REPUBLIC OF MOLDOVA

THE NATIONAL CLIMATE CHANGE ADAPTATION PROGRAMME UNTIL 2030

Chapter I
INTRODUCTION

1. Climate conditions are constantly changing, and their evolution requires ensuring a resilient future for present and future generations. Adapting to climate change is no longer an option, rather it has become a vital necessity. In 2020, humanity ended its hottest decade since measurements were initiated, a period in which the record for the hottest year was broken eight times. Earth's average surface temperature has risen by about 1.1°C since the beginning of the twentieth century. According to the latest projections by the Intergovernmental Panel on Climate Change (IPCC) included in its Sixth Assessment Report, it could rise a further 1.4–4.4°C by 2100, when compared with the late nineteenth century. In addition to negative impacts on human well-being and sectors of the economy, increased climate variability – from changes in frequency to severity of extreme weather events – increases disaster risk for millions of people across the globe, particularly affecting minorities, and vulnerable groups (such as women, persons with disabilities and the elderly).

Section 1
Context of NCCAP 2030 development

2. According to the NDGAIN vulnerability assessment methodology (BM, 2016), Republic of Moldova ranks as the most climate-vulnerable country in Europe. It is forecast that the impacts of climate change on the country's social, environmental, and economic dimensions will intensify in the medium- to long- term. This is expected to have devastating effects on the key economic sector – agriculture, as well as the predominantly rural population for whom agriculture is a major source of food and income. Climate change is projected to decrease surface water flows in Moldova by 16–20% until 2030. Midterm projections indicate a continuous increase of annual average temperature by 2°C between 2010 and 2040.

3. Regarding precipitations, the 4th National Communication of the Republic of Moldova forecasts a 13% decrease in the total annual amount, while annual flows will become more unstable with the increase in the frequency of floods. Climate models from different greenhouse gas (GHG) mitigation scenarios demonstrate a reduction in the availability of water resources unless adequate adaptation measures are taken in time.

4. With respect to climate-related natural hazard risks, the Republic of Moldova is particularly prone to floods and droughts. According to the study of the UN Office for Disaster Risk Reduction (UNISDR) "Human Cost of Weather-Related Disasters 1995-2015", Moldova ranks in the top ten countries of the world with the highest proportion of people affected by climate disasters. The country suffered a severe flood in 2008, which spilled well over the Dniester and Prut riverbeds, with total

damage amounting to 120 million USD. More than 40 localities and around 6525 hectares of agricultural land were affected by these floods. Also, 667 private houses and 471 public buildings were flooded and 131 of them were destroyed. On the left bank of the Dniester River, the entire riparian area of Tiraspol town was covered with water, flooding 800 houses, and causing the evacuation of most residents. Subsequently, the severe floods from 2010 affected more than 13 thousand people in 60 villages, causing more than 75 million USD in losses and damage.

5. However, it is projected that droughts will become longer and more severe. According to statistics, depending on the geographical location, a drought is recorded once every 3 to 10 years. According to information published on the World Bank's (WB) Climate Change Knowledge Portal, average annual losses caused by drought were about 19 million USD per year, in the period 1996 - 2004. Severe droughts occurred in 2007, 2012 and most recently in 2020 and 2022. According to WB estimates, Moldova suffered the worst drought in its recent history in 2007, affecting 80% of the territory and 135,000 people and causing losses of around 1 billion USD. The drought of 2020 caused a reduction of more than 26% in agricultural production and had a significant socio-economic impact, with almost 20% of job losses in the agricultural sector, thus affecting the daily existence of the vulnerable rural population. Insufficient rainfall drastically reduced agricultural production in 2022, with an estimated drop of more than 30% in wheat and maize production compared to 2021, contributing to the general recession caused by the Covid-19 pandemic and the economic crisis.

6. According to the World Bank's 2016 estimates, the total cost of inaction on climate adaptation amounts to around 600 million USD (equivalent to 6.5% of GDP), a value that could double by 2050 to about 1.3 billion USD. In this context, the Republic of Moldova has engaged in a national process of climate change adaptation planning (NAP) since 2013, in accordance with the Cancun Adaptation Framework, approved at the 16th Conference of the Parties to the United Nations Convention on Climate Change (UNFCCC) in 2010. The NAP is a long-term process geared towards achieving resilience to climate change for sustainable social and economic development of the country. The NAP aims to create an enabling environment for coherent and effective adaptation action, integrating climate risks into investment decision-making and business planning, while remaining socially and gender comprehensive.

7. The economy of Moldova already bears significant costs from climate extremes and misses potential benefits from timely climate change adaptation measures. Real and opportunity costs will increase in the future, mainly due to damage caused by floods and droughts, climate impacts on agriculture as well as on health (such as mortality from heat waves, food- and waterborne diseases, exotic diseases). The specific risks for the most vulnerable sectors, should no further measures be taken to increase economy-wide climate resilience, could be as follows:

1) Reduced water availability below total demand within the next decade.
2) Increasing effects of climate change on human health, associated with an increasing number of heatwave-related diseases (including cardiovascular diseases), transmission of gastrointestinal or other diseases caused by introducers, and direct or indirect victims of natural disasters.
3) Significant decrease of agricultural productivity due to growing water scarcity for crops, as well as the impact of extreme climatic events (e.g. hailstorms and late spring frosts, major floods and droughts, or changes in phytopathological situation related to mass proliferation

of pests and diseases).

4) Reducing forest productivity, worsening phytosanitary status and increasing the incidence and area of wildfires.
5) Seasonal change in peak energy consumption trends, affecting energy distribution and transmission infrastructure, as well as compromising the country's potential to reduce energy imports by harnessing renewable sources (solar, biomass, wind and geothermal).
6) Damage to transport infrastructure, which is already affected by extreme weather events (such as floods and heat waves).

8. In this context, the National Climate Change Adaptation Programme to until 2030 (NCCAP 2030) takes over the results of the first stage of the national adaptation planning process (2014–2020), to ensure their continuity for the benefit of the citizens of the Republic of Moldova, including the most vulnerable, by:

7) Potential savings from reducing the harmful effects of climate change and related economic costs, thereby reducing the cost of protection against harmful effects.
8) Potential revenues from directly strengthening climate-dependent primary production (agricultural and forestry products and services, water services, and climate-related renewable energy generation).
9) Efficient use of natural resources, following the implementation of adaptation measures.

9. Thus, according to the "Investment Planning for Climate Change Adaptation in Moldova" Report (World Bank, 2016), the measures included in the Programme Action Plan are expected to bring substantial benefits to the national economy of over 100 million USD annually, by providing better protection against current and future harmful climate impacts.

Section 2
Purpose and approach in developing the NCCAP 2030

10. The aim of the NCCAP 2030 is to integrate climate change adaptation measures into development planning at all priority levels and sectors to ensure environment and long-term climate resilience of economic, social and ecological systems. In this regard, the focus will be maintained on the six vulnerable sectors - agriculture, water resources, health, forestry, energy and transport, in order to achieve the national development agenda embedded in the National Development Strategy (NDS) "European Moldova 2030", the Sustainable Development Goals assumed within it, as well as the updated National Determined Contribution (NDC) presented by the Republic of Moldova in 2020 under the Paris Agreement.

11. The national climate change adaptation approach is systemic, cross-sectoral, mainstreamed into relevant sectoral policies and is based on up-to-date knowledge and risk assessments for vulnerable sectors. Building on the experience of the first NAP cycle, the NCCAP 2030 aims to strengthen vertical and horizontal synergies – between the climate change vulnerable sectors, to avoiding duplication of actions, streamlining resources, and ensuring a coherent approach to integrating climate change

responses into national and local development planning. In addition, the 2030 NCCAP provides for the creation of a strengthened NAP monitoring and evaluation framework, based on gender-sensitive indicators, with the aim of improving the collection and distribution of data relevant to climate change adaptation (CCA) for better informed timely decision-making in this interdisciplinary policy area. Climate budget tagging (CBT) is applied to monitor allocations and expenditure related to climate change responses in budgetary programmes, thus ensuring that financial needs for CCA are assessed and addressed more precisely.

12. NCCAP 2030 Vision: resilient infrastructure and strengthened national climate change adaptation capacities to ensure population well-being, environmental sustainability and imperturbable functioning of economic sectors.

13. The climate change adaptation framework of the Republic of Moldova outlined in the NCCAP 2030 will contribute to achieving the country's sustainable development goals set out in the NDS "European Moldova 2030" by improving the living conditions of the population (SO 2.1, SO 2.3), increasing the resilience of the health system (SO 5.1), ensuring a healthy environment (SO 10.1, SO 10.2, SO 10.3, SO 10.4), and ensuring climate resilience and facilitating adaptation in the six priority sectors.

14. One of the promoted strategic objectives directly targets population life quality by increasing their access to safe water and energy sources, appropriate sewerage infrastructure, roads and information technologies. The achievement of this overall objective largely depends on the measures to be implemented in key economic sectors, aimed at gradual achievement of sectoral and overall resilience to climate change, contributing directly or indirectly to the following SDG targets: 1.5, 5.5,5.a, 6.4, 6.6, 9.1, 9.4, 11.2, 13.1, 13.2, 13.3, 15.2, 15.3, 15.5 and 15.9.

15. The NCCAP 2030 also correlates with the updated NDC, submitted by the Republic of Moldova in March 2020 in the context of the Paris Agreement. Adaptation to complex climate change requires cross-sectoral perspectives resulting from the involvement of a multi-level governance system: sectoral, central, regional, and local. Thus, the NAP framework until 2030 aims to address cross-sectoral issues as identified during NAP-1 and outlined in Moldova's updated NDC.

16. From a broader perspective, the NAACP 2030 will contribute to the implementation of the international commitments of the Republic of Moldova undertaken not only by signing the Paris Agreement, but also with the adoption of the Global Agenda 2030 and its Sustainable Development Goals (SDGs), as well as the Sendai Framework for Disaster Risk Reduction, and the Global Compact for Safe, Orderly and Regulated Migration, in particular its climate objectives. By ensuring a coherent planning of climate change adaptation measures in six key sectors of the national economy, NCCAP 2030 and the Action Plan on its implementation will facilitate the short- and medium-term budget planning process, as well as the decision-making process related to intersectoral financing and support from development partners. The included measures are aimed at overcoming the deficiencies and gaps identified during the NAP-1 process and outlined in the Report on the assessment of the implementation of the National Climate Change Adaptation Strategy until 2020 (NSACC 2020) and its Action Plan.

Chapter II
SITUATION ANALYSIS

17. Changes in precipitation regimes and increased climate aridity are the main types of climate impacts to which the Republic of Moldova is exposed. This is according to the climate impact, risk and vulnerability assessments carried out in the process of drafting the National Communications, and considering the forecast scenarios on climate change, temperature increase. The changes are associated with the amplification of the frequency and intensity of extreme climatic events, such as heat waves and frosts, severe droughts, floods, storms with heavy rain and hail. These premises are the starting point for setting medium and long-term planning priorities, actions, and investments for adaptation, along with monitoring the effectiveness of planned and implemented adaptation measures.

Section 1

Climate risk context, vulnerabilities and CCA options in economic sectors

18. Studies carried out to assess climate risks over time focused on a period of 30 years - from 1961 to 1990, as a reference period, analyzing the influence of climate conditions on relevant sectors within three time periods: 2010-2039, 2040-2069 and 2070-2099. Three General Circulation Models (GCMs), representing physical processes in the atmosphere, ocean, cryosphere and land surface, were used to assess the country's vulnerability to climate change and identify adaptation options. Accordingly, the following have been established:

1) Winters will be warmer and wetter, and summers and autumns will be hotter and arid in Moldova. It is anticipated that temperatures will rise by 1.7-2.0°C in the near future, and by the end of the century, this increase may reach an average of 4.1-5.4°C. Depending on the GCM, these values range from 1°C to 6°C. With warming, a continuous annual decrease in average rainfall is also expected It is anticipated that the greatest warming will take place in winter and transition seasons (spring and autumn). Moderate increases in precipitation over time are expected over time in winter and spring, while rainfall trends in summer and autumn are mainly negative (20-30% decrease projected by 2080).
2) Extreme weather events will become more common in the future. Projections for Moldova suggest that what are climatic phenomena of absolute maximum temperatures in the reference climate (34-35°C) will become average maximum summer temperatures in future. More general projections for Europe show that the risk of floods is increasing in Northern, Central and Eastern Europe and that today's very severe droughts, which occur every 100 years, will recur every 50 years (or more often) in Southern and South-eastern Europe, including in the Republic of Moldova.
3) The process of climate aridisation is expected to accelerate considerably in the future. Currently, a large part of the territory of the Republic of Moldova is characterized by dry or sub-humid climate. Aridity, leading to a high incidence of droughts, is expected to increase considerably by 2040. Aridity will be more pronounced during the growing season of plants (June-October). Humidity conditions over the century indicate that the Republic of Moldova

is following the path to a drier climate – from dry-subhumid to semi-arid.

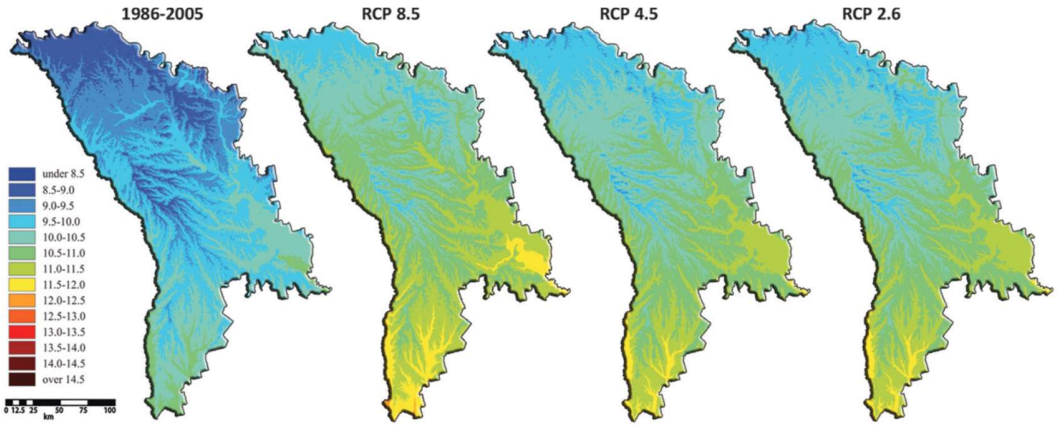
19. In the updated National Communication Four and NDC, climate change scenarios for assessing climate vulnerability and adaptation are presented for the short term (2016–2035), medium term (2046–2065) and long term (2081–2100), under three representative concentration pathways RCP8.5, RCP4.5 and RCP2.6. For the current update of the climate risk and vulnerabilities of key economic sectors, the short-term scenario (2016-2035) has been considered.

Temperature variable

20. According to the Climate Change Vulnerability and Impact Assessment in the Republic of Moldova, all three Representative Concentration Pathways (RCP8.5, RCP4.5 and RCP2.6) project similar temperatures in the near-term decades: +0.9 – 1.1°C throughout the country. Annual temperature changes are very homogeneous in the three agro-ecological zones of Moldova – North, Centre, and South.

21. Starting even from the 2050s, the three emissions scenarios produce temperature patterns distinguishable from each other. This is due to both the high inertia of the climate system and to the time required for the climatic effects of greenhouse gas emissions to materialize. By 2080, the rate of warming is higher in RCP8.5 scenario (on the average reaching +4.6°C); moderate in RCP4.5 (+2.4°C) scenario and lower in RCP2.6 scenario, ensembles average would be +1.3°C. All general circulation models (GCMs) used in NC4 agree that for the three periods (2016–2035, 2046–2065 and 2081–2100) an increase in temperature compared to the reference period 1986–2005 is expected. Figure 1 shows this modelling for the period 2016-2035 (covering the implementation period of this NCCAP until 2030).

Figure 1. Modelling on the evolution of the projected annual average air temperature on the territory of the Republic of Moldova during 2016-2035, °C



Source: Republic of Moldova's Fourth National Communication ***(CMIP5 21 GCMs Ensemble)***

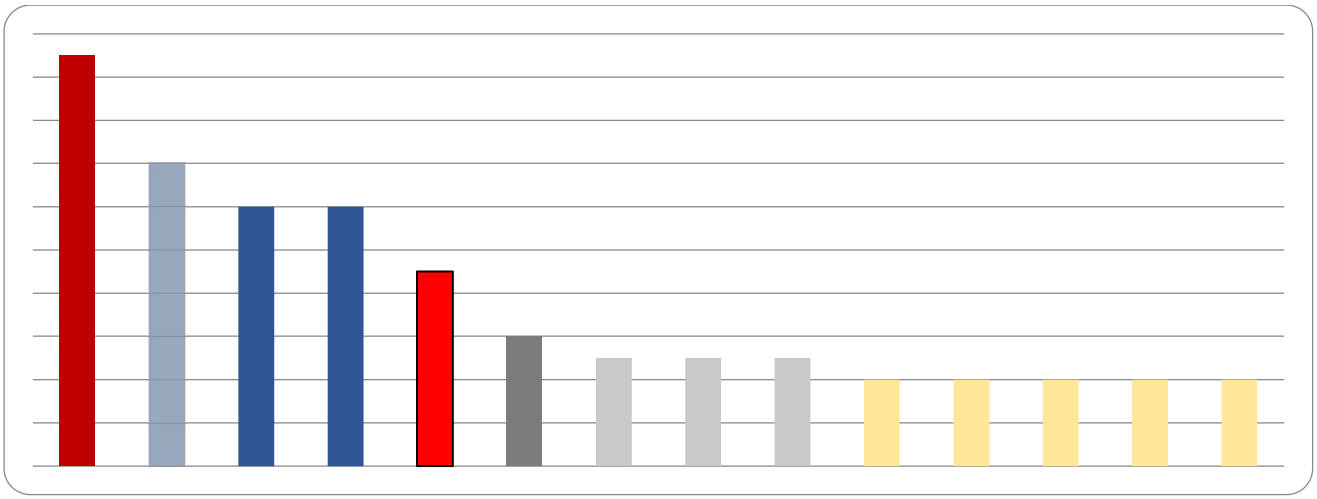
22. To update the state of art in situation during the implementation of NCCAS 2020, Table 1 and Figure 2 present the data collected for the period 2015-2022 by the State Hydrometeorological Service (SHS).

Table 1. Average and extreme temperatures for the period 2015-2020

Indicator	2015	2016	2017	2018	2019	2020	2021	2022
Annual average, °C	12.0	11.2	11.2	11.2	12.2	12.7	10.6	11.7
Above normal climatic value, °C	2.5	1.7	1.7	1.7	2.7	3.2	1.1	2.2
Absolute maximum, °C	+38.6	+37.0	+39.0	+37.0	+37.0	+38.0	+37.0	+37.0
Absolute minimum, °C	-24.6	-22.0	-21.0	-23.0	-17.0	-10.0	-21.0	-13.6

Source: SHS database

Figure 2. Range of years with high annual average temperatures, Chisinau meteorological station



Source: SHS database

23. In the last decade, the 6 highest average annual air temperatures since 1891 (when climate observations began in Moldova), have been recorded. The winter season 2019-2020 was extremely hot. For the first time since the beginning of the observation period, an average air temperature exceeding the norm by 4-5°C was reported. In 2022, the maximum air temperature on January 5 rose to +17.4ºC (SM Tiraspol), which in January was reported for the first time throughout the entire observation period. Abnormally warm weather was also recorded in the third decade of August 2022, when the average decadal air temperature exceeded the norm by 5-6 °C.

