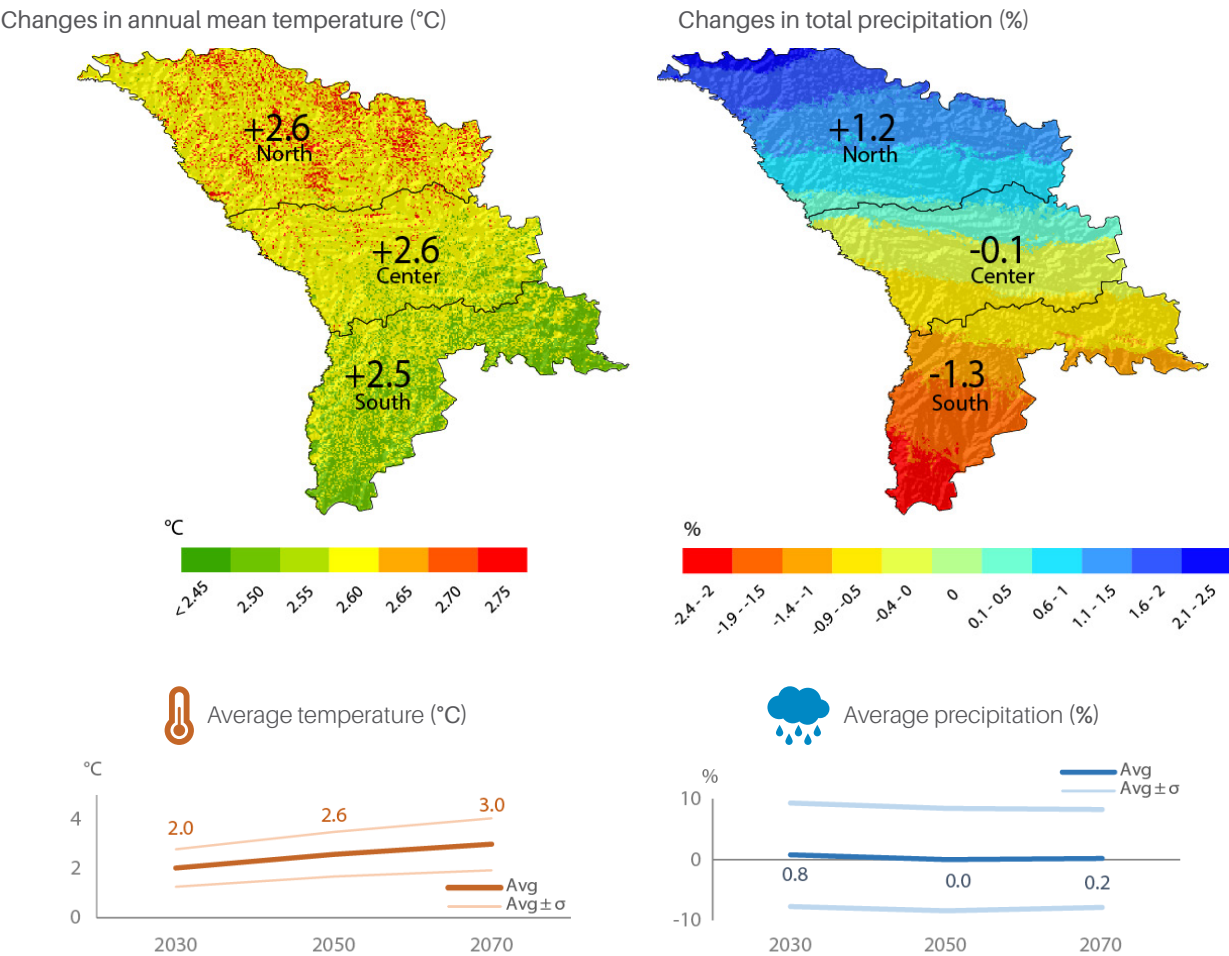
50% of the agricultural land is protected by anti-hail rocket systems located on the North and South regions.

Scientists and farmers have observed increased temperatures and dry spells over the past years.<sup>12</sup> Some of the main trends are discussed below.

*Temperature:* Annual mean air temperature in Moldova will increase under both emissions scenarios. By the end of this century, the increase may amount, on average, to 4.1–5.4 °C. Depending on the GCM experiment, these values vary from 1 to 6 °C. Moldova expects maximum warming in winter and in transition seasons (See Annex 4).

*Precipitation:* For the time horizons 2010–2039 and 2040–2069, precipitation is projected to decline by 9 mm and 38 mm, respectively. Winter and spring precipitations are projected to increase slightly. On the whole, Moldova will face warmer and wetter winters but hotter and drier summers and autumns.

**Projected changes in temperature and precipitation in Moldova by 2050** [29, 30, 31]



12 The climate projections for Moldova are based on a range of recent coupled atmosphere-ocean General Circulation Models (GCMs). Such models are used as a research tool for studying and simulating the climate, and for operational purposes, including monthly, seasonal, and inter-annual climate projections. The results of six GCM experiments based on the A2 and B2 marker scenarios of the Special Report on Emissions Scenarios (SRES) for three time slices (2010–2039; 2040–2069; 2070–2099) served as a basis for downscaling [18].



*Extreme weather events:* Heavy rainfall is expected to increase in frequency. In summer, the frequency of wet days is projected to decrease, but the intensity of extreme events is projected to increase, causing flash flooding, erosion, affecting slope stability and ground water recharge, among others. The frequency and intensity of droughts are also likely to increase, as a consequence of higher temperatures and reduced mean summer precipitation. The longest dry period within a year may be prolonged by one month by the end of the century [18].

*Water resources:* Projections on climate change impacts on water resources show that the two major basins of the country, Nistru and Prut, will experience 15.9%, 36%, and 57.7% decline in available surface water resources by 2020, 2050, and 2080, respectively [18].

*Impacts on agriculture:* Climate change, manifested through heat and water stress, is expected to reduce nearly all crop yields across the three AEZs by 10–30% by 2050 (relative to 2013 yields), if no adaptation measure is taken into account and considering the current water shortage and irrigation infrastructure situation. The predicted increased rainfall variability, and overall drop in rainfall will increase the chances of drought periods and probably reduce agricultural productivity.