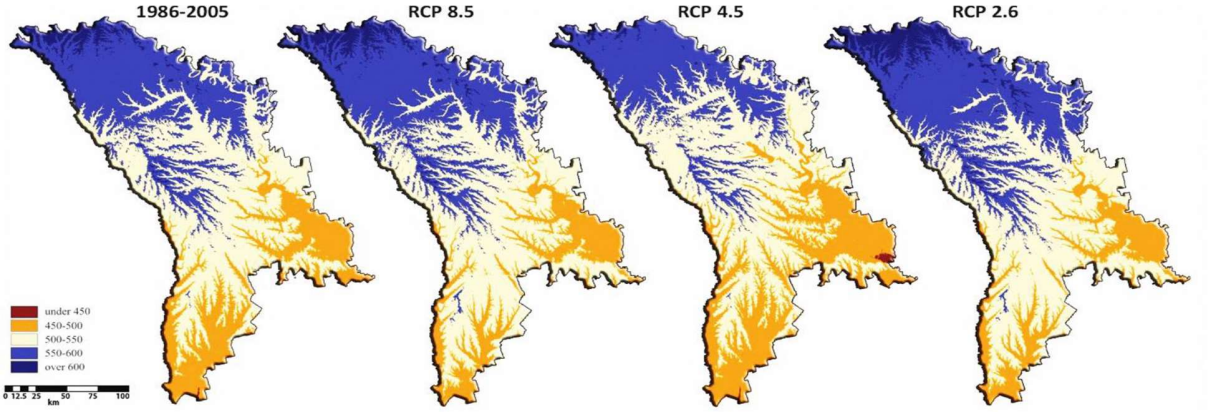
Precipitation and humidity variables

24. In terms of annual and mean precipitation, according to SHS data, in the period from 2015 to 2021 the norm of annual precipitation has been met (except for 2015 and the second half of 2019), although it is distributed very unevenly geographically and over time. The year 2022 is characterized by a significant deficit of precipitation. The annual amount of rainfall on 70% of the territory was 260-400 mm (55-75% of the norm). The 4th National Communication and Climate Change Vulnerability

and Impact Assessment in the Republic of Moldova forecast that in the next decade agro-climatic indices, such as precipitation and humidity, will register an insignificant increase, while starting with the 2050s, the three emissions scenarios forecast annual models with low precipitation.

25. RCP8.5 and RCP2.6 forecast a slight increase in rainfall of more than 0.6-2% in all agro-ecological zones (EEZs) between 2016 and 2035 (see Figure 3). According to RCP4.5, a slight reduction in precipitation from 1.5% to 2% is anticipated for ZAE North and Centre compared to the reference period (1986-2005). Average values for all three RCP scenarios reveal that rainfall reduction will be much more severe during summer and autumn.

Figure 3. Projected evolution of total annual precipitation on the territory of the Republic of Moldova for 2016-2035, mm



Source: The 4th National Communication of the Republic of Moldova ***(CMIP5 21 GCM assembly)***

26. The assessment of the hydrothermal coefficient (HTC) to identify trends in the humidity indices changes in the context of climate change during the growing season, shows that the basic climatic conditions of HTC ranged from 1.4 in the North to 0.8-0.9 in the South-East of the country in 1986-2005. Values recorded are characteristic of moderately dry climate, in the first case, and dry climate, in the last case. According to the updated NDC, the HTC assessment revealed that moisture insufficiency will become even more pronounced in the future. This clearly demonstrates the gradual aridisation of the Republic of Moldova's territory, including Northern AEZ, which is currently considered to be still sufficiently wet.

27. Potential evaporation is projected to increase by 7-11% over the growing season in 2016-2035. Thus, the low level of precipitation during summer and autumn (not compensated by a slight increase in precipitation in winter and spring), in a context of rising temperatures, will cause a strong moisture deficit and a sequential increase in potential evaporation.

Extreme climatic events

28. The Republic of Moldova is at increased risk of droughts and extreme weather events, both of which are exacerbated by future climate change. Thus, 7 out of 10 warmest years recorded in the Republic of Moldova occurred in the last two decades (see Figure 2).

29. According to recent World Bank and the Global Facility for Disaster Risk Reduction and Recovery studies, drought affects us once every 3-10 years, being felt more or less depending on the geographical location. In 2007, the country suffered its worst drought in recent history, affecting 80% of its territory with about 135,000 people, causing losses of about 1 billion USD. The drought from 2020 caused a reduction of more than 26% in agricultural production and had a significant socio-economic impact, with around 20% of jobs lost in the agricultural sector. Household income and consumption was thus reduced, whilst contributing to the general recession and entailing additional burdens for the budget.

30. Floods affect the Republic of Moldova recurrently. In the last 70 years, 10 major floods have been reported in the area of large rivers (Dniester and Prut), three of them occurring in 2006, 2008 and 2010. Small river areas, although with modest flows, are often affected by flooding.

31. The socio-economic costs caused by natural disasters associated with climate change are significant, with droughts and floods having the greatest impact.

32. In 2015-2022, the country faced several extreme climatic phenomena:

1) 2015 – storms with heavy precipitation (51-59 mm in 3 hours) and summer drought (20-30% of the norm of precipitation) in the North.
2) 2016 was remarkable for massive rainfall in October – with 100-185 mm of precipitation, the amount recorded being an absolute record for the given time of year.
3) 2017 – heavy snowfall recorded on 20 and 21 April. The damage caused by these snowfalls was catastrophic for the national economy, especially for the forestry and energy sectors.
4) 2018 – storms and strong winds, snowstorms in January – March.
5) 2019 was the year of an extreme manifestation of uneven distribution of precipitation, when most of the rains fell in the first half of the year, after which, from July to May of the following year, there was an extreme deficit of precipitation (SHS announced atmospheric and pedological drought).
6) 2020 – the hydrothermal coefficient from April to September was 0.7, implying dry weather; in July and August HTC dropped to 0.2, which corresponds to a severe drought. Extreme weather phenomena in the form of torrential rains (May-July, September-October), hail (June, July), as well as strong winds with a maximum speed of up to 26-27 m/s (February) were reported.
7) 2021 – extreme weather phenomena were reported during the year in the form of torrential rains and hail (May-August), which caused damage to agricultural crops and damage to objects of the national economy.
8) 2022 - between May and July, rainfall was 15-45% of the norm, which in part of the territory is reported for the first time in the entire observation period.

33. According to the data of the General Inspectorate for Emergency Situations for 2011-2022 (Table 2), an average of 60 emergencies caused by climatic factors occurred annually in the Republic of

Moldova, causing considerable economic losses, especially in the agricultural sector. The most common were torrential rains, hail, strong winds and heavy snowfall.

Table 2. Emergency situations caused by climatic factors that occurred in the Republic of Moldova during 2011-2022

Emergencies caused by climatic factors	**Years / Number of emergencies**												**Total**
	2011	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	
Torrential rain with hail	25	51	71	62	28	40	23	33	31	18	22	6	410
Heavy rains with strong winds	22	15	19	13	5	8	14	6	8	9	14	3	136
Floods								1	3	4	2		10
Droughts		1			1				4	1		2	9
Frosts, ice		1		1	-		23	1	2	12	3	6	49
Storms, snowfalls, blizzards		1	2	3	15	5	1	3	9		1		40
Total	**47**	**69**	**92**	**79**	**49**	**53**	**61**	**44**	**57**	**44**	**42**	**17**	**654**

Source: General Inspectorate for Emergency Situations database

34. The latest assessments of the climate change context in the Republic of Moldova and the vulnerability of its economy confirm the trend that climate change will increase the frequency and intensity of most extreme phenomena and natural hazards (e.g. droughts and floods, hailstorms, torrential rains, late spring frosts, strong winds). These phenomena will significantly affect economic growth. This is especially the case in rural areas, which are more dependent on natural resources and vulnerable to climate shocks and have fewer resources to avoid risks. Agriculture, water resources and forestry, as well as human health, are among the sectors most at risk from climate change impacts.

35. Agricultural productivity will be significantly reduced due to increased water stress on crops, even without considering the upward impact of extreme weather events. Water availability will fall below total demand within a few decades, with repercussions on irrigation (which is a vital contribution to increasing the resilience and, thus, productivity of the agricultural sector). The productivity of forests in the Republic of Moldova, which is estimated at a total economic value of 66.77 million USD, will decrease significantly, and pathological trends (diseases and pests) are to change adversely (WB, 2016). Climate change will increase the vulnerability of sensitive social groups, including women, persons with disabilities, displaced persons, and refugees, who are disproportionately affected by the effects of disasters. At the same time, it will increase the vulnerability of assets to the impacts of natural hazards, entailing significant challenges to the country's ability to prepare for and respond to natural disasters.

36. According to World Bank estimates, the current total cost of inaction on adaptation to climate change in Moldova amounts to about 600 million dollars (equivalent to 6.5% of GDP). This figure is expected to more than double by 2050 to around 1.3 billion USD. The direct costs of climate

change by 2050, i.e., reduced production caused by climate change, plus increased damage and costs of prevention, are expected to reach about 1 billion USD. 70% of this is borne by the agricultural sector.

Subsection 1
Climate change impacts and CCA options in the AGRICULTURE sector

37. Agriculture employs about 30% of Moldova's population and is the basic pillar of the rural economy. However, the sector is exposed to and dependent on climatic conditions, being affected both by gradual changes in temperature and precipitation distribution pattern, as well as by extreme climatic phenomena - droughts, hail, torrential rains, late spring and early autumn frosts, sudden temperature fluctuations in winter.

38. The sector's share of national GDP has gradually decreased over the past 20 years, reaching 7.9% in 2022 compared to 2000, when it constituted 22.5%. Over the same period, agriculture's share of employment has also decreased – from around 50% in the 2000s to 20.8% in 2022, which is a steeper reduction compared to other countries in the region.

39. Moreover, population migration has created a real shortage of labor force in villages, and the agricultural sector registers the lowest average monthly income compared to other economy sectors. Climate and non-climate risks have led to labor migration to other sectors, resulting in labor shortages in rural areas.

40. The Republic of Moldova registers a relatively high level of agricultural land use, as 67% of the country's land stock is for agricultural purposes, of which 76% is arable land. A good part of the soils in agro-climatic zones are chernozems that had a high content of organic matter. But the unsustainable practice of using them has led to a drastic reduction in soil humus content from 5-6% at the beginning of the last century to 2.5-2.7% today. As a result of this process, 30% of agricultural land is currently eroded and heavily eroded.

41. According to the database of the United Nations Food and Agriculture Organization (FAO) Aqua stat (2015), the total area equipped for irrigation was estimated, in 2014, at 228,300 ha, of which only 11.4% (26,100 ha) are de facto irrigated. On January 1, 2022, this area constituted 214.22 thousand ha of which only about 20 thousand ha were irrigated. Thus, lately there has been a constant reduction of both the areas arranged for irrigation and those actually irrigated. Irrigation is concentrated mainly in the southern and central parts of the country, in the valleys of the Dniester and Prut rivers. The major sources of water available for irrigation are the Dniester River (57%) and the Prut River (10%). The rest (33%) is water from inland rivers, lakes and groundwater suitable for irrigation.

42. Farmland in Moldova is highly fragmented due to land reform and privatization. Thus, crop productivity is relatively low compared to EU countries (including the new EU Member States). The current structure of the sown areas is oversaturated with hoeing crops, being accompanied by low doses of application of organic and mineral fertilizers, on the one hand, and the high level of soil processing with furrow overturning, on the other.

Climate risks and vulnerabilities in the agriculture sector

43. The severity and frequency of extreme weather events has increased in Moldova and this trend will continue in the coming years, entailing a major risk for the agricultural sector. It is expected

that by mid-century, the air temperature in the country will be 1.7-2.0°C higher than in 1961-1990. By the end of the century, it will increase by 4–5°C, unless greenhouse gas emissions are significantly reduced globally. According to this scenario, Moldova will register a significant reduction in the productivity of most agricultural crops and will be affected by more frequent extreme climatic phenomena, such as torrential rains with hail, late spring and early autumn frosts, floods and droughts, which will simultaneously lead to changes in the incidence of diseases and the spread of pests. Such direct impacts on agricultural production and declining yields will further lead to fluctuations in market prices and crop change.

44. The combined effect of changes in water regime could lead to insufficient water for irrigation and high competition for water, which could eventually lead to higher prices and regulatory pressures. Drought will lead to soil degradation, which poses a major threat to the sustainability of land resources, thus reducing the ability of the Republic of Moldova's agriculture to successfully adapt to climate changes. Increased salinization could result in their land being abandoned as they become unsuitable for cultivation.

45. Table 2.3 summarizes the direct impacts of climate change and potential socio-economic consequences that are relevant for agriculture. These include changes in temperature and the heat stress effects; changes in precipitation volume, intensity, and seasonal distribution; and increasing frequency of extreme and potentially harmful climatic events. Five of the identified risks are of high priority:

1) High risk of droughts and water scarcity.
2) Increased irrigation needs.
3) Soil erosion, salinization, desertification.
4) Increased risk of pests, diseases, and weeds.
5) Decreased wheat and maize yield.

46. Three of these risks relate to the consequences of potential changes in rainfall patterns, with increased rainfall in winter and reduced water availability in summer. Thus, strategies to conserve as much water as possible in winter and to maintain water supplies in summer should be considered. Much of the research on adaptation in the agricultural sector should focus on strategies to address future water scarcity. Such adaptation measures as water conservation and adjustment of planting and harvesting periods could play a key role in reducing losses associated with future moisture limitations.

Table 3. Direct impacts of climate change on agriculture and potential socio-economic consequences

Climate hazards	Impact on Agriculture	Social/Economic impacts
Increasing temperatures, heat stress	Changes in water requirements	• Increased demand for irrigation • Decreased yield of crops • Changes (positive and negative) in distribution, introduction of new crop varieties
	Changes in agricultural pests and diseases	• Reduced water quality from increased use of pesticides • Decreased yield and quality of crops • Increased economic risk • Loss of rural income
	Changes in crop growth conditions	• Pollution by nutrient leaching • Loss of indigenous crop varieties • Changes (positive and negative) in seed production and seedling requirement
	Changes in optimal conditions for livestock production	• Changes in optimal farming systems • Loss of rural income
	Changes in crop distribution	• Changes in crop and livestock production activities • Relocation of farm processing industry • Loss of rural income • Increased economic risk • Shift of labor to other sectors
Change in precipitation patterns	• Changes in the hydrological regime • Increased water shortages	• Risks of water quality degradation • Increased risk of soil salinization • Conflicts between water users • Increased groundwater extraction, water depletion and reduced water quality
Extreme weather events: **- heat waves** **- frost** **- droughts** **- floods** **- winds, hailstorms** **- more frequent and intense rains**	• Changes in soil fertility, salinity and erosion • Crop failure • Yield decrease • Competition for water • Increased risk of desertification	• Reduced water quality due to fertilizer runoff • Reduced crop income • Land abandonment and labor migration to other sectors • Increased spending on emergency and remedial actions • Poor food security in areas with low economic development • Higher food prices

Source: Adapted from NC3 (2013), NC4 (2018) and Updated NDC (2020) of the Republic of Moldova

47. It should be noted that socio-economic consequences are felt differently by men and women, given differing roles and responsibilities assigned to them. For example, loss of rural income might affect women more profoundly than men (especially single women or women heading households), given their more limited opportunities to migrate, due to prevailing stereotypes in society.

48. In the process of assessing the risks and opportunities of climate change on the agricultural sector of the Republic of Moldova carried out in the process of development of the 3rd and 4th National Communications, the approach of dividing the country's territory into agro-climatic zones was used (Table 4). Thus, it was found that future climatic conditions will have a key impact on the main agricultural crops, especially in the central and southern regions where crop productivity is expected to reduce by up to 25% by the middle of this century.

49. According to the assessment of vulnerability and opportunities associated with climate change in agricultural production, the most vulnerable regions in the Republic of Moldova are the South (South Moldavian plain, the terraces of the Lower Prut and Dniester Rivers) and partially the Centre (sub-zone II, the Plain of Central Moldova and the Codrii region, and sub-zone II, the terraces of the Dniester River and the rivers Prut, Raut, Bic, Botna, etc.), for which the highest number of high-probability risks was identified (Table 2.4).

Table 4. Risks and opportunities deriving from climate change on agriculture in agro-climatic areas of the Republic of Moldova

	Detail of magnitude risk/ opportunity	North (moderately hot, semi-humid)		Centre (hot semi-humid)		South (hot-arid)
		Sub-zone I-a, the Plain of Northern Moldova*	Sub-zone I, the Plain of Northern Moldova, front Dniester hills**	Sub-zone II-a, the Plain of Central Moldova and Codrii region***	Sub-zone II, Terraces of the Dniester, Prut, Raut, Prut, Bic, Botna etc. rivers****	The Plain of Southern Moldova, terraces of the inferior Prut and Dniester Rivers*****
Risk	Crop area changes due to decrease in optimal farming conditions	LOW	LOW	MEDIUM	MEDIUM	HIGH
	Wheat and maize yield decrease	LOW	MEDIUM	MEDIUM	MEDIUM	HIGH
	Grapevine general decrease in yields.		LOW[1]	MEDIUM	MEDIUM	MEDIUM
	Fruit general decrease in yields	LOW	MEDIUM	MEDIUM	MEDIUM	HIGH
	Increased risk of agricultural pests, diseases, weeds	HIGH	HIGH	HIGH	HIGH	HIGH
	Crop quality decrease	LOW	MEDIUM	MEDIUM	MEDIUM	MEDIUM
	Increased risk of drought and water scarcity	LOW	LOW	MEDIUM	MEDIUM	HIGH
	Increased irrigation requirements	MEDIUM	HIGH	HIGH	HIGH	HIGH
	Soil erosion, salinisation, desertification	LOW	MEDIUM	HIGH	HIGH	HIGH
	Deterioration of conditions for livestock production	LOW	MEDIUM	MEDIUM	MEDIUM	HIGH
	Flood increase in frequency and intensity	LOW	MEDIUM[2]	HIGH	HIGH[3]	MEDIUM[4]
Opportunity	Crop distribution changes leading to increase in optimal farming conditions	HIGH	HIGH	MEDIUM	MEDIUM	LOW
	Increasing the range of horticultural crops that can be grown outdoors	HIGH	HIGH	MEDIUM	MEDIUM	LOW
	Crop productivity increase	MEDIUM	MEDIUM			
	Grapevine increase in quality		MEDIUM	HIGH	HIGH	HIGH
	Lower energy costs for glasshouses	MEDIUM	MEDIUM	HIGH	HIGH	MEDIUM

Source: Third National Communication of the Republic of Moldova

50. Climate change is expected to bring both advantages and disadvantages for agricultural crops. Although higher temperatures will extend the growing season, they could damage crops due to heat stress, changing rainfall regime and pest problems. Impacts will vary regionally as well as depending on crop types. There are also potential benefits. The longer growing season will potentially

increase grass yields, while higher temperatures will increase the potential for growing forage legumes. The longer growing season will also reduce the costs of housing livestock. There could also be benefits for horticulture, both in terms of reducing costs for production in protected spaces and because of a greater range of horticultural crops that can be grown in open spaces.

51. However, most impacts of CC on agriculture in the Republic of Moldova are expected to be adverse (Table 4). Cultivation patterns are gradually changing, with a shift from high value-added products such as fruit and meat to an expansion of areas sown with wheat, sunflower, maize, which are exported as raw materials, which does not increase the sector's climate resilience. High summer temperatures and the risk of drought could cause difficulties in potentially increasing harvests and jeopardize current productivity levels. Some crops will be more vulnerable to hotter and drier summers. Thus, vegetable, potato and forage crops are likely to be severely affected due to reduced irrigation possibilities. Changes in frequency and intensity of extreme climatic events (e.g. droughts, heavy rainfall with thunderstorms and hail, late spring and early frosts of autumn, sudden temperature fluctuations in winter, floods, etc.) are the biggest challenge that the country's agriculture will face as a result of climate change. These extreme phenomena, which are difficult to forecast and prepare to minimize losses, could disrupt the normal development of the agricultural sector, as has been demonstrated repeatedly in the past. There may also be problems arising from the introduction of new pests and diseases. Droughts and heat waves also affect domestic animal husbandry. Model projections and observed climate trends suggest that warming will be greatest in the winter months. Although warmer winters will reduce cold stress, it will increase the risk of winter thaw damage and reduce the thickness of the protective snow cover.

52. Future changes in water availability are a key concern in the Republic of Moldova's agricultural sector. In general, climate change is expected to reduce water supply during the growing season, while demand for this resource increases simultaneously. Water scarcity will be the main problem in some regions of the Republic of Moldova in the future (see Table 4). For some crops, climate change could also provide some benefits, such as higher temperatures required for some thermophilic species and a longer growing season for others, which directly contributes to their productivity, but these potential benefits will be severely limited if sufficient water is not available.

Recommended CCA actions for the agriculture sector

53. The comprehensive assessment of the results of the implementation of NCCAS 2020 revealed a low level of adaptation to climate change of the agricultural sector of the Republic of Moldova. Reforms initiated in different time periods, in the absence of a systemic vision, were fragmentary. Although sector scientific institutions, in cooperation with academic ones, have developed a series of recommendations on crop rotation, soil processing, land use and irrigation, erosion control, etc., the effectiveness of these measures is reduced due to the lack of an integrated (sustainable) agricultural system, which aims both to maintain and increase crop productivity, and the conservation and rational use of natural resources, particularly soil.

54. Among the barriers and challenges regarding the implementation of climate change adaptation measures in the sector, the following should be noted:

1) Lack of a single platform at governmental level for the interaction between different sectors

of the national economy (agriculture, transport, energy, environment, etc.).

2) Lack of a sustainable agricultural system, which would correspond to the ecological principles of agricultural intensification (and reduce both the sector's dependence on fossil energy sources and their derivatives, as well as the negative impact on the environment and human health).
3) Lack of a development plan to ensure food security in conditions of increased vulnerability of the agricultural sector to climate change.
4) Need to restore the seed production system, with the predominant use of varieties and hybrids of local origin, which are better adapted to climatic and soil-related conditions.
5) Need to popularize knowledge on how to produce organic crops and its benefits on human health, thus ensuring the expansion of the market for organic products.
6) Need to find a balance between arable land, forests, meadows, etc., in each locality, taking into account the peculiarities of the landscape and ensuring the mandatory share of natural vegetation in each household, which will lead to increased biodiversity (for arable land, particular importance must be given to improving the structure of sown areas in order to respect crop rotation as a fundamental measure to prevent negative environmental impact and reducing the impact of droughts).
7) Insufficient systemic (interdisciplinary) scientific research on agricultural production with pro-active participation of agricultural producers.
8) High rates of outmigration which, on the one hand, generate a lack of workforce and knowledge in the field of agriculture and adaptation of the sector to climate change but also a flow of financial remittances that can provide support to farmers in implementing adaptation measures.

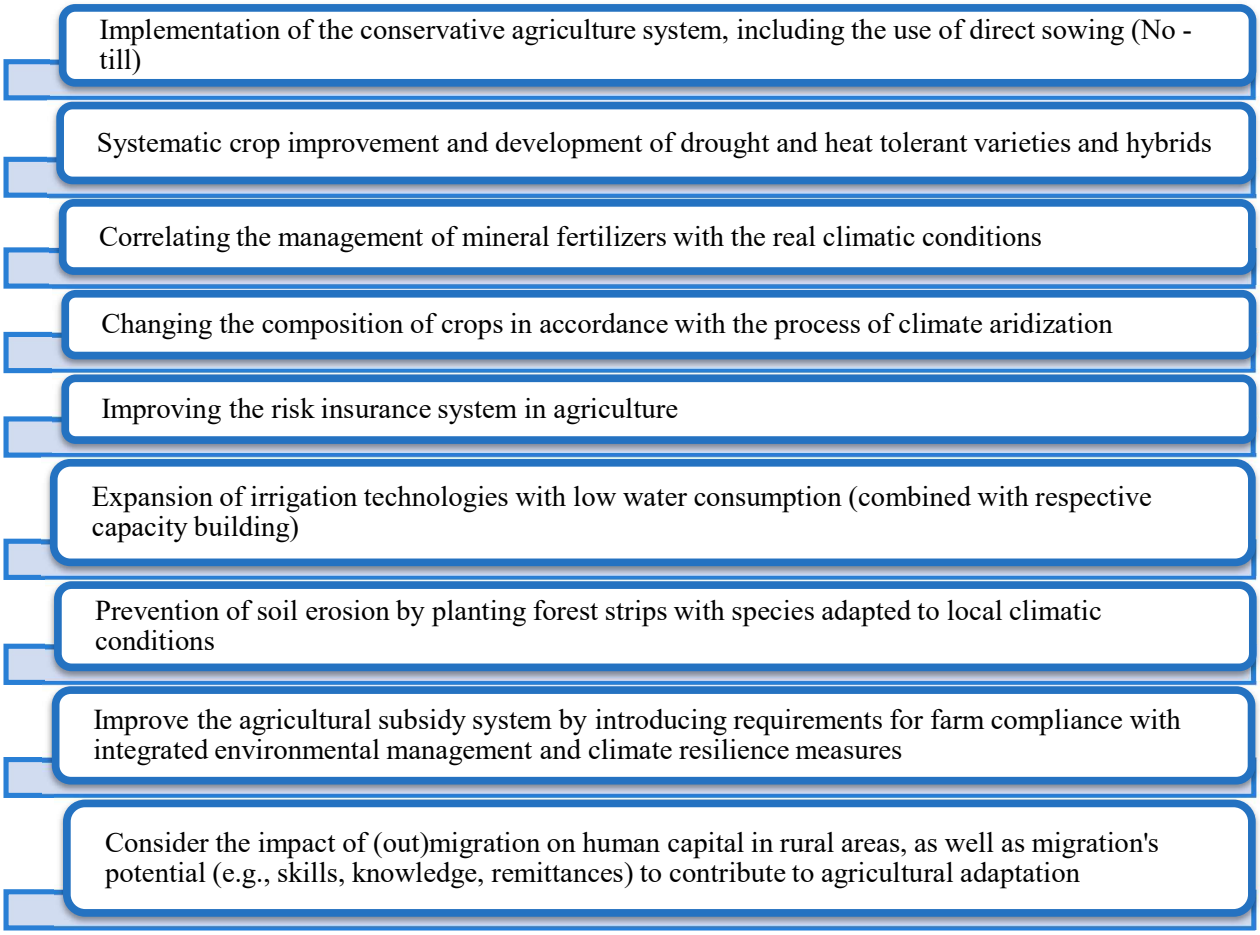
55. There is currently a Code of Good Agricultural Practice, but compliance with them is not mandatory. Agricultural producers continue their activity based on only two indicators – the level of production and profit, which is insufficient for sustainable agriculture and resilience to climate change. In the case of limited natural resources and continuously rising prices for fossil energy resources (on which the dominant model of agricultural intensification is based), increased efforts are needed to ensure a harmony between increasing production levels and protecting the environment, while maintaining the competitiveness of the agricultural producer. Based on these considerations, the need for transition to a new model of agricultural intensification emerges. This is based both on technological and, particularly, systemic changes in accordance with the principles of organic as well as conservative agriculture. The new model of agricultural intensification must be based on reducing dependence on fossil energy sources and their derivatives (mineral fertilizers, pesticides, etc.), ensuring the conservation and rational use of natural resources (soil, water, biodiversity, etc.), while considering current and future climate changes. Projected changes in key climate indicators such as temperature and precipitation need to be considered at early stages of planning the location of crops, especially for perennials ones.

56. In this context, climate change adaptation options for the agricultural sector in Moldova are presented in Figure 4. They were promoted in NCCAS2020 and partially implemented during the first phase of the National Adaptation Process (NAP-1). However, more substantial efforts are needed in the period up to 2030, including institutional and capacity development, to make the adaptation process in

the sector irreversible.

57. A series of studies and projects carried out in the sector confirm that the modernization of centralized irrigation systems and drainage infrastructure will significantly contribute to increasing agricultural productivity and reducing climate impacts in the future. These measures are expected to achieve increased rates of return if combined with the development of institutional capacities for irrigation system management. Other options include small-scale on-farm irrigation systems, soil management and climate risk management technologies, in particular conservation farming and the transition from annual to multiannual crops (grapes and fruit trees), which will be more resilient to climate change.

Figure 4. Climate change adaptation measures recommended for the agriculture sector



58. The variety of options for adapting to climate change reveals the existence of many challenges, but also investment opportunities in the agriculture sector. In the Report "Investment planning for adaptation to climate change in the Republic of Moldova" (2016), the WB estimated the average annual loss caused by extreme climatic phenomena (droughts, floods, hail, heavy rains, winds, frosts, landslides) at 34 million USD per year. The estimate of anticipated annual damage and losses through 2050 is about 335 million USD. According to the updated NDC, the Medium-term investments (until 2040) needed to address the current productivity gap in Moldova's agriculture with increasing resilience to climate change are about 2.4 billion USD.

Subsection 2
Climate change impacts and CCA options in the ENERGY sector

59. The vulnerabilities of the energy sector in the Republic of Moldova are determined by the interaction of historical, geographical and political factors. They are observed on both the demand and supply sides, such as production capacity, energy efficiency and supply security, amplified by climate change events such as high temperatures, changes in rainfall patterns, increased frequency and severity of extreme weather events, including storms, floods, droughts and heat waves.

60. As Moldova's energy self-sufficiency is extremely low – only about 23.90% of energy consumption is covered by domestic production (in 2021). The energy sector faces many challenges, especially those related to import dependence, especially natural gas and oil products. Domestically, heat and electricity are largely generated by combined heat and power (CHP) plants, which in turn are old, inefficient and expensive. Therefore, most cogeneration plants are particularly vulnerable to fluctuations in water regime as a climate threat; Power grids are sensitive to fluctuations in temperatures and storms, and high-voltage lines are vulnerable to storms and flooding, which cause disruptions to the power distribution network.

Climate change risks and vulnerabilities in the energy sector

61. Table 5 shows the direct impacts of climate change and the potential socio-economic consequences relevant to the energy sector. According to climate projections, changes in the annual rainfall regime will reduce the country's potential for hydroelectric power generation. River flow is expected to decrease, and the amount of available water (surface and ground) needed for different uses – drinking water, irrigation, ecosystem conservation and electricity generation – is at risk of continuous decrease.

62. Temperature fluctuation scenarios reveal risks for electricity generation in CHP plants, as rising temperatures affect the efficiency of thermal conversion. The temperature of water for cooling installations may exceed technical limits and hot water discharged into rivers after technical cooling processes may exceed the legal temperature limits, especially in the case of long-term heat waves. Thermal power plants will also be affected by the availability of water for cooling – reduced water availability and increased water temperatures could lead to reduced operating mode or temporary shutdowns.

63. Warmer and drier summers can be a threat to the production of biomass biofuel. The final product will become more expensive (for example, it would require additional irrigation), or the volume of raw material will become more limited (in a more arid environment vegetation may decrease).

64. Extreme events such as severe storms and floods could endanger energy distribution networks (recent examples date back to 2008, 2009 and 2017). Warmer summers in general, but also heat waves combined with increased levels of pressure and water scarcity, pose a threat to the well-being of humans, crops, animals, and wildlife. Thus, the demand for air cooling in buildings, commercial and industrial sectors is set to increase, which will lead to an increase in the use of air conditioning and refrigeration installations. The demand for electricity will increase during the summer.

Table 5. Summary of the socio-economic impact of climate change in the energy sector

Climate hazards	Impact on the energy sector	Social/Economic impacts
High temperatures and heat waves	• Increased demand for electricity due to greater need for air conditioning and cooling in industrial processes • Increased consumption of natural gas due to increased demand for electricity • Increased water needs for thermal power plants	• Access to air conditioning only available for higher income households • High demand and increased demand during peak hours, being a challenge for transmission and distribution systems • Low amounts of energy generated
Changes in precipitation regime and water regime	• Lower electricity generation capacity caused by reduced water flow in Prut and Nistru rivers • Low hydropower generation • Reduction of biomass harvest	• Hydropower generation can be seriously affected by droughts (10-30% reduction expected) • Potential competition between energy and non-energy crops for land and water resources • Threats to energy production due to biomass reduction
Extreme phenomena: **-Droughts** **-Flood** **- Winds, Hail** **- frosts**	• Reduced resilience of energy sector infrastructure, including lifetime assets, higher capital expenditure and administration and maintenance costs • Reduction of the share of electricity generation in RES due to reduced reserve of balancing energy	• Threat to electricity transmission and distribution • Increased uncertainty regarding energy production and line repair cost • Low electricity production from RES

Source: Adapted from NC3 (2013), NC4 (2018) and Updated NDC (2020) of the Republic of Moldova

65. As regards the socio-economic consequences listed in Table 5, it should be noted that women and men usually experience them differently, given the roles and responsibilities assigned to them. For example, less electricity can bring specific challenges to women who are usually responsible for productive tasks in the household (e.g. cooking).

66. Renewable Energy Sources (RES) are very sensitive to extreme weather events. According to the updated NDC, the value of climate-dependent renewable energy production in the Republic of Moldova is estimated at only 286,000 USD annually (mainly hydroelectric energy), while the lost energy production is estimated at only around 150 million USD annually.

67. However, climate change also offers opportunities. For example, reduced cloud cover and increased wind speed would increase the potential of photovoltaic and wind power plants, thus

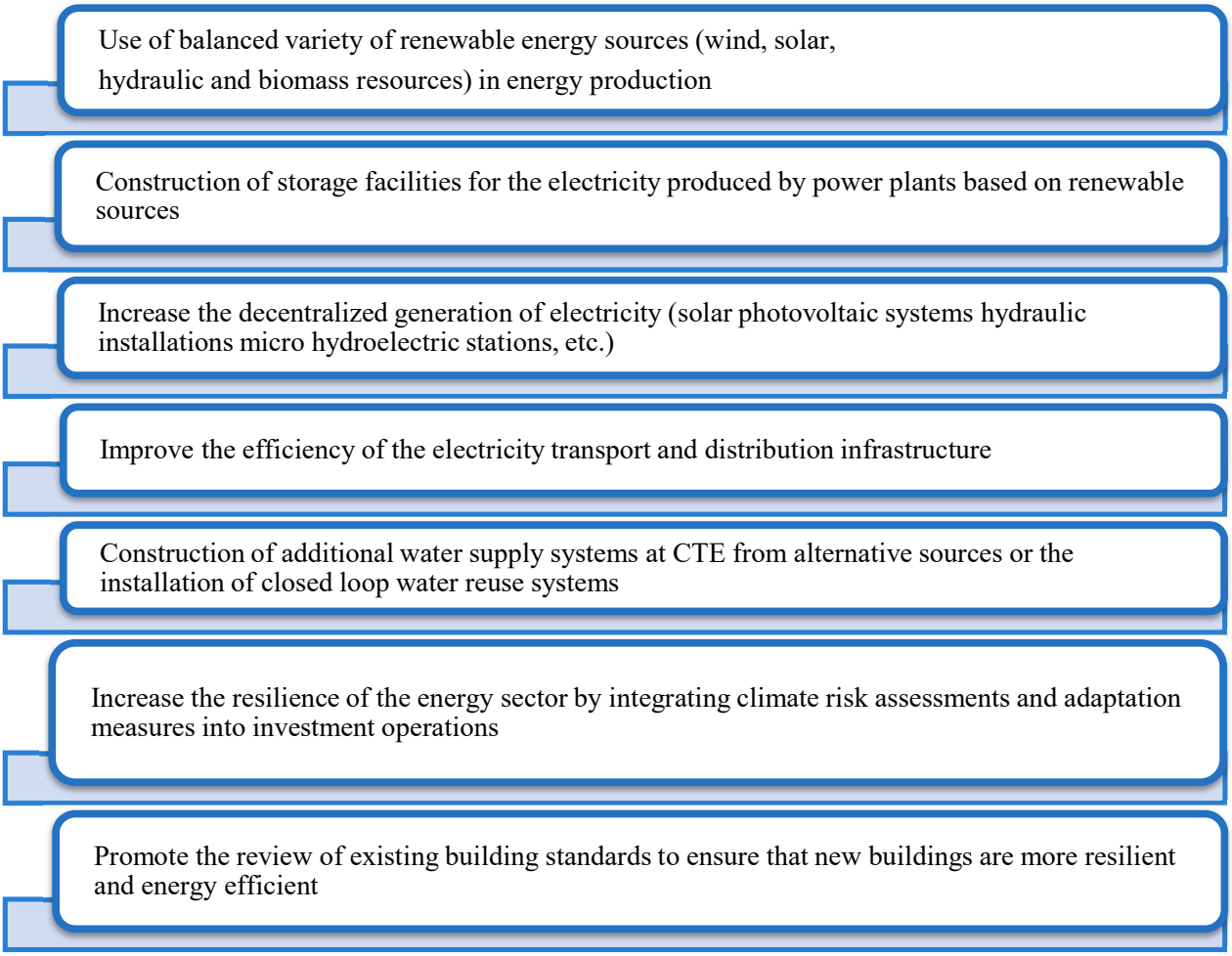
providing an opportunity to diversify renewable energy supply. Therefore, climate change considerations need to be integrated into energy sector development and investment planning at the earliest possible (programming) stage.

Recommended CCA actions for the energy sector

68. The CCA activities planned and implemented in the energy sector under the NCCAS and the Action Plan until 2020 were assessed as relevant, effective, and sustainable. Most measures for this sector involve an overlapping mitigation and adaptation effect, thus benefiting from greater political support. The effectiveness of the CCA measures applied in the energy sector has been assessed quite highly, assuming that the planned financing was well integrated into the budgetary framework until 2020 and successfully executed through the Energy Efficiency Fund (EEF), budget-directed support, as well as grants and credits financed by development partners.

69. Figure 5 shows the recommended specific adaptation actions for the energy sector in Moldova beyond 2020 to increase the sector's resilience and mitigate risks caused by projected climate hazards.

Figure 5. Recommended climate change adaptation measures for the energy sector



70. Promoting more sustainable development of the energy sector, improving energy efficiency and increasing the use of renewable energy sources are the main objectives of the Energy Strategy of the Republic of Moldova until 2030. Investments and other expenses needed for 2020-2030 to address CCA and minimize the cost of inaction in the energy sector represent about 235 million USD, according to assessments made with technical assistance for climate adaptation investment planning in Moldova (WB, 2016). A WB study conducted in 2016 within the ESMAP Energy Sector Management Assistance Program estimates the total investment potential in RES development at the same value. The measures proposed by this NCCAP until 2030 build on those achieved by 2020. They aim to further contribute to the viability of the energy sector against climate change risks, through targeted integration of climate change adaptation considerations into all investment and sector development decisions.

Subsection 3
Climate Change Impacts and CCA Options in the FORESTRY Sector

71. Forest products and ecosystems services are climate dependent. According to the 2021 EU Adaptation Strategy, the frequency and severity of weather and climate extremes are increasing, causing unprecedented events, such as forest fires, severe droughts and bark beetle outbreaks, all with devastating effects for European forests. Consequently, the economic viability of forests is affected, as well as their capacity to provide sustainable ecosystem services (wood, clean water and air, food and fiber, erosion control and habitat for forest biodiversity).