Yield projections developed by the International Institute for Applied Systems Analysis (IIASA) for rain-fed wheat show moderate decline in the majority of the country wheat yields for 2025 and severe yield declines of up to 25% for 2050 in the central and southern AEZs (moderate decline in the northern AEZ). The impact on rain-fed maize production is projected to be more severe, with yield declines of up to 25% for the central AEZ by 2025, and almost all of Moldova by 2050. In the case of grape production, productivity will decline by a range of 13–19% and 22–30% by 2010–2039 and 2040–2069, respectively, if no adaptation measure is taken. However, the higher temperatures could shift grapes cultivation towards the country's northern border and may improve grape quality, by increasing sugar content, which could significantly boost wine quality.

The duration of warm temperatures may increase by three to four weeks in the 2020s and by more than two months in the 2080s. The sums of active temperatures (above 10 °C), most important for agricultural crop growth, may increase sequentially by about 13, 28, and 46%. Although these trends may lengthen the periods of vegetation and increase the yields of the plants, the gradual aridity of Moldova's territory may prevent any positive impact on crop production [6].

## CSA technologies and practices

CSA technologies and practices present opportunities for addressing climate change challenges, as well as for economic growth and development of the agriculture sector. For this profile, practices are considered CSA if they enhance food security as well as at least one of the other

objectives of CSA (adaptation and/or mitigation). Hundreds of technologies and approaches around the world fall under the heading of CSA.

In response to increased variability and changes in climate, Moldovan farmers have sought ways of adapting to new conditions, by implementing conservation agriculture techniques, drought-resistant cultivars, irrigation systems, anti-hail service system, ecosystem-based restoration of protective forest belts and pasture lands, among others. While such practices have brought about short-term benefits on their livelihoods, more institutional support for infrastructure investments and incentives for continuing implementing such CSA practices is needed to sustain existing efforts.

The following graphic and Table 1 present a selection of CSA practices with high climate smartness scores according to expert evaluations. The average climate smartness score is calculated based on the individual scores of each practice on eight climate smartness dimensions that relate to the CSA pillars: yield (productivity); income, water, soil, risks/information (adaptation); energy, carbon, and nutrients (mitigation). A practice can have a negative/ positive/ zero impact on a selected CSA indicator, with 10 (+/-) indicating a 100% change (positive/ negative), and 0 indicating no change. Practices in the graphic have been selected for each production system key for food security, as identified in the study. A detailed explanation of the methodology can be found in Annex 5.

This study recognizes the importance of addressing major urgent resource-related problems, such as water shortages (through soil and water conservation practices) to ensure food production and availability. However, it also highlights entry points for more investments in improved efficiency and resilience of livestock systems, through research and promotion of climate-smart practices (such as improved pastures), as well as incentive mechanisms (especially financial and policy support) to enable their adoption by small-scale farmers.

Most practices that stood out in the analysis are a major entry point for adaptation action and aim to facilitate the conservation of water in soils, since the major threat to agriculture production in the country is water shortage, combined with extreme weather events (especially droughts).

An example in this sense is *drip irrigation* for tomato, apples, and grapes, as a water-use efficiency measure. Drip irrigation, adopted by all types of farmers (small-, medium-, and large-scale), brings multiple benefits to adaptation and productivity: increases soil fertility; reduces heat stress, soil erosion and pests and diseases; increases yields and decreases post-harvest loss, and consequently enhances food availability and incomes.

*Conservation agriculture* for maize, sunflower, and wheat production (particularly No-till and Strip-till), stood out as a CSA practice with high potential to help adapt the system to drought conditions and soil erosion, while contributing



to carbon sequestration in soil and reducing CO<sub>2</sub> emissions in the atmosphere.<sup>13</sup> The total area under conservation agriculture has increased from 40,000 to 250,000 ha, whereas the potential area could increase to at least 900,000 ha [32]. The advantages of greater soil health, productive capacity and lower cost of production leads to higher crop yields and greater profit margins and competitiveness from implementing the practice.

Three types of conservation agriculture practices are common to Moldovan farmers: no-till, mini-till and strip-till, distinguished by their level of tillage, production costs per kilogram, and machinery required. For instance, the initial investment for no-till farming is considerably higher compared to mini- and strip-tillage (agricultural machinery), yet the number of agricultural machinery units is lower. Moreover, as a result of reduced tillage and field works, the soil compaction and cost of production per kilogram is lower. Mini- and strip-tillage technology requires a higher number of agricultural machinery and a high-quality GPS signal. As a result of higher level of tillage and number of field works, the efficiency of mini- and strip-till practices to conserve soil and water and to reduce erosion is lower in comparison to zero tillage.

*Organic mulching* has been identified as an efficient water-conservation measure applied mostly to apples and grapes and in combination with nitrogen fertilization. Despite its relatively low adoption levels among Moldavian farmers, due to insufficient knowledge for its correct application, shortage of available biomass, and absence of equipment, the practice can bring important contributions to increasing productivity and system resilience. Organic mulching helps conserve moisture by physically holding it and releasing it slowly to the soil beneath. It can also prevent weed growth and soil compaction, reduce soil erosion, cool the soil surface, and improve soil fertility and quality.

*Greenhouse climate control systems* for tomato production stood out in the analysis as a CSA practice with important benefits on yields and incomes, water and fertilizer use, women employment and reduction of post-harvest losses, given the ability of farmers to control the plants' growing needs year round, thus reducing the impacts of natural hazards. However, the high equipment and energy costs during winter, and weak technical skills among farmers to maintain these systems trigger low to medium adoption rates of the practice among tomato farmers.

The benefits of anti-hail nets to prevent the hail storm damage of apple and grape fruits is widely acknowledged by farmers and experts alike. A short episode of hail during the growing season causes severe injuries to apple and grape plants and fruits, both downgrading the quality and producing entry points for diseases. The use of hail nets can boost yields and incomes, biodiversity, and reduction

of water and fertilizer use, bird-caused damages, and post-harvest losses. However, the anti-hail net is cost effective only for intensive and super intensive use in orchards.