72. The Republic of Moldova faces the same risks for its forests, in particular regarding changing sensitivity of forest species to water scarcity and increasing abiotic damage caused by fires, windstorms, floods and droughts. As a result of the assessment on the NCCAS2020 implementation, it was found that the forestry sector suffered considerably from the reduction of rainfall levels and the drying up of some water basins, as a result of droughts occurred in the last two decades. The evolution of forests' state during 2015 - 2020 shows that:

1) The area of stands affected by a complex of diseases and pests (especially some species of defoliators, with outbreak explosions that synchronize in space and time) shows an increase of about 15% compared to the previous period, registering on average about 78.9 thousand ha / year or 21.8% of the total forest area.
2) The area of forests affected by wildfires increased by 5.1% compared to the previous period, registering on average about 249 ha / year, cumulative for the period - 1.5 thousand ha or 0.4% of the total forest area.
3) The area of stands affected by mass drying shows an increase of 5.6% compared to the previous period, registering – on average about 11.0 thousand ha / year; cumulative for the period – 65.7 thousand ha or 3.7% of the total forest area.

73. It should be noted that the actual area of wildfires affecting forest areas is higher, especially on land managed by local public authorities (LPAs). Some fires are not recorded and extinguished in time, which most often leads to spontaneous spread of fire outbreaks. This situation arises due to the poor national system of monitoring, registration, and intervention in the field of wildfires. This system is still poorly developed, with breaches in the processes and protocols of record-keeping. The phytosanitary monitoring system of forests also contains many shortcomings, which implies several gaps in the detection and registration of outbreaks of forest diseases and pests. These generate delays and hinder response measures when outbreaks can be stopped with minimal resources and consequences for the biological resistance of trees and stands.

74. Forecasts on the evolution of forests in the Republic of Moldova in the next century (World Bank, 2014) indicate a gradual trend of reducing forest productivity in the long term. It is undeniable that forests will be directly and indirectly affected by climate change, and forest managers in vulnerable areas will need to learn how to adapt management practices to changing environmental conditions. Important activities, such as ecosystem regeneration (assisted or natural), afforestation of new land (extension), and increased protection (including against exotic elements), will require adequate budgetary support.

75. In this context – ecological restoration of inadequate stands, extension of forest protection belts and forest areas remain key adaptation measures provided for in the Programme. The expansion of areas with new forests, as well as the restoration of degraded forests, can significantly contribute to increasing agricultural productivity. This can be both through natural hydrological regulation and accumulation of precipitation (snow), as well as through wind protection and reduction of landslides or soil erosion.

76. The degradation and fragmentation of natural habitats in the Republic of Moldova is due to both abiotic (climatic), biotic (insects, diseases) and anthropogenic factors (deforestation, hunting, etc.). Forest habitats, along with steppe and petrophilic ones, are the most dependent and vulnerable to climatic conditions in the region. The direct action of these factors includes changes in the moisture regime in the air and soil, lowering the level of groundwater, worsening of the evapo-transpiration regime, etc.

77. In the current pedoclimatic conditions of the Republic of Moldova, 512 endangered plant species (27.4% of the total number) are in the risk zone. Among the vascular plant species most dependent on climatic conditions are plants from forest (126 species), steppe (151 species) and rock (68 species) ecosystems. The animal world is influenced by the degradation of plant associations, scarcity of food, water and breeding sites caused by climate change. The increased vulnerability of the plant and animal world in the Republic of Moldova is the result of the low functionality of natural ecosystems. Most natural ecosystems are fragmented and degraded. In river basins there is an intensification of the process of water eutrophication, in steppe and meadow ecosystems – of the process of xerophysis and substitution with ruderal plants. The felling and deforestation of forests and trees on riverbanks leads to increased water evaporation and reduction of the ecological capacity of water basins to maintain a wide diversity of aquatic animals.

Climate change risks and vulnerabilities in the Forestry sector

78. An eloquent example of how the effects of climate change influenced the development of the forestry sector was the drought of spring-summer 2007, which affected over 80% of the country's territory. This phenomenon caused a mass drying of about 19 thousand ha or 6.3% of the forest area managed by the "Moldsilva" Agency, especially in the South and Centre of the country (and the impact on forest lands managed by other holders was devastating). The drought affected about 20 native and alien forest species. The most affected was white acacia, constituting 71.3% (13 thousand ha) of the total area of forests affected by drying, especially in the southern area (which was an indication and a lesson learned for specialists). The drought of 2007 involved long-term consequences, with visible impact for many more years. Thus, according to the silvo-pathological research data conducted by specialists from the Forest Research and Management Institute (FRMI), the total area of the degraded and dry stands (of different intensity) constituted over 33 thousand ha or 11.0% of the forest area managed by the "Moldsilva" Agency during 2008-2011.

79. The drought of 2012 also had a destructive effect on forests. As a result, in 2012-2015, about 41 thousand ha of forests were affected by different degrees of drying, most of the cases being registered in the South and Centre of the country. In general, the drying process of the forest has started to become a constant phenomenon in the Republic of Moldova over the past decades. According to

FRMI data, only in the last decade the area of forests affected by drought is 119.1 thousand ha, and the pace of drying alarms the authorities.

80. The vulnerability of forests in the Republic of Moldova to climate change is also confirmed by the poor phytosanitary status of forest ecosystems. Thus, due to recently occurring droughts (2007, 2011, 2012, 2015, 2019, 2020), there was a degradation of forest ecosystems. This meant a reduction of the biological resistance of trees to the action of negative factors, which conditioned the vulnerability of trees, as well as the intensification of drying processes on large areas, along with the creation of favorable conditions for the mass spread of phytophagous and xylophagous pests. According to the "Moldsilva" Agency data, the average area of the outbreak of phytophagous pests in 2010-2020 was 69 thousand ha, of which about 30 thousand ha or 43.5% required control measures. Among defoliating pests, the greatest share and destructive effects are recorded from the green lark (Operophtera brumata) and brown tree lark (Erannis defoliaria), as well as the green oak moth (Tortrix viridana). Although all these species are polyphagous insects present in forest and agricultural ecosystems, their outbreaks have had a cyclical evolution in recent decades. This was widely influenced by climatic conditions during critical periods of development (larvae, etc.), as well as by insufficient monitoring and intervention capacities of central and territorial forestry structures.

81. Climate change influences moisture conditions in forests through changes in both thermal and rainfall regimes. In some areas of the country, the future reduction in rainfall levels will accentuate water stress caused by warming. Also, changes in the seasonal nature of precipitation and extreme phenomena such as droughts and heavy rainfall will be important.

82. The potential lack of summer rainfall associated with prolonged droughts is the main limiting factor of forest growth and productivity. Rising temperatures and changing rainfall patterns are the main factors that expose forests to the action of various pests and diseases (especially fungal). According to the study "Vulnerability and impacts assessment of climate change in the Republic of Moldova" (GEF / UNEP, 2018), it is expected that during 2021-2039 the phytosanitary status of forests will change significantly in the Northern part of the country, where areas with stands affected by drought will expand by about 15-25%. In 2040-2069, changes in phytosanitary status caused by the level of tree drying in the northern part of the country will strongly stimulate expansion to the south and southeast. Significant changes will occur in this context between 2070 and 2099. This process is already underway in the South and partly in the Centre of the country, being confirmed by the degree of dryness of the forest, having as indicator the share of hygiene cuts in the application of forestry treatments in the forest fund managed by the "Moldsilva" Agency.

83. Climate variability, with all its components, extreme temperature values and lack of precipitation during periods of drought favor the exposure to fires of agricultural crops, feed deposits, areas with forest vegetation, households, etc. The effects on soils depend on soil type and moisture content. On dry and coarse-textured soils, fires leave a hydrophobic soil (by accumulating chemicals, resulting from burning vegetation, in the lower layer of the litter box). As a consequence of a fire, the disappearance of vegetation intensifies water runoff from the surface and causes erosion, especially in areas naturally susceptible to erosion. This also increases the risk of flooding. After a fire, river basins have an increased potential for erosion and flooding. In case of heavy rains or storms, mineral compounds are removed and stored in reservoirs designed to ensure water supply to the population. The adverse effects of forest fires on agricultural crops, forage storages, areas with forest vegetation and households determine residents to identify alternative income opportunities and, respectively, forced

migration to urban centers.

84. Although most fires are man-made (either accidentally or intentionally), it is widely recognized that weather conditions play a dominant role in fire risk variability over time. This fact is also confirmed by recent statistical data, which reveal that the forest area affected by fires in the Republic of Moldova increased significantly (from an average of 25 ha/year to 203 ha/year or an increase of 81.2%) in 2001-2020 compared to that of before 2000. It is also mentioned that significant annual increases are observed with major droughts recorded (2007, 2012, 2020, etc.).

85. Thus, most of the important risks associated with national forest ecosystems are:

1) disturbance at the ecosystem level;
2) changes in the composition of stands;
3) changes in the competitive behavior of species;
4) changes in the rate of forest regeneration;
5) increased susceptibility to outbreaks of diseases/pests;
6) changes in phytosanitary conditions;
7) predominance of alien (introduced) species.

86. The overall analysis of climate-related vulnerabilities for forest ecosystems and the respective socio-economic impacts is provided in Table 6.

Table 6. Summary of the socio-economic impact of climate change on the forestry sector

Climate hazards	Impact on forestry sector	Social/economic impact
High temperatures, heat waves	• Longer vegetation period • Negative consequences for species sensitive to temperature changes; • Increased vulnerability to forest fires;	• Reducing the volume of wood production; • Transition to other forms of energy; • Additional costs for the population;
Change in precipitation indices	• Change in phytosanitary status of forests • Change in species composition in forests • Change in types and incidence of pests and diseases in forests	• Reduced capacity of forest habitat to maintain biological diversity, protect the environment and ensure specific socio-economic functions;
Extreme phenomena: droughts, fires, floods and windstorms	• Low biomass growth and production • Increase in forest fires • Increased mortality rate of forest seeds	• Economic losses in the forestry sector; • Displacement of persons; • Forced migration of people seeking alternative income opportunities in urban centers;

Source: Adapted from NC3 (2013), NC4 (2018) and updated CND of the Republic of Moldova (2020)

87. To ensure the development of measures/technologies relevant to climate change adaptation, based on specific objectives and targets, potential climate impacts on forest ecosystems have been aggregated into three categories:

1) Decrease of production indices (biomass, forest products and services).
2) Changing the rate of forest regeneration, degradation, and reduction of forest areas.
3) Deterioration of phytosanitary condition and increased incidence of forest fires.

88. At the same time, it is considered that some impacts associated with climate change for forest ecosystems in the Republic of Moldova will generate certain opportunities, which could partially compensate for potential losses:

1) Expansion of forest areas, including forest protection belts, which will significantly contribute to reducing local climate processes, combating soil erosion and landslides, reducing torrents, crop protection and other social and economic objectives.
2) Strengthening the management of (a) the communal and private forestry sub-sector as important components of the integrated national forestry sector, and (b) increasing the traceability of wood, which will create a competitive market through diversified and specialized use of forest goods (wood, non-wood products, other services).
3) Promotion of species that will benefit from the new environmental conditions and reach higher accumulations of total biomass throughout the production cycle (depending on the region and species (willow, linden, poplar, etc.), the accumulation can reach 20-40% more than under "normal" environmental conditions).

Recommended CCA actions for the Forestry sector

89. The establishment of stable and diversified forests in the Republic of Moldova is a continuous measure, planned to improve the stability of stands by selecting appropriate species, origin and genotypes. The requirements for increasing forest productivity and developing the forest economy taking into account adaptation to climate change require ensuring the production of high-quality reproductive material. Data from activity reports of forestry sector institutions confirm that forest nurseries currently produce propagating material that does not meet EU standards and climate change adaptation requirements.

90. The forest sector management aspects that need to be integrated into post-2020 national climate change adaptation planning are:

1) Increased intensity of extreme events such as droughts, hail/frost, which are a stressor for forest ecosystems. Forecasts on the evolution of forests in the Republic of Moldova (WB, 2015) which assume that the longitudinal climate gradient will move northwards, and the phytosanitary status of stands will worsen.
2) Emission scenarios for the period up to the end of the 21st century with a general and gradual trend of reduction of annual precipitation, varying from one geographical area to another, trends of change of thermal regime which, in correlation with reduced precipitation, will directly or indirectly affect forest ecosystems.

3) Policy documents regulating the forestry sector in the Republic of Moldova (strategies, programs, action plans, etc.) largely expired, with established actions not implemented or partially implemented.
4) Insufficient institutional capacities at central and local level to address climate change adaptation issues, afforestation design, ecological restoration of inadequate stands, rehabilitation of protective forest belts, etc.
5) Lack of in-depth studies on forest ecosystems in relation to CCA (e.g. genetic variability of valuable forest species and habitats, climate thresholds corresponding to the spatial distribution of forest types and forest species, development of bioclimatic models, calibration of biogeochemical models to forecast changes in stand productivity and carbon stocks in main forest types, etc.).
6) Insufficient supervision of the production process and quality of forest material in nurseries, their insufficient endowment with modern technologies and equipment.
7) Insufficient ecological regeneration and restoration works to improve the composition of stands, by promoting biotypes resistant to climate change, restoring fundamental phytocenosis, etc.
8) Significant reduction in the rate of expansion of forest cover on degraded land or other land unsuitable for agricultural use, due to the lack of a policy document for the targeted extension of land covered with forest vegetation (including with the aim of reducing land degradation and vulnerability to climate change).

91. Forests play a special role in maintaining ecological balance, combating desertification and degradation of land and soils, waters and river basins, biodiversity conservation, climate change mitigation, and last but not least, in preventing and reducing the risk of natural disasters. It is extremely important to achieve a minimum afforestation rate of 15%, especially by planting native species or creating silvo-pastoral plantations, where conditions allow and pressure on natural forests is high. This target afforestation rate will solve several economic, social and environmental problems in the Republic of Moldova. To this end, it is necessary to develop new provisions in the normative acts in the forestry sector, with clear measures for adaptation to climate change.

92. The objectives and measures to address climate change adaptation in the forestry sector of the Republic of Moldova are established based on the analysis of the current situation and the assessment of related needs. This approach must be based on sustainable forest management, to be ensured by:

1) long-term forestry assessments and policies;
2) prioritizing the environmental objectives of the forest-based sector;
3) ensuring the integrity of the forest fund and the permanence of forests;
4) increasing the area of land covered by forests and forest vegetation;
5) enhancing the role of the forestry sector in the sustainable development of society;
6) supporting all forest owners/holders and stimulating their association;
7) maintaining, conserving and enhancing biological diversity in forests;
8) maintaining the health and vitality of forests;
9) maintaining and enhancing forest protection functions;

10) maintaining and strengthening the productive capacity of forest resources, their contribution to global carbon cycles;
11) mitigating the effects of climate change on forests and strengthening the adaptive capacity of forests.

93. Climate change projections and impacts are to be framed in forest management, afforestation, reforestation and regeneration practices, including activities of:

1) development and implementation of forest management plans (forest management plans);
2) forest fire detection and protection;
3) forestry operations in vulnerable and inappropriate stands;
4) forest protection practices that take into account changes in pest profiles and associated hazards;
5) specific measures to optimize compositions with a view to improving the overall sustainability of forests;
6) forestry and regeneration operations to replace stands of one species with mixed and multi-species stands;
7) maintaining and restoring wetlands within forest bodies for biodiversity conservation and climate change protection;
8) training and development of forestry specialists skilled in climate change, their impacts on forests and implementation of appropriate adaptation options.

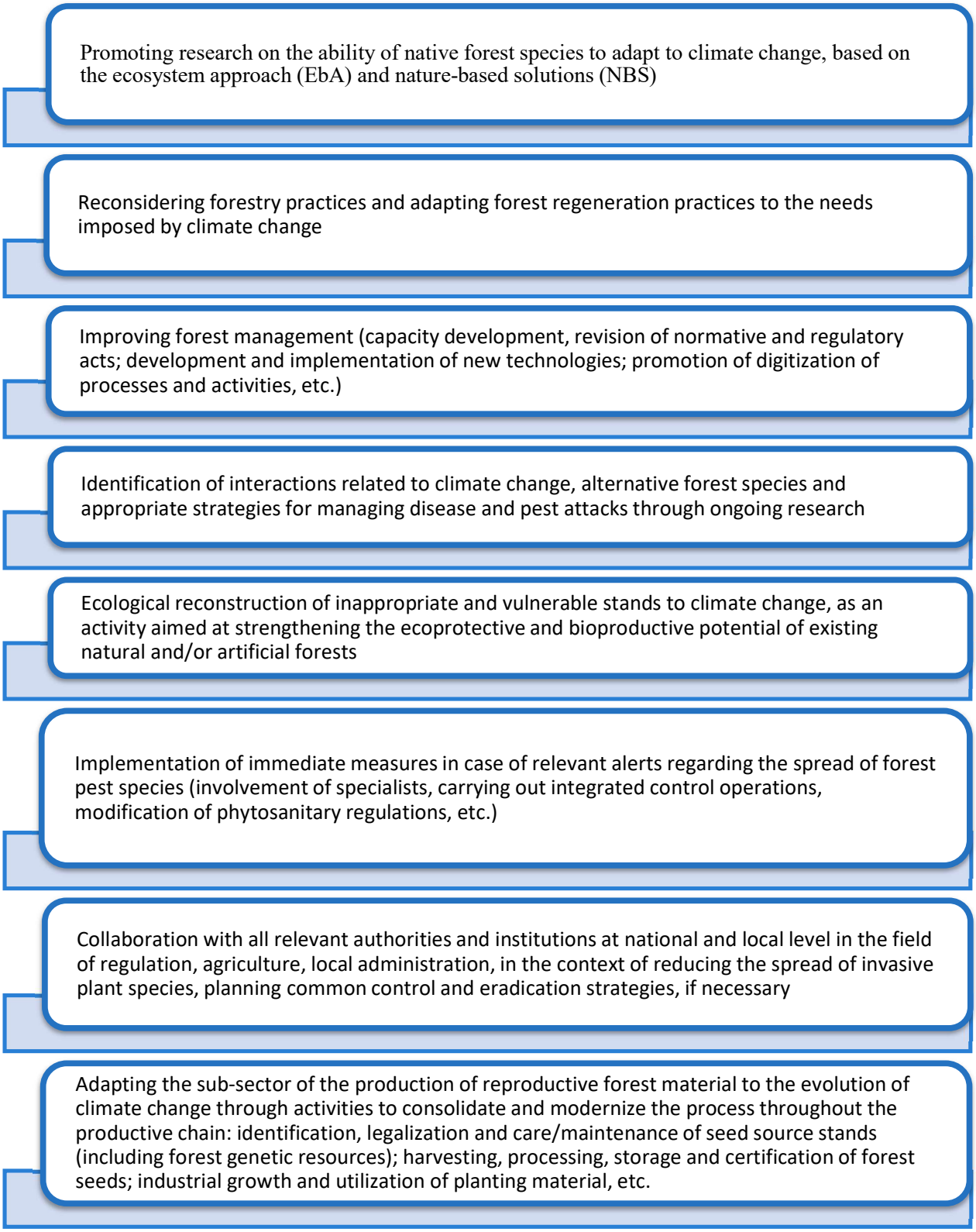
94. In this integration process, the needs of forest beneficiaries, including women, young people, the elderly, people with disabilities and marginalized social groups, will be taken into account.

95. At the same time, ecosystem-based adaptation measures (EbA) are mainly focused on:

1) Ecological restoration and rehabilitation of forest, steppe and meadow ecosystems (wetlands).
2) Extension of protected areas with forest profile to ensure in-situ conservation of representative and vulnerable biological diversity, protection of genetic diversity of native species, and minimization of biodiversity loss caused by climate change.
3) Ensuring a functional management of the National Ecological Network and the Emerald Network as part of Natura 2000 to ensure the survival of vulnerable flora and fauna species.
4) Implementing a mechanism for monitoring and controlling invasive species and minimizing risks to ecosystems.