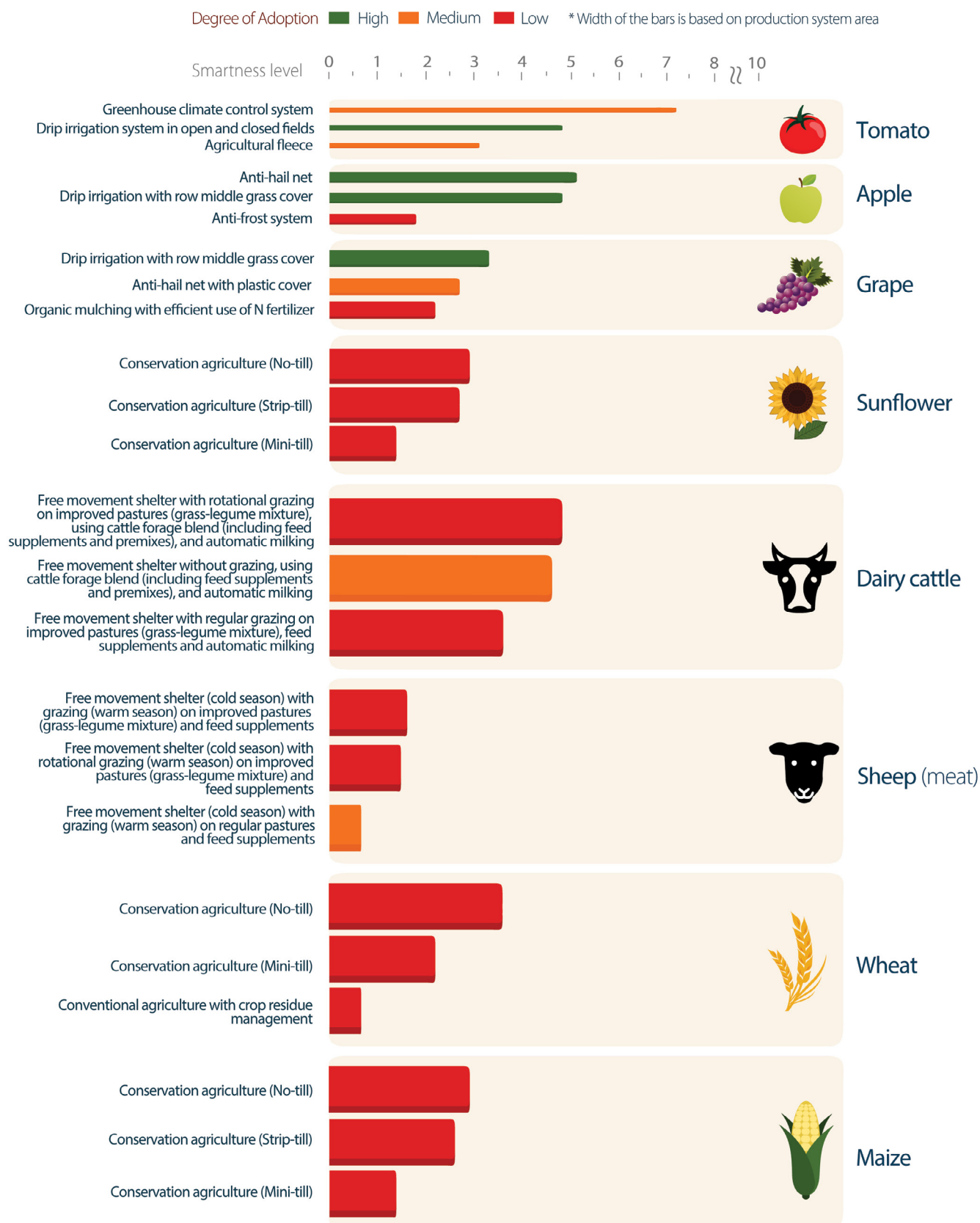
The use of anti-frost systems for apples is most common in the spring and fall seasons, when frost is expected to decrease crop quantity and quality, severely affecting incomes. The application of anti-frost systems in apple orchards provides increases in yield and income, food availability, and biodiversity, and reductions in post-harvest losses. However, the practice has generally low adoption rates among farmers in the country due to high implementation and maintenance costs, low efficiency at low temperatures (-60 °C and below), lack of equipment supply and limited knowledge for implementing the practice.

The use of *agricultural fleece* as a means to protect vegetable crops (tomato, cucumber, ball-pepper, and watermelon) against seasonal frosts is most common among small- and medium-scale vegetable farmers. The practice allows for increases in farmer's profit (yields and income) by up to 150% compared to the situation when the practice is not applied. Agricultural fleece also helps conserve water in soils, reduce weed occurrence, protect plants from pests and diseases, and warm the soil temperature, among others.

*Improved pastures* (for cattle and sheep) is a relatively new practice among Moldavian farmers and experts. Insufficient knowledge and information on how such practices improve efficiency and resilience of the system has been one major reason why livestock-related practices have generally scored low in climate smartness evaluations. While such practices are implemented by some categories of farmers across the three AEZs, their adoption is more arbitrary than systematic and seen as a short-term solution to emerging challenges (floods, drought), rather than as a long-term resilience-building measure. The majority of small-scale farmers use uncontrolled extensive grazing given the low number of livestock heads per farmer (1–2 cows; 15–20 sheep). Moreover, almost all pastures are public property.

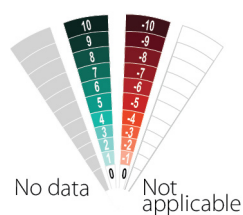
13 This is associated with a decreased fuel use (by 60–70%) and lower fertilizer and pesticide use after 4 to 5 years of implementing the practice.

## Selected CSA practices and technologies for production systems key for food security in Moldova



**Table 1.** Detailed smartness assessment for top ongoing CSA practices by production system as implemented in Moldova.

CSA practice	Region and adoption rate (%) <div>&lt;30 30-60 60&gt;</div>	Predominant farm scale S: small scale M: medium scale L: large scale	Climate smartness	Impact on CSA Pillars
<b>Cattle (milk)</b>				
Free movement shelter with rotational grazing on improved pastures (grass-legume mixture), using cattle forage blend (including feed supplements and premixes), and automatic milking	North-Central and Southern <div>&lt;30%</div>	<div>S M L</div>		<b>Productivity</b> Increase of yield and income. <b>Adaptation</b> Increase of food availability, soil quality, water & fertilizer use, biodiversity, reduction of soil erosion. <b>Mitigation</b> Reduction of GHG emissions and GHG emissions intensity.
Free movement shelter without grazing, using cattle forage blend (including feed supplements and premixes), and automatic milking	North-Central and Southern <div>30-60%</div>	<div>S M L</div>		<b>Productivity</b> Increase of yield and income. <b>Adaptation</b> Increase of food availability, women employment, decrease of biodiversity and pests and diseases, no change of soil quality and erosion, water and fertilizer use. <b>Mitigation</b> Increase of GHG emissions and GHG emissions intensity.
<b>Sheep (meat)</b>				
Free movement shelter (cold season) with rotational grazing (warm season) on improved pastures (grass-legume mixture) and feed supplements	Southern <div>30-60%</div>	<div>S M L</div>		<b>Productivity</b> Increase of yield and income. <b>Adaptation</b> Increase of food availability, soil quality, water and fertilizer use, biodiversity, reduction of soil erosion. <b>Mitigation</b> Reduction of GHG emissions but increase of GHG emissions intensity.
Free movement shelter (cold season) with grazing (warm season) on improved pastures (grass-legume mixture) and feed supplements	Southern <div>&lt;30%</div>	<div>S M L</div>		<b>Productivity</b> increase of yield and income. <b>Adaptation</b> increase of food availability, women employment, decrease of biodiversity and pests and diseases, no change of soil quality and erosion, water and fertilizer use. <b>Mitigation</b> Increase of GHG emissions and GHG emissions intensity.