96. The optimal set of tools needed to ensure improved forest management and their adaptation to climate change must include in particular the aspects presented in Figure 6.

Figure 6. Recommended climate change adaptation measures for the forestry sector



97. According to the World Bank assessment presented in the report on Investment Planning for Climate Adaptation in Moldova (WB, 2016), priority investments needed between 2020 and 2030 for

ecological restoration of forests and forest belts in the country represent about 96 million USD. The updated NDC of the Republic of Moldova (2020) estimates priority investments of about 170 million USD in the sector until 2025 – to strengthen the process of expanding land covered with forest vegetation, intensify the restoration of degraded grasslands, improve forest monitoring and management.

Subsection 4
Climate change impacts and CCA options in the HEALTH sector

98. Although agriculture is considered to be the sector most affected by climate change at national level, the impact on the health sector is also significant, and measures are needed to increase its resilience to climate extremes and hazards.

99. There are some methodological difficulties in establishing and estimating the impact of climate change on the health system of the Republic of Moldova, as well as its vulnerabilities, because the indicators used for this purpose belong to four interdependent components and have different approaches. These are:

1) population health, which depends on several factors outside the health system (social, economic, environmental, hereditary, cultural, etc.);
2) volume and quality of services provided by healthcare providers (hospitals, primary care, emergency care, etc.);
3) level of state supervision of public health;
4) the level of preparedness and resilience of health institutions to public health emergencies, including those caused by the impact of climate change factors, as well as prevention (such as warning systems) and preparedness (such as educational campaigns related to behavior change to cope with extreme climatic events, e.g., heat waves, etc.).

100. Within the national health system, various types of assessments have been and continue to be carried out, each with its own specific and general purposes, methodologies and objectives. Usually, most assessments are focused on indicators reflecting the health status of the population (life expectancy, mortality, morbidity, prevalence, etc.), indicators reflecting the activities of medical institutions (number of patients treated or number of surgeries performed), as well as indicators reflecting the capacities of the health sector (number of beds, etc.). At the same time, no data were identified on comprehensive assessments or epidemiological studies of the direct or indirect impact of climate change on public health and healthcare.

101. However, the problem of the relationship between human health and climate change has been studied quite widely in the scientific works of Moldovan scientists, but climate change adaptation measures identified for the health sector have not been streamlined in sectoral development programs. This could, therefore, affect the budgeting process, especially given that most measures will be financed by budgetary means.

Climate change risks and vulnerabilities in the health sector

102. The impact of climate change on public health manifests itself both in the direct effects of extreme events (e.g. physiological effects caused by extreme temperatures) and in indirect effects over time. These effects may include urbanization and population migration, changes in human behavior (forced migration, more time spent outdoors), changing patterns of infectious diseases or the emergence of new diseases, increasing transmissibility of food- and vector-borne diseases or other impacts of climate change. The negative impact of climate change on agriculture, the forest-based sector and the economy in general could, for example, cause food security problems and poor nutrition, which in turn could lead to adverse health effects in the medium- and long-term. Extreme droughts can cause reduced food production and lead to food problems among the population, increasing their vulnerability to diseases. Another indirect effect of climate change on health could also be due to limited access to health services, because of obstacles created by floods or heavy snowfall, or damage caused to medical facilities by storms, torrential rain, floods, fires and other climatic factors.

103. The level of adverse health impacts of climate change depends on the extent to which people are exposed to its impacts, the sensitivity of the population, social and cultural attitudes and expectations towards women and men that influence behaviors, the specific characteristics of each person, such as gender, age, educational attainment, income and health, and the capacity of government and the medical system to cope with the consequences of this impact by ensuring access to medical services, economic and social support. The elderly, children, women, people with chronic cardiovascular and respiratory diseases, those working outdoors, migrants, displaced persons, refugees and homeless people are particularly vulnerable to the impacts of climate change.

104. The effects of climate change on public health also depend on geographic area and habitat conditions. In this context, two important impact factors need to be highlighted, namely access to drinking water and air quality. According to the National Report on the implementation of the Protocol on Water and Health in the Republic of Moldova, in 2018 about 30% of the country's population lacked access to safe drinking water, including 2.7% urban population and 54.9% rural population. Among waterborne diseases and hygiene conditions, it was found that although there is a stable reduction in their incidence, the values for morbidity caused by viral hepatitis A and hemorrhagic enterocolitis caused by E-coli are much higher compared to the European average.

105. The impact of climate change on residents varies depending on whether they live in urban or rural areas. Due to the specific microclimate caused by population density, large number of urban transport, areas limited by green spaces, physical properties of building materials (concrete, asphalt), roads and other infrastructure, cities are more sensitive to negative climate impacts, especially during periods of extreme heat. The urban population is exposed to several risks with a combined effect. For example, air pollution increases health risks associated with exposure to high temperatures. The increase in the number of hot days exacerbates the effect of the "urban heat island" (meteorological phenomenon manifested by higher temperatures of an urban space compared to neighboring rural areas), thus causing health problems.

106. At the same time, rural communities are at risk of insufficient or even lack of water, reduced agricultural production, poor food security, and residents of rural areas, especially those in remote localities, are at increased risk of health problems due to limited access to health services. From this perspective, cities provide hope for a better life. However, many urban migrants live and/or work in

neighborhoods with limited public facilities, especially without access to water supply, sanitation and waste management services. They may live or work in buildings with insufficient ventilation or low energy efficiency, which increases their vulnerability to climate change.

107. However, not all climate change will have adverse impacts on human health. For example, due to milder winters, the seasonal peak of morbidity and mortality due to the spread of diseases in the cold season of the year (acute respiratory infections, respiratory diseases, etc.) will decrease. Rising temperatures could also reduce the vitality of some vector mosquito populations. However, despite these factors, climate change generally has and will have a negative impact on human health. The main direct and indirect impacts of climate change on human health can be summarized as follows:

1) Increased morbidity and mortality. The main concern is associated with heat-related morbidity and mortality due to increases in average annual and extreme temperatures, although this problem is also influenced by socio-economic factors, as well as by age distribution. According to recent data from the World Health Organization (WHO), over the last 20 years, mortality from high temperatures among people aged over 65 has almost doubled globally, reaching up to 300,000 deaths in 2018. Deaths in the WHO European Region increased by more than 30% over the same period (WHO Regional Office for Europe, 2020). The elderly have reduced ability to control and regulate body temperature and have the highest risk of death from heat shock and cardiovascular, renal, respiratory and metabolic disorders. Although the total number of deaths is closely related to the population number, changes in mortality rates could be much more pronounced in regions where the phenomenon of rising temperatures is stronger.
2) Infectious vector-borne diseases. Vectors such as mosquitoes or ticks are strongly influenced by climate change, due to alterations in their geographical spread area, seasons of activity and population size. Changes in land use and socio-economic factors (e.g. human behavior, movement of people and goods) are an important factor for vector propagation. As a result, variability in temperature and precipitation levels favors the emergence and spread of such diseases as malaria, Dengue fever, Lyme disease, West Nile fever, etc.
3) Water-related diseases. Heavy rainfall is correlated with a number of waterborne disease outbreaks as a result of pathogen mobilization or large-scale water contamination due to leaks from sewer networks. At the same time, reduced river flows during the summer increase the potential for bacterial and chemical contamination of water. Also, the increase in cases of contamination with fecal bacteria entails the risk of affecting drinking water supply systems, as well as water intended for other domestic use, food production or recreational purposes. Insufficient water to meet daily hygiene needs, such as hand washing, an essential element for health, could contribute to multiplying infectious disease outbreaks.
4) Foodborne diseases. High temperatures are also associated with high risks of explosions of salmonella and campylobacter outbreaks. Heavy rains could contaminate drinking water from wells, and algae that multiply due to high temperatures can cause gastrointestinal problems. As a result, foodborne diseases, which are usually caused by microbial contamination, are a growing health problem among those caused by climate change.
5) Allergic reactions. With increasing temperature, the pollen reproduction period in plants is longer, which intensifies and prolongs the allergy season. Increased levels of carbon

emissions into the atmosphere can also cause more intensive plant growth and pollen production, which in 20% of cases is the main cause of allergic reactions. Such symptoms as pain in the sinus area, pressure in the ears and nasal congestion could become much more intense. There is also the possibility of extending the season and duration of allergies ("hay fever", asthma), with effects on the direct costs of healthcare and medicines, as well as on working hours. People who already have chronic respiratory conditions, such as asthma or chronic obstructive pulmonary disease, will be at particularly high risk.

6) Pregnancy and complications in childbirth. Climate change is exacerbating air pollution and extreme heat waves, which could affect pregnant women and new-born babies. In developing countries, pregnant women may suffer from lack of water or food and are at increased risk of contamination by disease-carrying insects, all caused by climate change.
7) Heart and lung diseases. Air pollution rises as temperatures rise, causing stress to the heart and respiratory systems. Wildfires, the frequency of which is increasing due to droughts and high temperatures, are sources of pollutant emissions into atmospheric air. Emissions from burning fossil fuels exacerbate cardiovascular disease, asthma attacks and other respiratory problems, causing an increase in hospital admissions and fatalities.
8) Health problems related to ultraviolet radiation. An indirect effect of climate change on health is driven by changes in ultraviolet radiation It has been confirmed that high temperatures will influence clothing and time spent outdoors, thus inducing the risk of increased exposure to ultraviolet radiation, which increases the incidence of skin cancer, including malignant melanoma and cataracts.
9) Mental disorders. People exposed to, or displaced by, the effects of extreme weather events are at high risk of mental illness. The increasing number of disasters caused by adverse climatic conditions (such as floods, droughts, heat waves, hail, etc.) could also lead to an increase in the number of people affected in this context.
10) Trauma. Extreme weather events, including storms, floods and forest fires, often cause physical damage such as fractures, injuries and smoke inhalations. Very high temperatures are also associated with aggression and violence, and the climate crisis is linked to violent conflicts and forced migration. In the case of low temperatures, there is also an increase in the number of traumas caused by falls due to frost, as well as in the number of people with frostbite and hypothermia.

108. In the Republic of Moldova, the most common climate change phenomena affecting people's health and well-being are:

1) heat waves;
2) prolonged droughts;
3) floods;
4) heavy rains;
5) hail;
6) heavy snowfall;
7) fog, frost, sleet;
8) strong winds, storms, hurricanes.

109. The most relevant impacts of climate change for the health of the population of the Republic of Moldova and the national health system are presented in the following table.

Table 7. Socio-economic impact of climate change on the health sector

Climate hazards	Health impact	Social/economic impacts
High air temperatures and heat waves	• Increased morbidity and mortality rate from heat waves • Increased incidence of hyperthermia and sunburn, especially among people working outdoors and the elderly • Impaired health of people with chronic cardiovascular, respiratory and kidney diseases • Increasing incidence and spread of infectious diseases transmitted through water and food • Increased incidence of vector-borne diseases	• Reduced labor activity, including among migrant workers and reduced economic output • Absent school days (due to increased morbidity) • Increased burden of diseases and conditions, including allergic diseases • Increased cost in healthcare of people, especially vulnerable groups • Increased mental and behavioral disorders due to stress • Reduced access to food and rising prices due to reduced agricultural productivity • Population displacement
Flood	• Increased number of deaths and injuries • Increased number of waterborne diseases	
Droughts	• Affecting food security and exacerbating malnutrition and malnutrition • Increasing incidence and spread of infectious diseases transmitted through water and food	
Low temperatures and cold waves	• Increased incidence of acute respiratory diseases and exacerbation of chronic respiratory diseases • Increased incidence of hypothermia and frostbite, especially among homeless people and the elderly • Increased trauma from falls due to frost • Reduced access to healthcare due to road blockages during heavy snowfall	

Source: Adapted from NC3 (2013), NC4 (2018) and Updated NDC (2020) of the Republic of Moldova

110. The impact of extreme climatic events on human health and people's quality of life differs considerably, depending on the living environment and geographical region. According to the assessment of risks and opportunities related to climate change for human health, the most vulnerable regions in the Republic of Moldova are Chisinau municipality, the southern region and partly the central region of the country. The northern region, being in the vicinity of the Carpathians, will benefit from more favorable climatic conditions (see Table 8).

Table 8. Assessment of climate change risk on health depending on geographical areas in the Republic of Moldova

Type of health risks	Geography			
	North	Center	South	Mun. Chișinău
Increased morbidity and mortality rate from heat waves	Low	Medium	High	High
Increased number of diseases caused by air pollution	Medium	Medium	Medium	High
High risk of allergic diseases	Medium	Medium	Medium	High
High risk of droughts and water scarcity	Low	Medium	High	Low
Increased frequency and intensity of floods	Medium	High	High	Low
Increased incidence of water- and foodborne diseases	Medium	High	High	Low

Source: Adapted from NC3 (2013) and NC4 (2018) of the Republic of Moldova

111. Climate change does not affect all people equally; some groups are clearly more vulnerable than others. As already estimated for heat waves, the overall health effects of climate change are heterogeneous in different regions of Europe. Health and well-being are closely related to socio-economic factors such as income, mediums of living, occupation, education, gender dimension and lifestyle. Thus, the effects of climate change will increase health disparities between populations in different countries as well as within countries, leading to an unequal distribution and additional burden for low-income groups and some vulnerable groups, such as children, people working outdoors, elderly, pregnant women, and people with chronic diseases. Persons in temporary shelters (e.g., migrants, refugees or persons displaced due to extreme weather events) are also particularly vulnerable to climate risks during transit or at the place of destination.

112. Current cases of heat-related mortality indicate a strong dependence on socioeconomic living conditions, in addition to other factors such as age or chronic disease. In addition, gender plays an important role, as research has shown that women are more at risk of death during heat waves.

113. Another element of inequality could be the fact that the population in villages are more dependent on decentralized water supply than the population in cities, and worsening water quality (including in cases of extreme climatic events such as droughts and floods) will primarily affect people in rural areas, children being one of the most vulnerable groups to intestinal diseases. Additionally, healthcare infrastructure is less accessible in villages than in cities, and providing primary health care institutions in rural Mediums with staff and medical transport is still a major problem in the healthcare system.

114. The vulnerability of certain categories of people is related to their state of health. Adjusting physiological processes to new climatic conditions and mobilizing protective reactions happens fairly quickly in the body of a healthy person, and as a result, healthy people adapt quite easily to climate change. Whereas in the case of a sick person, adaptive reactions are weakened, and the body loses its

ability to adapt quickly.

115. The influence of weather conditions on a person's well-being is also associated with the age and individual susceptibility of the body. Under conditions of rapid climate change, human adaptation mechanisms are overloaded and often unable to react normally, which increases the vulnerability of the population. Table 9 summarizes the health risks associated with climate change and the most vulnerable groups of people to these threats.

Table 9. Health risks associated with climate change per vulnerable groups

Health problems caused by climate change	Vulnerable groups
Non-communicable diseases	
Heatwave-related illnesses and deaths	Elderly; People with chronic diseases; New-borns and children; Pregnant women; Poor and low-income people; Residents of the Urban Medium; Farm workers; People working outdoors.
Diseases and deaths due to air pollution	Children; People with respiratory and cardiovascular diseases; People with unfavorable allergic status; Traffic police workers.
Diseases and deaths related to extreme climatic events	Poor people; Pregnant women; People with chronic diseases; People with disabilities. People in temporary shelters (migrants, refugees or people displaced by extreme weather events).
Communicable diseases	
Waterborne infectious diseases	Elderly; Children with reduced immunity; People who do not have access to drinking water in adequate quantities and of good quality; People in contact with wastewater. Migrants from rural to urban mediums, living in neighborhoods with limited public services (water, waste and sewerage).
Foodborne infectious diseases	Homeless, low-income and poor people.

Vector-borne infectious diseases: Lyme disease, malaria, etc.	People who carry out work in forest areas, public gardens, etc. People coming from endemic areas; People with reduced immunity, children, pregnant women; People with genetic deficiencies.

Source: Adapted from NC3 (2013) and NC4 (2018) of the Republic of Moldova

116. According to the above mentioned, an indirect effect of climate change on health could be induced by limited access to health services due to obstacles created by floods, storms, fires or other factors related to climate change. At the same time, many medical institutions in the Republic of Moldova are not resilient to the impacts of climate change. According to a study on the safety of hospitals in emergency situations, conducted in Moldova in 2016 with the WHO support, several gaps in hospital safety were identified, namely:

1) "Structural safety" (condition of buildings): cracks in load-bearing partitions, lintels and floors, and in some cases damage to the foundation; exposed joints between vertical panels of fortified concrete, which allow moisture to penetrate and may cause damage to external walls; partially damaged roof sections; maintenance deficiencies.
2) "Non-structural safety" (state of engineering infrastructure and networks): large number (in some hospitals exceeds 60%) of engineering networks (electricity, aqueduct, sewerage, etc.) requiring renovation; lack or reduced capacity of alternative sources of electricity, drinking water and heating; deficiencies in fire protection; lack or malfunction of ventilation / air conditioning systems, etc.

117. Although these infrastructure deficiencies do not result directly from climate change, they reinforce vulnerability and weaken the resilience of Moldova's public health sector to climate-related hazards and their impacts.

Recommended CCA actions for the health sector

118. Based on studies and analyses conducted during NAP-1, Moldova's updated NDC from March 2020 summarizes the key challenges faced by the health system and its efforts to strengthen resilience to climate change, for example:

1) limited networks of medical services in rural areas;
2) insufficient provision of personnel, equipment, and financing of the public health system;
3) insufficient capacity to assess and monitor vulnerability to climate-related health risks (including gender assessment);
4) need to strengthen primary health care (including primary prevention) to support local communities' capacities to become resilient to climate-related health risks;
5) need to improve access to healthcare for vulnerable groups of the population;
6) need for coordinated health and emergency management measures to reduce the impact of extreme phenomena on health;

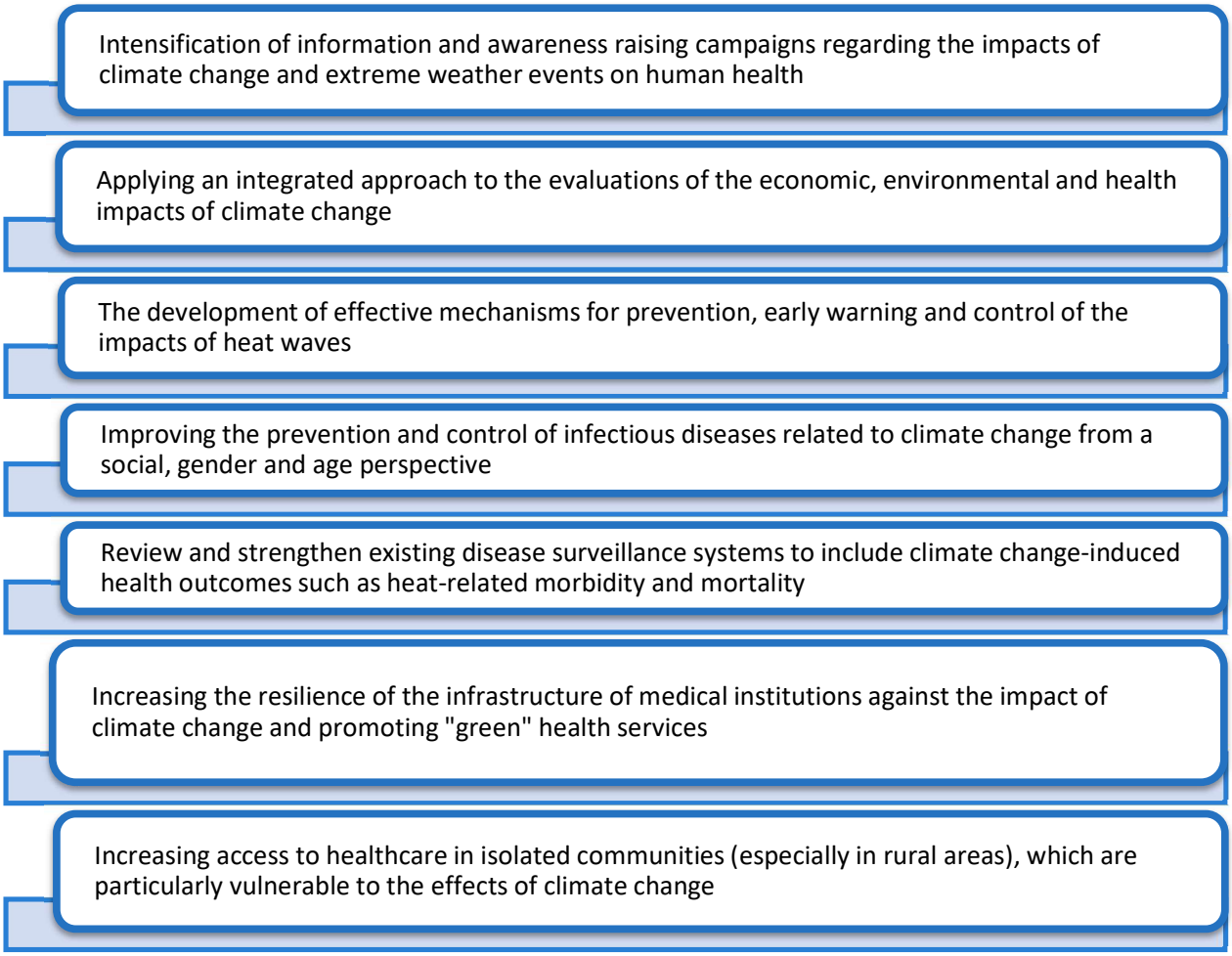
7) need for targeted integration of climate change considerations into sectoral development policies and strategies (including financing).