Yield

Income

Water

Soil

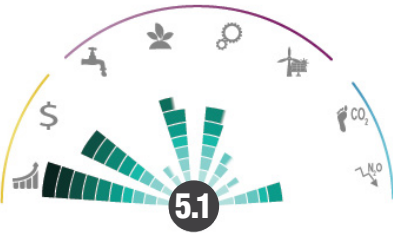

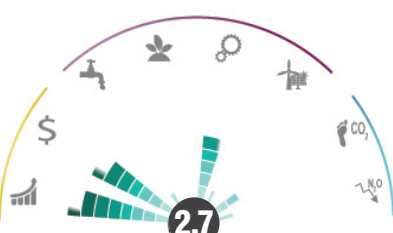


Risk/Information


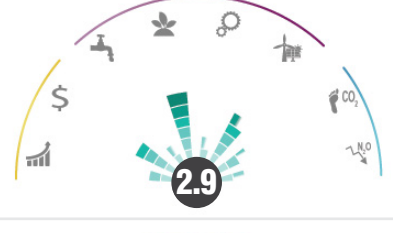
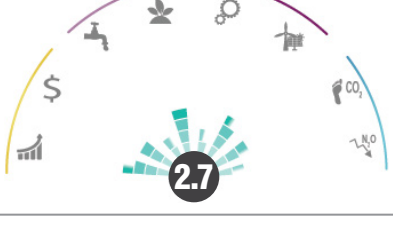

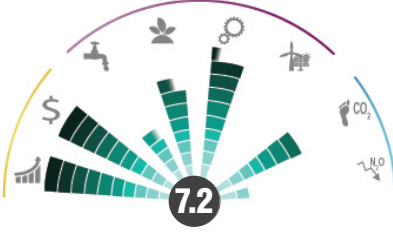
Energy

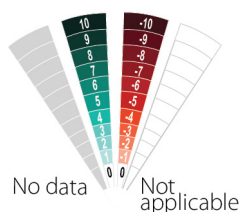
CO<sub>2</sub> Carbon

N<sub>2</sub>O Nutrient



CSA practice	Region and adoption rate (%) <div>&lt;30 30-60 60+</div>	Predominant farm scale S: small scale M: medium scale L: large scale	Climate smartness	Impact on CSA Pillars
<b>Apples</b>				
Anti-hail net	Central, Northern <div>&gt;60%</div>	<div>S M L</div>		<p><b>Productivity</b> Increase of yield and income, reduction of post-harvest losses.</p> <p><b>Adaptation</b> Increase of food availability, women employment, biodiversity, reduction of water and fertilizer use.</p> <p><b>Mitigation</b> Reduction of GHG emissions and GHG emissions intensity.</p>
Drip irrigation with row middle grass cover	Central, Northern <div>&gt;60%</div>	<div>S M L</div>		<p><b>Productivity</b> Increase of yield and income, reduction of post-harvest losses.</p> <p><b>Adaptation</b> Increase of food availability, soil fertility and quality, water and fertilizer use, reduction of soil erosion and pests and diseases.</p> <p><b>Mitigation</b> No change of GHG emissions and GHG emissions intensity.</p>
<b>Grapes</b>				
Anti-hail net with plastic cover	Central, Southern <div>30-60%</div>	<div>S M L</div>		<p><b>Productivity</b> Increase of yield and income, no change of post-harvest losses.</p> <p><b>Adaptation</b> Increase of food availability, water and fertilizer use, reduced pests and diseases.</p> <p><b>Mitigation</b> Increase of GHG emissions and GHG emissions intensity.</p>
Drip irrigation with row middle grass cover	Central, Southern <div>&gt;60%</div>	<div>S M L</div>		<p><b>Productivity</b> Increase of yield and income, reduction of post-harvest losses.</p> <p><b>Adaptation</b> Increase of food availability, soil fertility and quality, water and fertilizer use, reduction of soil erosion and pests and diseases.</p> <p><b>Mitigation</b> No change of GHG emissions and GHG emissions intensity.</p>
<b>Maize</b>				
Conservation agriculture (No-till)	Central, Southern <div>&lt;30%</div>	<div>S M L</div>		<p><b>Productivity</b> Increase of yield and income, no change in post-harvest losses.</p> <p><b>Adaptation</b> Increase of water and fertilizer use, soil fertility, reduced soil erosion, and after 2-3 years reduced degree of weeds.</p> <p><b>Mitigation</b> No change of GHG emissions and GHG emissions intensity.</p>

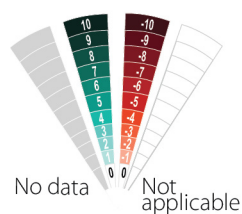
CSA practice	Region and adoption rate (%)	Predominant farm scale S: small scale M: medium scale L: large scale	Climate smartness	Impact on CSA Pillars
<b>Maize</b>				
Conservation agriculture (Strip-till)	Central, Southern <b>&lt;30%</b>	S M L		<p><b>Productivity</b> Increase of yield and income, no change in post-harvest losses.</p> <p><b>Adaptation</b> Increase of water and fertilizer use, soil fertility, reduced soil erosion, and after 2-3 years reduced degree of weeds.</p> <p><b>Mitigation</b> No change of GHG emissions and GHG emissions intensity.</p>
<b>Sunflower</b>				
Conservation agriculture (No-till)	Central, Southern <b>&lt;30%</b>	S M L		<p><b>Productivity</b> Increase of yield and income, no change in post-harvest losses.</p> <p><b>Adaptation</b> Increase of water and fertilizer use, soil fertility, reduced soil erosion, and after 2-3 years reduced degree of weeds.</p> <p><b>Mitigation</b> No change of GHG emissions and GHG emissions intensity.</p>
Conservation agriculture (Strip-till)	Central, Southern <b>&lt;30%</b>	S M L		<p><b>Productivity</b> Increase of yield and income, no change in post-harvest losses.</p> <p><b>Adaptation</b> Increase of water and fertilizer use, soil fertility, reduced soil erosion, and after 2-3 years reduced degree of weeds.</p> <p><b>Mitigation</b> No change of GHG emissions and GHG emissions intensity.</p>
<b>Tomatoes</b>				
Drip irrigation system in open and closed fields	Central <b>&gt;60%</b>	S M L		<p><b>Productivity</b> Increase of yield and income, reduction of post-harvest losses.</p> <p><b>Adaptation</b> Increase of food availability, water and fertilizer use, reduction of soil erosion and soil fertility.</p> <p><b>Mitigation</b> Increase of GHG emissions and GHG emissions intensity.</p>
Greenhouse climate control system	Central <b>30-60%</b>	S M L		<p><b>Productivity</b> Increase of yield and income, reduction of post-harvest losses.</p> <p><b>Adaptation</b> Increase of food availability, women employment, water and fertilizer use.</p> <p><b>Mitigation</b> Increase of GHG emissions and GHG emissions intensity.</p>



 Yield
  Income
  Water
  Soil
  Risk/Information
  Energy
  CO<sub>2</sub> Carbon
  N<sub>2</sub>O Nutrient

CSA practice	Region and adoption rate (%)	Predominant farm scale S: small scale M: medium scale L: large scale	Climate smartness	Impact on CSA Pillars
	<30 30-60 60>			

## Wheat



Yield  
 Income  
 Water  
 Soil  
 Risk/Information  
 Energy  
 CO<sub>2</sub> Carbon  
 N<sub>2</sub>O Nutrient

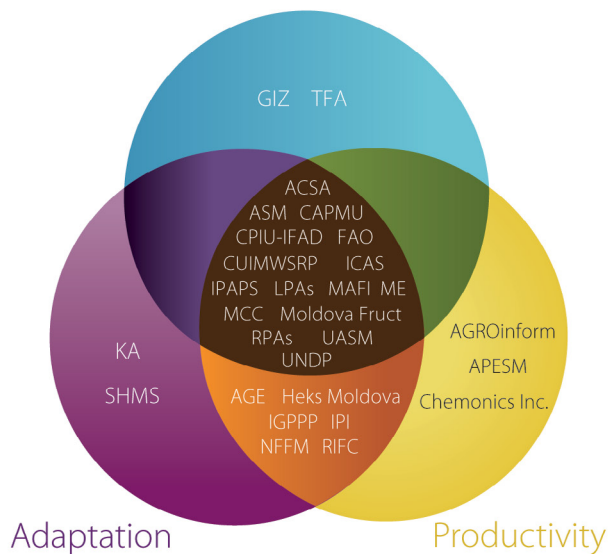


# Enabling institutions and policies for CSA

## Institutions for CSA in Moldova

Moldova has several key institutions aimed at supporting and increasing agriculture productivity and advancing CSA practices. The following graphic highlights key institutions whose main activities relate to one, two, or three CSA pillars (adaptation, productivity and mitigation). More information on the methodology and results from interviews, surveys, and expert consultations is available in Annex 6.

### Institutions for CSA in Moldova



**ACSA** National Agency for Rural Development **AGE** Agency for Geological Exploration “Apele Moldovei” **ASM** Academy of Sciences of Moldova **APESM** Table Grapes Producers and Exporters Association **CAPMU** The Consolidated Agricultural Projects Management Unit **CPIU-IFAD** Consolidated Programme Implementation Unit of IFAD **CUIMWSRP** Consolidated Unit for Implementing and Monitoring the Wine Sector Restructuring Program **FAO** Food and Agriculture Organization of the United Nations **GIZ** German Agency for International Cooperation **ICAS** Institute of Forest Research and Planning **IGPPP** Institute of Genetics, Physiology and Plant Protection **IPAPS** Institute of Pedology, Agrochemistry and Soil Protection, Nicolae Dima **IPI** Institute of Plant Industry “Porumbeni” **KA** Klassika Asigurari Company **LPAs** Local Public Authorities **MAFI** Ministry of Agriculture and Food Industry **MCC** Millennium Challenge Corporation Fund **ME** Ministry of Environment **Moldova Fruct** Fruit Producers and Exporters Association **NFFM** National Farmers Federation of Moldova **RIFC** Research Institute of Field Crops “Selectia” **RPAs** Rayonal Public Authorities **UASM** State Agrarian University of Moldova **SHMS** State Hydro-Meteorological Service **TFA** State Hydro-Meteorological Service **UNDP** United Nations Development Programme

The majority of institutions surveyed are, to different extents, working on CSA-related topics, mainly through financial and technical assistance (including insurances, grants and loans), technology development and sharing, and policy support (See Annex 6).

The Ministry of Agriculture and Food Industry (MAFI) has a leading policy role in rural sector and food industry

development. Through the State Agrarian University of Moldova (UASM), the Research Institute for Field Crops Selectia, the Soil Institute, the Animal Breeding and the Veterinary Medicine Institute, MAFI promotes knowledge and information development and dissemination, through research, extension, and training services. Extension services are also provided by the National Agency for Rural Development (ACSA), which has a lead role in delivering direct advisory support to farmers, through its 350+ consultants [13].

The Ministry of Environment (MoE) is the focal point for climate change in the country, with its role as Moldova’s Designated National Authority (DNA) on climate change and the Clean Development Mechanism (CDM) to the UNFCCC. Its policy jurisdiction falls under the areas of environmental protection (mainly via the National Institute of Ecology and the State Agency for Geology and Mineral Resources), and use and management of natural resources (via “Apele Moldovei” Agency) and waste. The State Hydrometeorological Service (SMSS) under MoE delivers weather forecasts and climate projections to farmers. Forecasts are also provided by the MoE’s Meteorological Department, which focuses particularly on meteorological and hydrological hazards. Water management and irrigation infrastructure policy, including maintenance of irrigation facilities in the country falls under the responsibility of the Apele Moldovei Agency [13].

Additionally, management of forests and forest resources is the responsibility of Moldsilva Forestry Agency, which is also in charge of ecosystem monitoring and rehabilitation of degraded (agricultural) lands via afforestation initiatives [13].