119. The Comprehensive Assessment of the NCCAS 2020 (conducted in September 2021) concluded that no strategic health policy document integrating climate change adaptation measures was approved during the reference period 2014-2020. A draft strategy for adapting the health sector to climate change has been drafted, but it has not been officially adopted. The necessary strengthening of relevant public health institutions (the National Agency for Public Health and its territorial public health centers) to coordinate public health preparedness and response to climate change has not taken place. On the contrary, as a result of the reform of the public health system, these institutions were even weakened. The NCCAS assessment showed that much of the climate change adaptation actions expected for the public health sector were underfunded or not funded at all. Based on this, the following recommendations were made:

1) Ensure targeted funding for CCA measures to be applied in the public health sector post 2020, with diversified indication of funding sources and allocations for each specific objective.
2) Strengthen the capacities of the National Agency for Public Health and its territorial subdivisions for integrating climate change considerations into public health programs and budgeting.
3) Ensure functional collaboration between relevant sectors and institutions (both within and outside the health system) to strengthen capacities to adapt to climate change and ensure more efficient use of available resources.
4) Creating an operational information system, in the field of environment and health, with climate change aspects and an effective mechanism for prevention, early warning and management of extreme weather phenomena affecting public health.

120. Figure 7 presents specific adaptation actions recommended for the public health sector in the Republic of Moldova post-2020 to increase resilience and mitigate risks arising from projected climate hazards.

Figure 7. Recommended climate change adaptation measures for the health sector



121. Namely the aspects and recommendations described above guided the identification of CCA measures proposed for the health sector in the Action Plan to this Programme (Annex 1). According to studies conducted during NAP-1, and experience in implementing NCCAS until 2020, the most considerable investments (according to the updated NDC about 164 million USD) are needed to:

1) provide healthcare services in isolated communities to populations particularly vulnerable to the effects of climate change (elderly and disabled people, migrants, or people displaced by extreme climate events);
2) equip emergency departments for cardiovascular diseases according to WHO requirements;
3) modify hospital infrastructure to operationalize "green" standards;
4) create a national information system for data collection and processing, including on the emergence and incidence of new diseases related to climate change;
5) the prevention, early warning, management and overcoming of the impact of extreme climatic events due to climate change (high temperatures, cold weather, floods).

Subsection 5
Climate change impacts and CCA options in the TRANSPORT sector

122. In order for the Republic of Moldova to ensure sustainable economic development, it is indispensable to develop an efficient road transport system and climate-resilient infrastructure that meets the needs of mobile citizens and facilitates trade both on the national and international market, thus attracting investments in various branches of the national economy.

123. The impact of climate change is felt in the development of all key sectors of the economy, transport being one of the most vulnerable. The transport sector, which includes road, rail, naval and air transport, is vulnerable to increased frequency and intensity of storms (wind, rain, snow), which pose a challenge to the resilience of that infrastructure and entail higher costs for its construction, maintenance, and operation. Taking into account that the Republic of Moldova is a country without direct access to the sea, roads are the basic infrastructure, which play an essential role in the national economy.

124. According to statistics, the length of the public road network in the Republic of Moldova increased by 105 km between 2014 and 2020 (from 9,360 to 9,465 km), while the overall length of navigable watercourses decreased by 148 km in the same period of time (from 558 to 410 km). A large part of the road network is covered with permanent or semi-permanent pavement (asphalt concrete, cement, concrete, bituminous mixtures executed in situ). Currently, 52% of national roads are in good or mediocre condition and 48% - in poor and very poor condition. This has a proven adverse impact on the environment, as fuel consumption on roads in poor condition increases by up to 20%, generating additional emissions into the atmosphere.

125. The unsatisfactory state of the transport sector in the Republic of Moldova and the outdated fleet of vehicles determine its increased vulnerability to extreme climatic phenomena that damage infrastructure, increase transport delays and affect the national economy by increasing public costs. Thus, adaptation to climate change is one of the major challenges in this sector. On the one hand, the standards and norms applied in the design of public roads do not correspond to the development trends in the sector and produce infrastructure that is not suitable either for road traffic flow or for new climatic conditions. On the other hand, financing road development and infrastructure maintenance in the country is insufficient and cannot counterbalance the speed of road degradation. In recent years, the rehabilitation of roads in the Republic of Moldova has been underfinanced by over 3 billion MDL, and cumulatively with the cost of infrastructure maintenance inaction increases the targeted amount to over 6 billion MDL. Persistent underfunding hampers medium- and long-term planning in the sector, including integrating climate change prevention and resilience into transport infrastructure investments.

126. Analyses of technologies used in the Republic of Moldova's transport sector have once again confirmed that the outdated and poor state of the country's transport infrastructure requires urgent action not only to modernize the sector, but also to increase resilience to climate change. An important step in this direction is the implementation of the Technical Regulation on minimum requirements for the marketing of construction products, approved by Government Decision no. 913/2016, with a transition period for implementation until December 31, 2020. Thus, it is foreseen that from January 1, 2021, all Moldovan road construction companies will produce and supply construction materials that meet European EN standards. For this purpose, a list of harmonized standards was approved by the Ministry of Economy and Infrastructure on 08.02.2021, which replaced the outdated technical norms

used until that time in the road industry. All new investments in the design and construction of transport infrastructure are to align with these standards.

Climate change risks and vulnerabilities in the transport sector

127. Climate change is causing a significant impact on the transport sector. Due to the limited public budget for maintaining transport infrastructure, it is increasingly vulnerable to gradual changes in weather conditions and sudden climate shocks. Phenomena associated with climate change, such as rising temperatures and changes in rainfall levels, will be a serious challenge for transport infrastructure if adaptation measures are not taken in time.

128. Rising temperatures and extended periods of heat waves can cause pavement damage, buckling of railway tracks and other structural issues. This can lead to overheating of equipment, damage to asphalt pavement, materials used in the construction of roads, bridges and railway structures, thereby reducing the service life of transport infrastructure. During multi-day heat waves above 40°C, severe deformations of pavement and railway tracks are anticipated. Such a negative impact was already attested in 2003, 2007, 2012 and 2019 when high temperatures were recorded over long periods of time. All types of transport could be adversely affected by climate change. Floods and other climate-related disasters can affect airport infrastructure, and rising temperatures can disrupt planes taking off. Shipping lanes could become impassable due to low water levels or climatic phenomena (droughts and floods). Railways are particularly vulnerable to extreme heat, which causes damage (buckling of railway lines). Thus, it is vital that the transport sector in the Republic of Moldova is provided with capacities to adapt to climate change.

129. Depending on the type of effects of climate change (rising temperatures, rainfall, extreme phenomena, etc.) a number of risks have been identified according to transport categories (road, air, waterborne, rail), presented in Table 10.

Table 10. Main risks and vulnerabilities caused by climate change in the transport sector

Sub-sector	Climate hazards	Risks and vulnerabilities
Railway	**High summer/winter temperatures**	- deformation of railway lines, increased instability of embankments; - overheating of equipment (e.g. engine ventilation, acclimatization); - increasing the frequency of wildfires can cause damage to infrastructure; - reduced life cycle of railway infrastructure and increased maintenance costs.
	Winter cold	- formation of ice surfaces on trains and catenaries, which will lead to disturbances in operation; - disruption/suspension of railway activity.
	Extreme precipitation	- deterioration of infrastructure; - flooding of railway infrastructure; - interruption of railway operations.
	Extreme winds	- damage to infrastructure, such as signs, electricity cables, etc. (e.g. due to fallen trees or pillars).
Road	**High summer temperatures**	- damage to pavement; - reduced life cycle of asphalt road surfaces; - damage to infrastructure/equipment; - thermal expansion of bridge joints and paved surfaces; - damage to the material of the bridge structure; - damage and breakdown of old vehicles; - increasing the number of accidents.
	Extreme rainfall/ Flood	- damage to infrastructure (washing pavement, road; instability of embankments); - damage to energy networks (affecting trolleybus transport); - disruption of the functioning of the transmission system; - flooding of underground passages; - overloaded drainage systems; - flooding of road infrastructure and collapse of bridges; - gradual degeneration of transport infrastructure; - disintegration of the surface of roads, sidewalks, cycle paths.
	Extreme winds	- damage to infrastructure (e.g. roadside trees/vegetation can block roads).
Aviation	**Summer heat**	- degradation of runways and runway foundation; - damage to infrastructure/equipment.

	heavy rainfall and other phenomena (wind/snow)	- flood-induced damage to airport infrastructure and runways; - failure of aircraft and traffic management equipment; - poor visibility and traction; - disruption of flights; - loss of ground access to the airport; - increased safety risks for ground operations.
Naval	**High river flow (e.g., extreme rainfall, snow melt)**	- speed limits due to dam instability; - navigation restrictions; - damage to port/cargo infrastructure; - increased costs for port construction/maintenance; - disruption of operation.
	Low river flow (e.g., drought)	- restrictions on load capacity; - reduced water levels imposing restrictions on inland navigation and increased fuel consumption; - navigation problems, reduced speed and use; - disruption of operation.

Source: Adapted from NC4 (2018) of the Republic of Moldova

130. Climate risks for the transport sector are directly related to hazards (and their combination, the main ones being floods, droughts and heat waves), as well as the nature and condition of transport infrastructure. Floods, droughts and extreme heat can, individually or in combination, increase the impact and wear of land transport infrastructure (in particular roads and railways). Floods can cause short- and long-term delays and disruptions to traffic, and diversion needs in case of destruction of transport infrastructure. This could, in turn, negatively affect the delivery of material aid and assistance to the displaced population, or disrupt the planned evacuation and return of displaced persons to their homes. Droughts, low seasonal and annual rainfall contribute to the reduction of river flows which, in turn, compromise the (already reduced) navigability of navigable watercourses.

131. Another concern is the need for financing for the maintenance of transport infrastructure and vehicles (transport for road, rail and naval). These needs tend to increase and risk not being met in the context of continued underfunding of transport infrastructure.

132. Climate risks for the transport sector are generated both directly by new climate trends and phenomena and indirectly – by changing transport models/patterns. A summary of climate-related vulnerabilities for the transport sector in the Republic of Moldova and the respective socio-economic impacts are presented in Table 11.

Table 11. Potential socio-economic impacts of climate change on the transport sector

Climate hazards	Potential impact on transport	Socio-economic impacts
High temperatures and heat waves	- Changes in pavement integrity, e.g., softening and migration of liquid asphalt, furrows formed by	- Accelerated deterioration of transport infrastructure

	vehicle wheels - Bridge expansion/deformation - Deformation of railway tracks - Damage to airport runways - Overheating of vehicles and damage to engines or overheating of equipment (e.g., engine ventilation, air conditioning) - Reduced life cycle of asphalt road surfaces - Degradation of runways and runway foundations - Reduced life cycle of paved surfaces and transport goods	- Restriction of transportation of heavy loads (affecting the revenues of transport companies); speed limits - Increased fuel consumption and higher emissions - Limitation of construction activity periods - Increased capital investment costs and costs of operating and maintaining transmission systems - Increased indirect costs for public and private transport users, as well as road infrastructure charges
Heavy rainfall and flooding	- Flooding of land/ship/rail infrastructure - Damage to transport and cargo infrastructure - Collapse of bridges - Flooding of underground - Frequent landslides - Increased delays due to weather conditions - Increased traffic disruption - Disruption of construction activities - Disruption of maintenance and safety operations	- Deteriorated transport infrastructure and restricted movement, which could negatively affect the delivery of material aid and assistance to the displaced population - Low revenues from transport activities - Interruptions in the supply of goods - Increased costs for maintenance and operation of transport - Increased costs for transport services - Rural communities could be isolated from the rest of the country
Low rainfall	- Low humidity of the caldera, especially in spring and autumn - Restricted development of river transport	- Reduced vessel circulation - Increased operational costs - The need for additional engineering work

Frequent extreme winds	- Damage to infrastructure on roads, railways, pipelines, ports, airports - Damage to cable bridges, signs, railway signs, overhead cables - Disturbance of safety of means of transport	- Suspension and interruption of transport services - Disruption of the commercial activity of transport operators, affecting the revenues of transport companies - Increased infrastructure maintenance costs

Source: Adapted from NC3 (2013) and NC4 (2018) of the Republic of Moldova

133. As for the other sectors, the impacts noted in Table 11 involve gender, which must be considered. For example, women are more likely than men to use public transport. If transport options are suspended or interrupted, this will disproportionately affect them.

134. During extreme weather events, key transport networks could become inaccessible or unsafe for both private and commercial travel, and public transport services could be disrupted or suspended. The gradual deterioration of transport infrastructure associated with extreme levels of rainfall and subsequent flooding can have a serious impact on several sub-sectors. As indicated in Tables 10 and 11, the main impacts relate to: disintegration of roads, pavements and cycle paths; increased bridge subsidence (if the material around the pillars and the pillars themselves are knocked down by the rapid movement of water, causing structural instability and possible destruction of bridges); increased risk of landslides (as the slopes become saturated with precipitation) leading to blockage or damage to the road, railway paths and transport infrastructure.

135. Thus, many roads are at risk of destruction and damage to the structure, due to extreme weather events, intensified by anticipated climate changes. Negative effects will manifest during hot and dry periods followed by intense local rains associated with thunderstorms and hail. Due to outdated and inefficient drainage systems in urban communities, floods are frequent on some road segments, as in the case of floods in Chisinau in 2005, 2008, 2009, 2015, 2016 and 2022. Unpaved roads – typical for rural areas – are likely to be adversely affected by the projected change in rainfall patterns, as they are generally more vulnerable to extreme climatic events. In warmer winters, increasing humidity levels will generate muddy and slippery roads, thus reducing road safety.

136. In conditions of hotter and drier summers (annual rainfall of up to 64% is less), water transportation in the Republic of Moldova could become increasingly vulnerable and expensive. During summer, the water level in the Dniester and Prut rivers could register significant reductions, which will make it impassable for the naval transport of passengers and goods – during summer and autumn, or in especially dry years. The inappropriate use of dams and the lack of dredging that is necessary to ensure adequate depth for vessel traffic are already a problem that may be aggravated by climate change in the future.

137. In the case of air transport, there is a risk that increasingly high temperatures in summer will gradually cause increased runway wear. High temperatures reduce runway resistance to plastic deformation and roughness, endangering take-off and landing maneuvers.

138. Given that the transport sector is sensitive to extreme events intensified by climate change, such as floods caused by heavy rainfall, as well as extreme temperatures, transport infrastructure needs to be designed to be resilient and cope with various climate stresses, and transport services need to

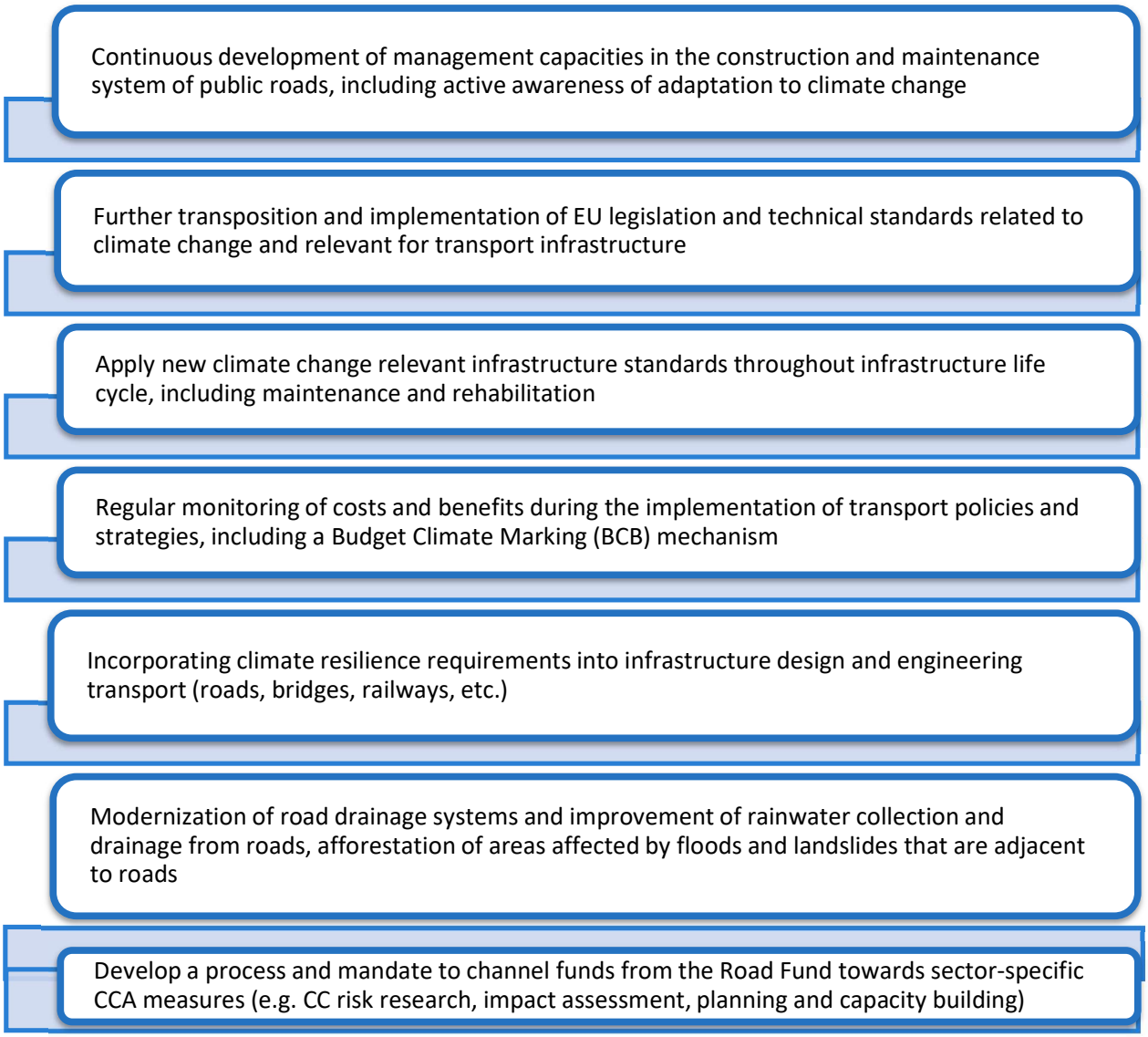
ensure the reduction of possible disturbances and increase safety in different weather conditions.