All national strategies around agriculture are developed in close collaboration with farmers associations (FAs). They participate in decision-making around the regulation of subsidies and water use, lobby for farmers’ interests to state structures, and initiate legislation change. FAs also have a seat in the Supervising Committees in the implementation units for international financing projects, and many technical assistance projects are implemented directly by FAs. However, FA structures in Moldova are relatively new, and the membership fees are low, which gives them limited financial capacity to act.

A generous number of research and academic institutions work on sustainable agriculture and soil protection issues. The education and research system has been restructured in the past years to give a stronger emphasis on applied science and to improve the quality of research output by optimizing the number of scientific institutions. However, knowledge and know-how sharing between scientists and farmers has remained limited, and the research conducted is still insufficient to answer questions about the impact of the various practices and technologies on adaptation/resilience, productivity, and mitigation goals and on how such efforts could be scaled out to reach a higher number of farmers [6].

Furthermore, regional and local authorities do not have sufficient capacities to perform their duties relating to the planning and implementation of initiatives for agricultural sector development. Burdened agenda, insufficient qualified personnel, limited technical and financial resources are barriers to mainstreaming climate change in the policy and decision-making agendas.

## Policies for CSA in Moldova

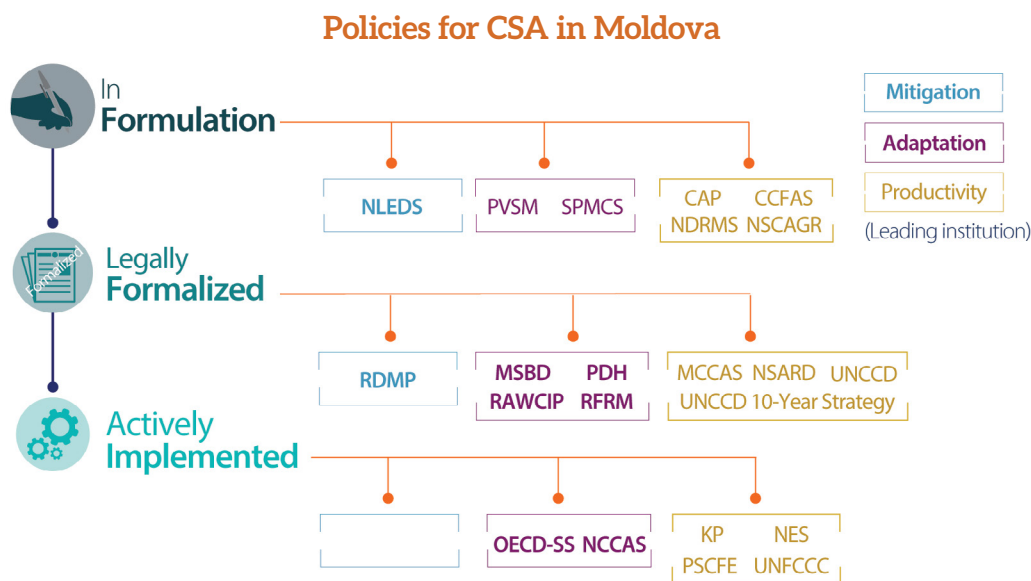
The graphic shows a selection of policies, strategies, and programs that relate to agriculture and climate change topics and are considered key enablers of CSA in the country. The policy cycle classification aims to show gaps and opportunities in policy-making, referring to the three main stages: *policy formulation* (referring to a policy that is in an initial formulation stage/consultation process), *policy formalization* (to indicate the presence of mechanisms for the policy to process at national level), and *policy in active implementation* (to indicate visible progress/outcomes toward achieving larger policy goals, through concrete strategies and action plans). For more information on the methodology, see Annex 7.

Internationally, Moldova has been formally engaged in climate change discussions since ratifying the UNFCCC

and the Kyoto Protocol in 2003, and has presented three National Communications to the UNFCCC, in 2000, 2010, and 2014, respectively. Additionally, since 2000, the country is a party to the United Nations Convention to Combat Desertification (UNCCD).

At national level, a number of national strategies, programs, and regulations have been designed and implemented during the last decades to build a sustainable and efficient agriculture and food industry sector. The milestone of climate change adaptation policy in Moldova is the National Climate Change Adaptation Strategy (NCCAS), adopted in 2014, where the main objectives for the agricultural sector are related to: (i) scale-out of conservation agriculture, (ii) adoption of more resilient and better adapted genetic varieties of plants and animals, and (iii) the development of improved plant protection and environmental risk management techniques. Conservation agriculture in particular is seen as a strategic investment for improving soil water conservation, increasing soil fertility, and preserving long-term quality and productive capacity of soils.

Also, the Second National Communication to the UNFCCC and the National Low-Emissions Development Strategy (NLEDS) (2013–2020) promote the adoption of initiatives that can help curb agricultural emissions, such



**CAP** Conservation Agriculture Programme 2014–2020 (2016) (MAFI) **CCFAS** Climate Change Forest Adaptation Strategy (2016) (Moldsilva Agency) **KP** Kyoto Protocol (2003) (ME) **MCCAS** The Republic of Moldova's Climate Change Adaptation Strategy by 2020 (2014) (MAFI) **MSBD** The Republic of Moldova's Strategy on Biological Diversity by 2020 (2015) (ME) **NCCAS** National Climate Change Adaptation Strategy by 2020 (2014) (MAFI) **NDRMS** National Disaster Risk Management Strategy (2015) (SCPS) **NES** National Environmental Strategy for 2014–2023 (2014) (ME) **NLEDS** National Low Emissions Development Strategy until 2020 (2016) (ME) **NSARD** National Strategy for Agricultural and Rural Development for 2014–2020 (2014) (MAFI) **NSCAGR** National Strategy for Conservation of Animal Genetic Resources (2017) (MAFI) **OECD-SS** Rules and Regulations of the OECD Seed Schemes (2008) (NFSA) **PDH** Programme for Development of Horticulture 2017–2020 (2016–2017) (MAFI) **PSCFE** Programme for Soil Conservation and Fertility Enhancement 2011–2020 (2011) (ALRCM) **PVSM** Program for Vineyard Sector Modernization 2016–2025 (2016) (MAFI) **RAWCIP** Regulation of Accumulated Water for Community needs, Irrigation and Pisciculture (2013) (ME, LPAs) **RDMP** Regulation of Drought Management Planning (2013) (ME) **RFRM** Regulation of Flood Risk Management (2013) (ME, LPAs) **SPMCS** Strategy Plan 2015–2017 for Meteorological and Climate Services (2014) (SHS) **UNCCD** United Nations Convention to Combat Desertification (2000) (ME) **UNCCD 10-Year Strategy** National Action Plan to Combat Desertification, Land Degradation and Reduce Drought Impact in the Republic of Moldova (ME) **UNFCCC** United Nations Framework Convention on Climate Change (2003) (ME)

as: conservation agriculture principles, the use of climate-adapted varieties, agro-pastoral systems for efficient manure use and management, use of organic fertilizers.

Despite progress on adaptation and mitigation policy initiatives, there is room for enhanced multi-sectoral and multi-level (national-regional-local) cooperation in decision-making, as well as for improved targeting, making sure that urgent climate and environmental challenges are prioritized. Particular attention is required in the realm of irrigation legislation, where, in the context of decreased surface water supplies and quality and capacity of reservoirs to collect and retain water, the provision of clearer regulations and standards for agriculture water use are key for improving the quantity and quality of water for agriculture.

Additionally, in order to achieve sustainable landscapes and adapt ecosystems to new climate conditions, more efforts need to be directed towards the creation of windbreaks (protective forest belts), as a strategy to combat desertification, improve soil fertility and reduce erosion. This requires cooperation between the agricultural and forestry sectors, with a particular focus on building capacity (knowledge and technology) of foresters and forest users on ecosystem-based restoration principles and methodologies.

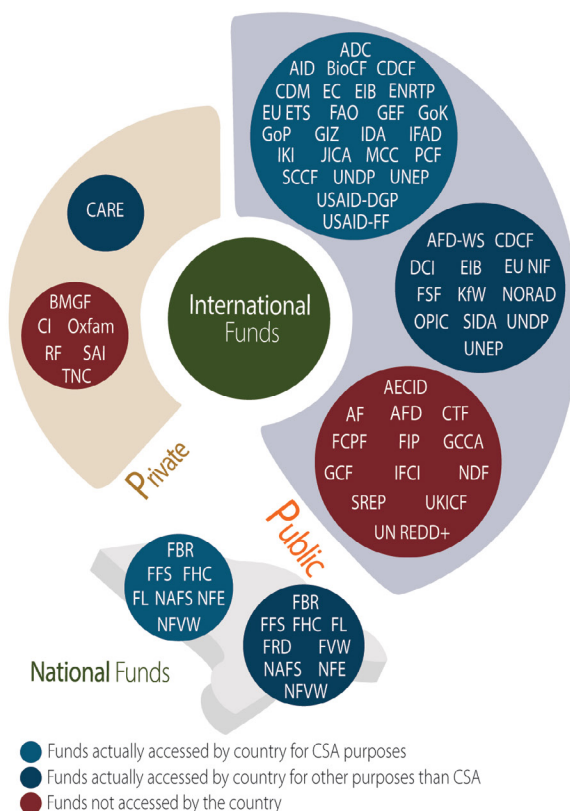
## Financing CSA

In Moldova, public spending for agricultural sector development in 2016 (including external financial assistance) amounts to 3.8% from the total public budget (equivalent to 1.33 billion Moldavian Lei [MDL]). External support is directed towards topics related to: disaster and climate risk reduction (International Development Association, UNDP), rural economic development and climate resilience (International Fund for Agricultural Development [IFAD], Austrian Development Cooperation), reducing small-holder farmers' vulnerability (Japan International Cooperation Agency [JICA]), soil conservation (World Bank) and rehabilitation of Soviet irrigation systems (Millennium Challenge Corporation [MCC]), sustainable management of pastures (European Commission), low-emissions development (Australian Agency for International Development), and information and communication technology to improve forest governance (Government of Korea), among others (See Annex 8).

The graphic on the right highlights existing and potential financing opportunities for CSA in Moldova. The methodology and a more detailed list of funds can be found in Annex 8.

Currently, the government offers agricultural subsidies through the National Agricultural Fund for Subsidies, which amount to a sum of 912 million MDL, where 525 million MDL come from public budget and 387.6 million MDL from the European Neighborhood Programme for Agriculture and Rural Development (ENPARD). Additional government funds for agricultural development refer to: the Fund for

## Financing opportunities for CSA in Moldova



ADC Austrian Development Cooperation AECID Spanish Agency for International Development Cooperation AF Adaptation Fund AFD French Development Agency AFD-WS French Development Agency-Water and Sanitation AID Australian Agency for International Development BioCF Bio Carbon Fund of the World Bank BMGF Bill & Melinda Gates Foundation CARE Cooperative for Assistance and Relief Everywhere CDCF Community Development Carbon Fund CDM Clean Development Mechanism CI Conservation International CTF Clean Technology Fund DCI Development Cooperation Instrument EC European Commission EIB European Investment Bank ENRTP Environment and Sustainable Management of Natural Resources Thematic Programme EU ETS European Emissions Trading System EU NIF European Neighbourhood Investment Facility FAO Food and Agriculture Organization of the United Nations FBR Fund for Biotechnology Research FCPF Forest Carbon Partnership Facility FFS Fund for Food Security FHC Fund for Horticulture and Field Crops FIP Forest Investment Program FL Fund for Livestock FRD Fund for Regional Development FSF Japan's Fast-Start Financing FVW Fund for Viticulture and Winemaking GCCA Global Climate Change Alliance GCF Green Climate Fund GEF Global Environment Facility GIZ German Agency for International Cooperation GoK Government of Korea GoP Government of Poland IDA International Development Association IFCI Australia's International Forest Carbon Initiative IFAD International Fund for Agricultural Development IKI International Climate Initiative JICA Japan International Cooperation Agency KfW German Development Bank International Climate Initiative MCC Millennium Challenge Corporation NAFS National Agricultural Fund for Subsidy NDF Nordic Development Fund NFE National Fund for Ecology NFW National Fund for Vine and Wine NORAD Norwegian Agency for Development Cooperation OPIC Overseas Private Investment Corporation PCF Prototype Carbon Fund RF The Rockefeller Foundation SAI Sustainable Agriculture Initiative SIDA Swedish International Development Cooperation Agency SCCF Special Climate Change Fund SREP Scaling up Renewable Energy in Low Income Countries TNC The Nature Conservancy UKICF United Kingdom International Climate Fund UNDP United Nations Development Programme UNEP United Nations Environmental Programme UN REDD United Nations Programme on Reducing Emissions from Deforestation and Forest Degradation USAID-DGP United States Agency for International Development– Development Grants Program USAID-FF United States Agency for International Development – Feed the Future



Food Security,<sup>14</sup> the Fund for Biotechnology Research, the Fund for Horticulture and Field Crops,<sup>15</sup> the Fund for Livestock,<sup>16</sup> the Fund for Viticulture and Winemaking,<sup>17</sup> and the National Fund for Vine and Wine<sup>18</sup> (under MAFI), the National Fund for Ecology<sup>19</sup> (under the Ministry of Environment), the National Fund for Credit Guarantee<sup>20</sup> (under the Ministry of Economy), and the Fund for Regional Development<sup>21</sup> (under the Ministry of Regional Development and Construction).