Recommended climate change adaptation actions for the Transport sector

139. Until the implementation of the first CCA strategy until 2020, technical regulations and standards in the field of construction in the Republic of Moldova did not provide for mandatory use of materials that would ensure the rigidity of the road surface during heat waves and other climatic hazards. Extreme temperatures, floods and flash floods create conditions for the destruction and continuous deterioration of road infrastructure, which is maintained only through minor repairs. In this context, the adoption of higher and climate-relevant construction standards, as well as their mandatory use in the rehabilitation of existing infrastructure and the construction of new transport infrastructure, is a measure of great relevance and efficiency and geared towards strengthening the resilience of the transport sector. The transition to higher, climate-relevant construction standards is to be beneficial in the medium- and long-term for the transport infrastructure of the Republic of Moldova. However, these standards must be applied throughout the entire life cycle of the infrastructure – from design to construction, and then in the maintenance process. Thus, better integration of climate change considerations into sectoral planning and, in particular, into the budgeting of priority measures, is an expected target for the national adaptation planning process after 2020. To this end, it is a priority to develop capacities for climate-resilient investments in the sector.

140. Figure 8 shows the recommended specific adaptation actions for the transport sector in the Republic of Moldova post-2020 to increase sector resilience and mitigate the risks from projected climate hazards.

Figure 8. Recommended climate change adaptation measures for the transport sector



141. Ensuring the future development and implementation of sustainable national transport and infrastructure policy implies taking into account the need for adaptation to climate change and new construction and operational requirements. The updated NDC of the Republic of Moldova (2020) estimates up to 159.5 million USD as priority investments in the sector – to address legal developments and capacity development, as well as to increase the climate resilience of infrastructure (roads, bridges, viaducts, railways, tracks) and to ensure rural population's access to climate resilient road system.

Subsection 6
Climate change impacts and climate change adaptation options in the Water resources sector

142. The hydrographic network of the Republic of Moldova consists of more than 3 000 rivers and streams, grouped into two river basin management districts. The Dniester River Basin district covers 57% of the country's territory in the eastern and north-eastern regions, and the Prut-Danube-Black Sea River Basin district covers 35% of the country's territory in the West and Northwest. The river network also includes around 60 natural lakes and around 3 500 artificial reservoirs and ponds constructed for irrigation purposes, flow regulation and fishing basins. The largest reservoirs in Moldova are Costesti-Stanca (678 million m^3) on the Prut River, jointly exploited with Romania, and Dubasari (235 million m^3) on the Dniester River. According to FAO estimates, total renewable surface water reserves in the country are estimated at 11 970 million m^3/year (FAO, 2019). The total storage capacity of water reservoirs in the Republic of Moldova is estimated at 2 584 million m^3 (FAO, 2015).

143. The main groundwater reserves are located in deep aquifers with a total flow of 1 300 thousand m^3, including 700 000 m^3 of drinking water. However, the natural recharge capacity of enclosed aquifers is limited, and the water is often too mineralized for domestic use or irrigation. In addition, about 75% of groundwater flow drains into the river system, therefore it does not contribute much to total renewable water resources (FAO, 2019).

144. It is estimated that climate change will generate a decrease in surface water flows in the Republic of Moldova by 16-20% by 2030, forecasts indicating that the average annual temperature will increase by 2°C and reduce annual runoff by 13% between 2010 and 2040. These values suggest that the trends of the current hydrological regime of small rivers in Moldova will be maintained, but that the flow will be well below the norm, especially in summer (due to frequent droughts). This will most likely lead to the drying up of rivers, especially in the south of the country. Overall, annual flows are expected to become more unstable, with flash floods more frequent.

145. There are data limits and scientific uncertainties that make it difficult to accurately assess the severity of climate change impacts on water resources in the Republic of Moldova. However, it is considered that at the current level of abstraction and use, water availability is not necessarily a constraint for the development of the country (Water Policy Outlook for the Republic of Moldova until 2030 (OECD 2020). Moreover, according to information extracted from the WB Database, there is a trend of increasing domestic renewable freshwater resources (588 m^3 per capita in 2017), which could be explained by the decrease in population number over time.

146. In the context of the lack of an approved methodology for defining and calculating core water management indicators reflecting the state of water security (water availability), climate change adaptation planning for the water sector needs to address certain issues as a matter of priority. These include issues related to intensity of climate change impacts on the water, dependent economic development goals of the country, the main vulnerabilities and the most impacted recipients.

Risks and vulnerabilities of environmental change in the water sector

147. The main drivers of future changes in physical conditions in the Republic of Moldova (impact generators), as forecasted by all climate models, are:

1) average annual temperature increase of 2ºC by 2040;
2) increased variability of precipitation with drying effect during the growing season;
3) 16 to 20% decrease in surface flow by 2030; and
4) reducing annual runoff by 13% between 2010 and 2040.

148. Table 12 includes potential socio-economic impacts on water resources that are produced by the above-mentioned climate change factors and extreme weather events.

Table 12. Potential socio-economic impacts of climate change on water sector

CC variables	Impact on water resources	Socio-economic impacts
Increased annual temperatures (Effect: warmer waters)	- Lower O^2 level in water pools (mainly in lakes in summer) - Increased ammonia concentration - Increased algae bloom - Loss of temperature-dependent freshwater organism species - Replacement of native aquatic species by invasive species - Increased levels of pathogens in water - Disruption of the spawning season - Increased evaporation	- Reduced water availability - The cost of drinking water increases (treatment of drinking water imposes additional costs) - Ecosystem services are affected - Human health affected - Recreation areas (tourism) are affected - Drying up small rivers and ponds
Change in precipitation pattern (Effect: greater variation in precipitation patterns, especially dry periods followed by more intense precipitation)	- Decrease in surface flow - Decrease in annual runoff - Groundwater lowering - Reduced water availability in summer	- Vegetation(s) affected due to low groundwater level - Drying shallow wells - Soil erosion - Clogging rivers and ponds - Contamination of surface waters with pollutants due to runoff caused by heavy rainfall Competition between water users
Extreme weather events: spring floods/summer	- Deterioration of social infrastructure - Pollution of ponds/rivers	- Damage to water supply and irrigation infrastructure - Loss of human and animal

floods	(chemical, bacteriological, physical pollution) - Clogging of rivers, ponds, reservoirs	life, material damage - Damage to agricultural land and destruction of crops - Health problems caused by waterborne diseases - Rescue costs - Population displacement/ forced migration
Extreme weather events: droughts	- Drying up of rivers - Groundwater lowering	- Shortage of drinking water for humans and animals - Loss of harvests - Remedial/mitigation costs - Migration to identify sources of income

Source: Adapted from National Communication 3 (2013) and NC 4 (2018) of the Republic of Moldova

149. The water sector involves strong gender connotations. For example, women and men have specific roles in household and agricultural water management, which means that water scarcity affects them differently.

150. The priority risks identified in NCCAS 2020 remain the same for the NAP-2 planning cycle: increased risk of drought and water insufficiency leading to increased irrigation demand; increasing the frequency and intensity of floods; changes in river flows – both rising and falling; water pollution by pesticides and fertilizers due to greater runoff; water quality indices (mineralization, hardness, dissolved oxygen, etc.) affected by climatic and non-climatic factors, which will amplify the effect of each other.

151. The severity of an impact is determined by assessing its intensity, duration, magnitude and likelihood of occurring in a given context (geographical scope and scale). The severity of CC impacts on the water sector has been assessed for the purposes of this National Adaptation Planning using the following methodological approach:

Severity of impact = Intensity of impact + Duration (temporal aspect) + Magnitude (spatial aspect),

Impact intensity = Magnitude of effect + Receiver value,

Effect magnitude – the magnitude of the effect assesses the extent to which the structural and functional characteristics of the component are adversely affected (*Very large*: if the effect results in the *loss or alteration of the whole or main characteristics* of the receptor, to the extent that it risks losing its identity: for example, destruction of the fertile soil layer, irreparably eroded (washed away) by leakage Devastating; *Moderate*: when the effect results in the *loss or alteration of certain characteristics of the affected component*, thereby reducing its qualities, although without compromising its identity: for example, wind erosion of the soil; *Low*: when *the effect does not significantly alter the characteristics*

of the affected element, so that it retains its identity and its qualities are not excessively degraded: for example, dust deposited on plants that affects their photosynthetic function until the first rain that will fully restore this function).

Receiver value – The Medium/Social value expresses the relative importance of an impact receiver. In this assessment, the prioritization of water use according to the provisions of the Water Law of the Republic of Moldova (272/23.12.2011) was used: 1) meeting the needs of drinking water and water for household needs; 2) irrigation and watering of animals; 3) industrial activities, including mining and agro-industry; 4) fish and fishing; 5) hydropower generation; 6) sports and entertainment; 7) other areas. The degrees of receiver value are: *Very* high: a very high value is assigned to receptors protected by law or regulation, or with a special status that strongly limits any action that may endanger the integrity of the element (*e.g. endangered or vulnerable species, drinking water supply*) as a matter of state/national security); *High*: An impact receiver is considered of great value when it has national or international protection status, or is considered essential for the functioning of the system or for human health, safety and well-being; *Moderate:* a receiver is assigned *an average value* when it is considered of lesser importance for the functioning of the system or for human health, safety and well-being; Low*:* A receiver is considered of *Low Value* when it is considered to be of little importance to the functioning of the system or to the health, safety and well-being of humans.

Duration – Duration indicates the *temporal aspect of the impact*. Assess, in relative terms, how long the impact will interact with the receiving medium. The terms "*long-term", "medium*", and "*short"* are used to describe this period of time.

Magnitude – Magnitude refers to the *spatial aspect of impact*. To classify this dimension, three levels of magnitude are defined: *regional, local* and *limited*.

152. The main elements in the water sector affected by climate change (impact receivers) are as follows (assessed according to the methodology described above):

1) Drinking water supply systems from surface/ground water – Very high
2) Irrigation and livestock – Very high
3) Industrial, including agro-industrial activity – Very high
4) Aquatic ecosystems, fish and fisheries (including fish stocking) – High
5) Sports and Entertainment – Medium
6) Hydropower production – Low (the only hydro-electric station existing in Moldova is the one at Costesti-Stanca, and the almost zero perspective for the future development of this sector justifies the "Low" degree attributed to hydropower generation).

153. Table 13 shows the principle of gradation of severity of CS impact on a receiver. It is determined by intensity, duration and magnitude, and is classified into three classes: high, moderate or low, according to the grid set out in the table.

Table 13. Severity of CC impact on an impact receiver

Duration	Extent	Intensity		
		High	Moderate	Low
Long	Regional	**H**	**H**	**M**
Long	Local	**H**	**M**	**M**
Long	Limited	**M**	**M**	**L**
Average	Regional	**H**	**M**	**M**
Average	Local	**H**	**M**	**L**
Average	Limited	**M**	**L**	**L**
Short	National	**H**	**M**	**M**
Short	Regional	**M**	**L**	**L**
Short	Local	**M**	**L**	**L**

Yellow = Low (L), Orange = Moderate (M), Red = High (H)

154. On this basis, the severity of CC impacts in the water sector is assessed below for the four 'very high' and 'high' graded impact receptors assigned according to the methodology outlined above.

Intensity of climate change impacts on drinking water supply

155. In addition to the social and economic importance of safe and reliable water supply, the severity of climate change impacts will also lead to changing each stage of the water cycle, thereby putting pressure on drinking water supplies. Three main impact factors – temperature increase, reduction of precipitation and course flow, and increased frequency of extreme weather events – are assessed in relation to the most important receiver – the drinking water supply system (Table 14).

Table 14. Intensity of CC impact on drinking water supply system

CC factors	Receiver Value (RV)	Magnitude (M)	Duration (D)	Extent (E)	Intensity (RV+M)	Probability (P)	Severity
Temperature	Very high	Moderate	Long	National	High	Definite	High
Decrease in precipitation	Very high	Low	Long	National	Moderate	Definite	Moderate
Extreme weather events: floods	Very high	Low to Moderate*	Short	Local	Moderate – High	Definite	Moderate
Extreme weather conditions: droughts	Very high	Low to Moderate*	Short	Regional	Moderate - High	Definite	Moderate
Overall							**Moderate**

** Depending on the type of drinking water source on which the consumer relies (centralized*

water supply or shallow wells in rural mediums)

156. Overall, the severity of the impact was assessed as moderate. This could be justified by a simple calculation where water availability per capita (4952 m^3/year) is reduced by 16-20%, which is the projected reduction in precipitation/water flow, resulting in 3961 m^3/year/capita, which is still more than the current water extraction level of 231 m^3/year/capita. Even if we admit a multiple increase in extraction, water supply is sufficient to meet the most ambitious demand for water in the future.

157. The severity of climate change impacts could be ranked above moderate for the southern agricultural zone of the country and part of the central agricultural zone, where water supply is not ensured due to environmental, technical or economic barriers, namely: water quality that does not meet drinking water standards; lack of infrastructure to transport water to consumers; affordability for water supply services.

158. The assessed climate variables will also impact water quality (temperature increase contributing most to this effect), thus generating additional costs for water treatment prior to supply. However, the share of non-climatic factors negatively influencing water quality in Moldova's river system is assessed as much higher than the expected impact of climate change.

Intensity of climate change impacts on irrigation and watering the livestock

159. The expected intensity of CC impact on irrigation and watering the livestock (Table 15) is assessed as higher than on drinking water supply, as these activities are more dependent on local water resources (water accumulations built on small springs and rivers) which are more sensitive to reduced rainfall and temperature increase.

Table 15. Intensity of impact of CC on irrigation and watering of animals

CC factors	Receiver Value (RV)	Magnitude (M)	Duration (D)	Extent (E)	Intensity (RV+M)	Probability (P)	Severity
Temperature	Very high	Moderate	Long	National	High	Definite	High
Decrease in precipitation	Very high	Moderate	Long	National	High	Definite	High
Extreme Weather Conditions: Floods	Very high	Moderate	Short	Local	High	Definite	Moderate
Extreme weather events: droughts	Very high	Low	Short	Regional	Moderate	Definite	Moderate
Overall							**High**

Intensity of climate change impacts on industrial activities, including agro-industrial activities

160. High water temperatures and reduced flow rates could alter water chemistry and affect the cooling process of electrical installations, possibly requiring more frequent servicing. However, the overall impact on this category of water use is considered relatively modest (Table 16), as the Prut and Dniester rivers will continue to transport sufficient volumes of water to meet the demand for energy generation and the respective cooling processes, without seriously jeopardizing the hydrological and ecological regime of these rivers.

Table 16. Intensity of CC impact on industrial activity

CC factors	Receiver Value (VR)	Magnitude (M)	Duration (D)	Magnitude (A)	Intensity (VR+M)	Probability (P)	Severity
Temperature	Very high	Moderate	Long	National	High	Definite	High
Decrease in precipitation	Very high	Low	Long	National	Moderate	Definite	Moderate
Extreme weather events: floods	Very high	Low	Short	Local	High	Definite	Moderate
Extreme weather events: droughts	Very high	Low	Short	Local	High	Definite	Moderate
Overall							**Moderate**

Intensity of climate change impacts on aquatic ecosystems, fish and fishery

161. Aquatic ecosystems in the Republic of Moldova are strongly affected by human activity. The main watercourses of the country – the Dniester and Prut rivers, as well as their tributaries are blocked by dams on their course, and their catchment areas are mainly agricultural land. As a result, the morphology of rivers is profoundly altered, and most ponds built for fish and irrigation have already lost their function due to siltation and water quality that does not meet chemical and bacteriological standards. In this context, climate change factors, such as increasing temperatures and reducing rainfall, will not have a significant share in the negative impact on already heavily damaged ponds.

162. In terms of extreme weather events, floods can play an important role in maintaining key ecosystem functions and biodiversity in many natural systems by connecting the river with related lands, recharging groundwater systems, filling wetlands, increasing connectivity between aquatic habitats and spreading sediment and nutrients in the surroundings and in the aquatic environment. For many species, floods trigger reproduction, migration and dispersal. These natural systems are resistant to the effects of flooding, except for very large ones, whereas areas that have been heavily altered by human activity tend to suffer more severe flood effects and degrade more severely. As for droughts, the

conclusion would be similar: droughts tend to affect already degraded systems even more.

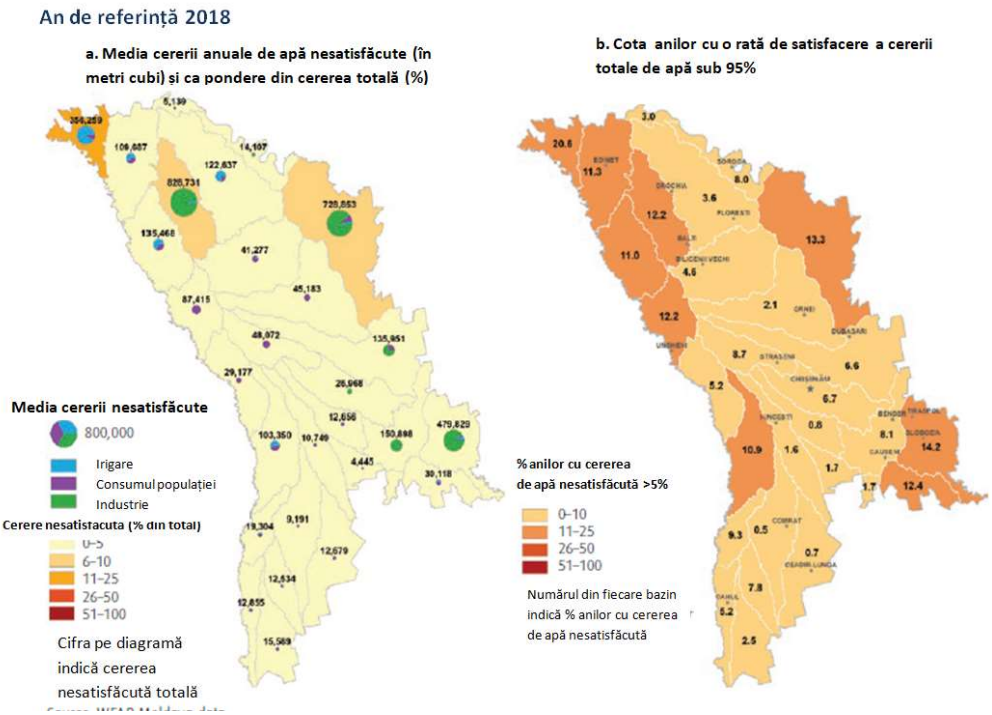
Table 17. Intensity of MS impacts on aquatic ecosystems, fish and fisheries

CC factors	Receiver Value (RV)	Magnitude (M)	Duration (D)	Extent (E)	Intensity (RV+M)	Probability (P)	Severity
Temperature	High	Low	Long	National	Moderate	Definite	Moderate
Decrease in precipitation	High	Low	Long	National	Moderate	Definite	Moderate
Extreme weather events: floods	High	Low	Short	Local	Moderate	Definite	Low
Extreme weather events: droughts	High	Low	Short	Local	Moderate	Definite	Low
Overall							**Moderate**

163. Vulnerability to climate change is determined by the severity of impacts and the adaptive capacity of impact recipients. In this context, the overall severity of the impact of climate change on the four main receivers for Moldova's water sector is moderate.