Although the government subsidizes 50% from the value of insurance premium, there is weak demand for crop insurances among farmers, given the expensive insurance premium (7 to 13% from insurance value). Moreover, the two (out of 33) insurance companies that offer agricultural risk insurances (namely Klassika Asigurari and ASITO) only ensure against hail and frost of high-value crop, but do not cover natural hazards, such as drought. Moreover, there is no clear regulation to assess the impact of the damage in order to adequately plan for the allocated budget. In this sense, the introduction of alternative instruments, such as weather index-based insurance (drought insurance) and multi-peril crop insurance (hail, temperature, and precipitation risks) could help improve the small-scale farmers' access to agricultural risk transfer schemes and reduce the public sector's burden.

Small-scale farmers' access to credits and loans for agricultural investments is also limited. This is mainly due to the absence of or insufficient collateral (low value of the property to be insured), high interest rates for agricultural loans and lack of capacity to apply for funding (fill-up of business-plans, application forms, delivery of financial reports, business transactions registry, potential future business risks, etc.).

## Outlook

Agriculture is a central pillar of the Moldovan economy and the main livelihood source in rural areas, contributing approximately 14.5% to national GDP and employing around 28% of the population. Climate hazards such as extreme temperatures, prolonged droughts, late spring and early fall frosts, hail and heavy rain, have had significant impacts on productivity, incomes, and natural resources and are expected to generally increase in intensity and frequency, multiplying the already existing challenges to the agricultural sector. The promotion of a CSA approach, where enhanced productivity, strengthened resilience, and a low-emissions agricultural development are seen as integral parts of the same goal, therefore, becomes a desired pathway for the sustainable growth of the agricultural sector.

This study has revealed a number of practices and technologies related to key agricultural production systems in the country, which can represent potential opportunities for CSA investments, due to the multitude of benefits they bring to production, adaptation, and mitigation goals. Soil and water conservation practices for crop production are key for addressing major urgent resource-related problems such as water shortages and so ensuring food production and availability. Improved efficiency and resilience of livestock systems, through research and promotion of climate-smart practices such as improved pastures, has been highlighted as an important entry point for investments towards a low-emissions development sector.

Additionally, research brings to light several gaps, both in terms of on-farm adoption of practices and of policy-making around mainstreaming climate change in agriculture decision-making and action. While it is key to invest in on-field application and scale-out of such practices, through development and dissemination of knowledge, information, and technology (extension, demonstration plots, etc.), institutional capacity needs to be built and strengthened in order to eliminate further barriers to adoption. In this sense, long-term cooperation across sectors (agriculture, environment, economy), operational scales (public, private) and value chains, accompanied by strengthened information and financial systems, represent key steps towards incentivizing the option and upkeep of on-farm CSA investments across the country.

<sup>14</sup> Refers to alcohol beverages control, livestock traceability, vineyard and wine electronic registers, the Agricultural Information Centre, among others.

<sup>15</sup> This fund is aimed at supporting the testing of plant varieties (including drought-resistant ones), the conservation and development of plant genetic resources, rural extension, hail service, co-financing contribution of Moldovan government in international projects implemented in Moldova.

<sup>16</sup> Fund for the conservation and development of livestock genetic resources.

<sup>17</sup> Mainly aims to offer protection of state-owned trademarks (wines, sparkling wines, spirits, wine tours, etc.).

<sup>18</sup> Promotion of wine industry, wine tourism, agro-tourism.

<sup>19</sup> Funding the implementation of strategies, programs, and plans for environmental protection, standards, and regulations of environmental protection (including financing the design and implementation of projects in the field of water supply and sewerage, collection, sorting and waste processing, improvement of air quality basin).

<sup>20</sup> This fund aims to offer solutions for small and medium enterprises that do not have collateral to access credit lines from banks.

<sup>21</sup> The fund was established to attract investments for regional agricultural development, among others.

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For further information and online versions of the Annexes, visit: [\[pending hyperlink\]](#)

**Annex 1:** Moldova's agro-ecological zones

**Annex 2:** Selection of agriculture production systems key for food security in Moldova (methodology)

**Annex 3:** Methodology for assessing climate smartness of ongoing practices

**Annex 4:** Climate change and agriculture in Moldova

**Annex 5:** Long list of CSA practices adopted in Moldova

**Annex 6:** Institutions for CSA in Moldova (methodology)

**Annex 7:** Policies for CSA in Moldova (methodology)

**Annex 8:** Assessing CSA finances in Moldova (methodology)

This publication is the product of a collaborative effort between the International Center for Tropical Agriculture (CIAT) – lead Center of the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) and the World Bank, to identify country-specific baselines on CSA in Moldova / Eastern Europe.

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This document should be cited as:

World Bank; CIAT. 2016. Climate-smart agriculture in Moldova. CSA Country Profiles for Africa, Asia, Europe and Latin America and the Caribbean Series. Washington D.C.: The World Bank Group.

Original figures and graphics: Fernanda Rubiano

Graphics editing: Elizabeth Minchew

Design and layout: CIAT

## Acknowledgments

We would like to extend a special thanks to the institutions that provided information for this study: the Ministry of Agriculture and Food Industry (MAFI), the Ministry of Environment (ME), State Agrarian University of Moldova (UASM), Climate Change Office (CCE), NGO BIO, the Institute of Pedology, Agrochemistry and Soil Protection “Nicolae Dimo” (IPAPS N. Dimo), Institute of Biotechnology in Animal Husbandry and Veterinary Medicine (IBAHVM), the State Civil Protection Service (SCPS), the State Hydrometeorological Service (SHS), the Table Grapes Producers and Exporters Association (APESM).

This profile has benefited from comments received from Mei Xie (World Bank) and Turi Fileccia (FAO).