164. Moreover, the latest studies and projections for the future (WB 2020; OECD 2020) reveals that the supply of water resources to the Republic of Moldova allows meeting the country's water demand in the future, even in the most optimistic scenario of economic development (the most demanding of resources) with increased water consumption. Figure 9 illustrates that in 2018, under current climatic conditions, the availability of physical water resources could almost entirely meet all existing water demands, with some regional exceptions.

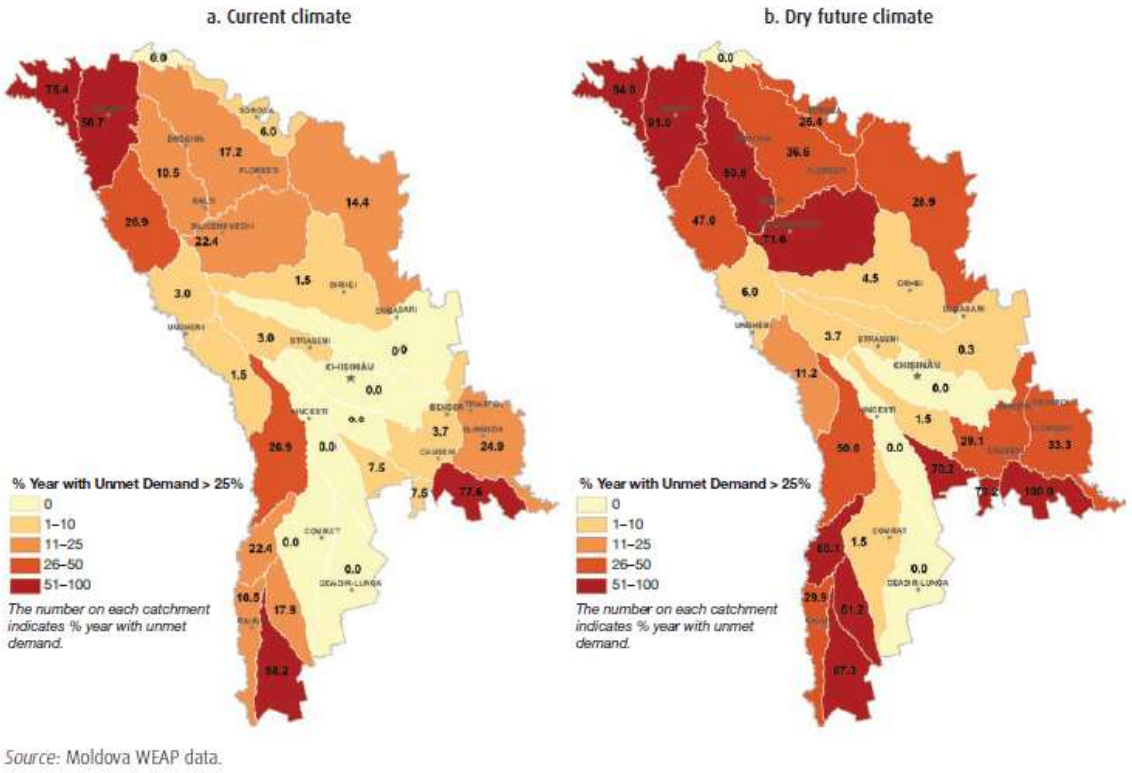
Figure 9. Average annual unmet demand in the 28 basins



Source: Moldova - Water Security Diagnostic and Future Outlook (WB,2020)

165. According to the Holistic Regional Development Scenario, at least 89% of total water demand can be met by 2030. The decrease in water reliability can largely be attributed to the lack of water for irrigation, which occurs in the growing season due to the large expansion of the irrigated area. Therefore, in the most pessimistic scenario of climate evolution for Moldova, the most vulnerable area remains water for irrigation. Figure 10 illustrates the level of unmet demand under the dry climate future scenario.

Figure 10. Reliability of irrigation water supply in catchment areas (expressed as percentage of years with less than 75% of irrigation demand satisfied)



Source: Moldova - Water Security Diagnostic and Future Outlook (WB, 2020)

166. Under dry climates and expanded irrigation development scenarios, climate change will reduce the reliability of water supply to this sector, corresponding to the degree of 'high severity' attributed to the impact of CC on the irrigation sector (Table 15).

Recommended climate change adaptation actions for the water resources sector

167. In the Republic of Moldova, socio-economic sectors in general, and the water sector in particular (although facing moderate CC impacts in severity), are very vulnerable to climate change. Although at the current level of use there is no urgent water security issue, effective water supply management, as well as timely implementation of adaptation measures, will be crucial for the country's development in the medium- and long-term.

168. The most sensitive and vulnerable recipients of CC impacts are rainwater-focused agriculture and livestock watering as rely on local water sources, followed by water supply in rural areas, especially in the dry south of the country. Climate change-related risks for these impact receptors could be mitigated through appropriate economic instruments (allowances, subsidies) targeting modern conservative 'no-till, mini-till, drip irrigation) farming practice as well as more efficient use of local sources and local water storage.

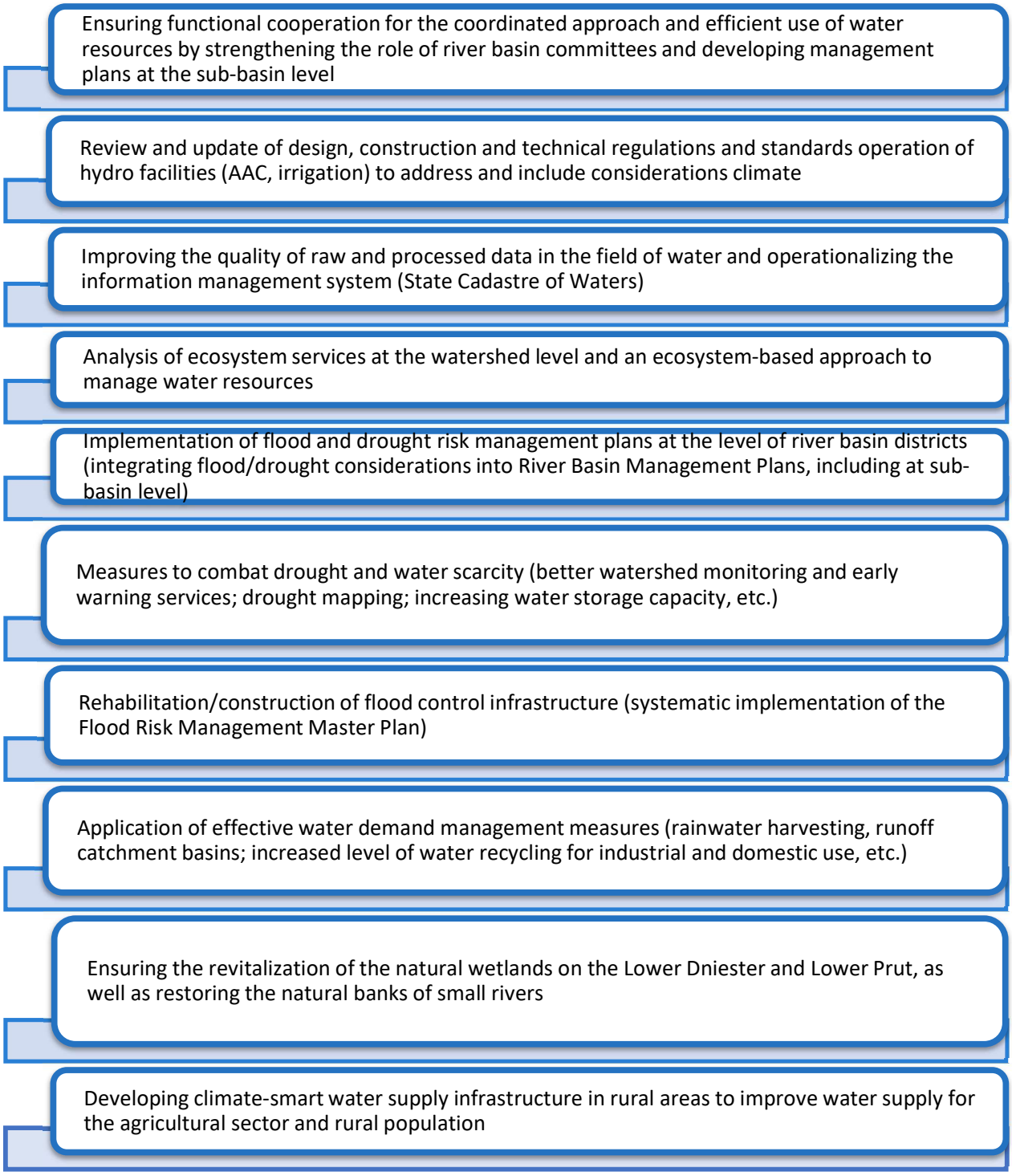
169. According to assessments carried out under the NAP-1 process, improving municipal water supply systems to reduce losses and building a storage reservoir on the Dniester River presents immediate, relatively modest investment opportunities with high returns. In the coming decades, larger-scale water storage infrastructure will be needed, although the size and timing of these works require more analysis and feasibility studies. Targeted investments in water infrastructure in rural areas could be an adaptation option to improve water supply in the agricultural sector as well as for the rural population. Substantial economic benefits from reduced damage and loss would also be ensured through investments for structural and non-structural flood prevention measures.

170. To facilitate these options, institutional capacity to efficiently manage investments in the water sector needs to be further strengthened in the light of climate change. As concluded in the NCCAS 2020 Implementation Assessment, planning for national adaptation to climate change until 2030 involves prioritizing the following issues:

1) Better sectoral cooperation with academia, agriculture and forestry under the new climate change coordination mechanism to steadily restore the Republic of Moldova's hydrological network.
2) Development of sectoral performance indicators to monitor the implementation of water management policy and progress towards achieving sectoral objectives, including for cross-cutting climate change mitigation and adaptation actions.
3) Detailed and systematic evaluation of the performance of the monitoring system (at the State Hydrometeorological Service, the Environment Agency and the Agency for Geology and Mineral Resources), to identify and remove the causes of malfunctioning and underfunding.
4) Improving the quality of raw and processed data for full operationalization of the water information management system (State Water Cadastre).

171. Figure 11 summarizes recommended priority adaptation measures for the water resources sector until 2030 to increase resilience and mitigate risks arising from projected climate hazards.

Figure 11. Recommended climate change adaptation measures for the water resources sector



172. The most important investment opportunities identified as beneficial for strengthening the climate resilience of the water resources sector are: improving the efficiency of municipal and industrial water systems to reduce losses; increasing capacities to store water and reuse it for industrial needs; implementation of groundwater layer refilling technology; structural and non-structural flood prevention measures (rehabilitation/construction of dams and, shore consolidation, wetland

conservation, development of warning systems, information/education of the population on flood risk and how to act in emergency situations). These measures will also help prevent, minimize and address migration in the context of climate hazards.

173. According to World Bank assessments, investment needs for priority CCA actions in the water sector until 2040 amount to approximately 940 million USD, while the total cost of inaction at is estimated at 205 million USD per year. The updated National Determined Contribution of the Republic of Moldova identifies over 203 million USD as imperative short-term financing needs (until 2025) for the immediate priorities of the CCA in this sector. The investments assessed by the WB with the highest cost-benefit ratio are those to increase the efficiency of municipal and industrial water systems, followed by water storage measures and non-structural flood prevention actions.

Section 2
Institutional and governance context of NCCAP 2030

174. The lack of institutional stability is an impediment to the implementation of new policies, adopted in the context of approximation to the EU legal and regulatory framework. To address institutional challenges, the country has embarked on legislative and institutional reforms, which have seen particularly strong momentum since 2016.

175. The administrative and institutional reforms carried out in the Republic of Moldova reflect the country's effort to align with EU rules of law and best practices. New responsibilities were assigned to subordinated institutions that did not have sufficient skills, staff and sufficient financial capacities, thus not being able to effectively support ministries in implementing the measures of the NCCAS Action Plan.

176. In order to develop the strategic and legal framework in the field of climate change, the Air and Climate Change Policy Section was created within the central public environmental authority. As regards the implementation of policies in the field, a substantial role belongs to subordinated institutions, the reform of which is a priority.

177. A challenge in institutional arrangements for implementing climate change adaptation policy, especially in terms of much-needed technological innovation in the sector, was the lack of active involvement of scientific institutions due to double subordination to the Academy of Sciences of Moldova (ASM) and former branch ministries.

178. On July 11, 2021, a new structure of the Government was approved, which includes the Ministry of Environment as a separate entity, along with the Ministry of Agriculture and Food Industry, the Ministry of Health, the Ministry of Economy and the Ministry of Infrastructure and Regional Development. This is an opportunity to strengthen the capacity of the environmental governance system and climate change, including in sectors vulnerable to CC, as well as in operationalizing the National Climate Change Commission.

179. Regarding the strategic framework for CCA in the Republic of Moldova, it was ensured by the National Climate Change Adaptation Strategy for the period 2014-2020 and the Action Plan for its implementation (approved by GD 1009/2014) whose main objectives were oriented towards increasing the country's capacity to adapt and respond to the current or potential effects of climate change. CCAS 2020 served as an umbrella strategy, which established a favorable environment for government and

local public authorities to integrate CCA and risk management into existing and future policy documents through a series of sectoral actions at national and local level. A comprehensive assessment of the implementation of the Strategy was carried out in 2021 under the NAP-2 project and its conclusions and recommendations are duly considered in the planning of post-2020 CCA actions.

180. Aspects of adaptation to climate change were found directly and indirectly in the following policy documents:

1) The Environmental Strategy for 2014-2023 and the Action Plan for its implementation, approved by Government Decision nr. 301/2014).
2) The Low Emission Development Strategy of the Republic of Moldova until 2030 and the Action Plan for its implementation, approved by Government Decision no. 1470/2016.
3) The Programme for promotion of the green economy in the Republic of Moldova for 2018-2020 and the Action Plan for its implementation, approved by Government Decision no. 160/2018.
4) National Strategy for Agricultural and Rural Development for 2014-2020 and Action Plan for its implementation, approved by GD 742/2015.
5) The programme for conservation and enhancement of soil fertility for 2011-2020, approved by Government Decision nr. 626/2011.
6) The Land Improvement Programme to ensure sustainable management of soil resources for 2021-2025 and the Action Plan for its implementation 2021-2023, approved by Government Decision no. 864/2020).
7) The strategy of sustainable development of the national forestry sector, approved by Government Decision nr. 739/2003.
8) Energy Strategy of the Republic of Moldova until 2030 approved by Government Decision nr. 102/2013.
9) National Health Policy, approved by Government Decision nr. 886/2007.
10) The Health System Development Strategy for 2008-2017 and the Action Plan for its implementation, approved by Government Decision nr. 1471/2007.
11) The National Public Health Strategy for 2014-2020, approved by Government Decision nr. 1032/2013.

181. According to paragraph 4 of the Government Decision nr. 386/2020 regarding the planning, development, approval, implementation, monitoring and evaluation of public policy documents, policy documents that do not comply with its provisions remain executable until the end of the implementation term, but not more than 2 years from the entry into force of this decision. Thus, in sectors vulnerable to climate change, new public policy documents are being developed that will include measures that will increase resilience to climate change.

182. The regulatory framework in the field of CCA includes:

1) Law nr. 78/2017 for the ratification of the Paris Agreement. The Paris Agreement explicitly addresses the setting of a global goal to "increase adaptive capacity, strengthen resilience and reduce vulnerability to climate change to contribute to sustainable development". The Republic of Moldova submitted to UNFCCC the 4th National Communication in 2018 and

the updated National Determined Contribution (NDC2) in 2020. Both documents contain adaptation components, which are based on the experience gained from the implementation of the first Climate Change Adaptation Strategy of the Republic of Moldova until 2020 and the Action Plan for its implementation, the National Strategy for Adaptation to Climate Change and the Action Plan. (NAP-1).

2) Government Decision nr. 1277/2018 on the establishment and functioning of the National System for Monitoring and Reporting Greenhouse Gas Emissions and Other Information Relevant to Climate Change.
3) Government Decision No 444/2020 on the establishment of the coordination mechanism for activities in the field of climate change.

183. As regards disaster risk management, a Floods Risk Prevention Master Plan with the EIB assistance was developed in 2016. Consequently, flood risk management plans were adopted for the two River Basin District Management Plans 2022-2027 (GD no. 562/2020).

184. In accordance with the United Nations Convention to Combat Desertification, Moldova developed its National Action Plan to Combat Desertification in 2000, introducing measures aimed at minimizing the consequences of desertification and drought. In 2019, to create a coordinated and comprehensive framework with integrated actions to reduce drought risk and improve drought preparedness based on adaptation and resilience perspectives, the National Drought Plan was developed. The plan identified key responsibilities for data collection and analysis, establishing a consistent basis for assessing drought severity and impact. It also established the national system of drought indicators, as well as drought-sensitive areas, identifying priority mitigation activities and investments, especially in the agricultural sector and rural areas.

185. At local level – most districts and localities have socio-economic development plans, in which some activities and targets could be affiliated to adaptation to climate change. 21 municipalities have submitted sustainable energy and climate action plans, which are supported by the Covenant of Mayors; however, adaptation to climate change is not explicitly addressed, because LPAs involved in promoting relevant activities do not have sufficient knowledge and experience in the field.

186. At sectoral level – adaptation plans have been developed for the forestry and health sectors, and integration options have been developed for the energy and transport sectors during the NAP-1 process. Although not formally adopted, these tools facilitated the integration of CCA measures into the sector planning process.

187. Currently, some of the sectoral strategies take climate change into account, albeit predominantly with elements of mitigation and less of adaptation. In the energy sector, climate change adaptation measures aim to reduce energy losses. Some adaptation measures are included in the transport sector, for example in road construction. In forestry, adaptation measures aim to increase forest cover, to mitigate climate change and increase biological diversity. The health sector identifies health risks associated with environment and climate factors in the country. In the agricultural sector, climate-smart agriculture is promoted, including the promotion of agricultural crops that have the potential to withstand climate change (drought, high temperatures).

Institutional framework for CCA

188. Planning and implementing climate change adaptation measures is a shared responsibility and requires the involvement of central public authorities, their subordinated institutions, local public authorities, the private sector and civil society. The cross-cutting aspect of climate change policy is reflected in the functions and duties of the National Climate Change Commission (NCCC), created by Government Decision no. 444/2020, to take over the responsibilities of the National Commission for the implementation of UNFCCC provisions and Kyoto Protocol mechanisms. NCCC is a permanent, formalized body, which brings together high-level representatives from line ministries, NGOs, academia, research, private sector and women's associations and representatives of the Congress of Local Authorities of Moldova.

189. The NCCC is the basic pillar of the Climate Change Coordination Mechanism, which must ensure cross-sectoral coordination of all climate-related issues, including adaptation and mitigation. The purpose of the mechanism is to foster dialogue, coordination, collaboration and coherence across sectors and to oversee reporting on planning and implementation of climate change adaptation actions by all stakeholders. As migration is a cross-cutting issue, it is necessary to ensure that government institutions with a mandate to address planned migration, displacement and resettlement (as referred to in the Paris Agreement) are included in the NCCC, with a view to ensuring their participation in coordinating the process of adaptation to climate change.

190. The Ministry of Environment is the authority vested with the competence to develop and promote policies in the field of environment protection, climate change, rational use of natural resources and biodiversity conservation, to identify priorities in the cross-cutting areas of environment and climate change; to develop and promote national programmes and actions that address these priorities; coordinating relevant actions and monitoring their implementation. On behalf of the Government, the Ministry of Environment is also responsible for implementing international treaties related to environment and climate change, to which the Republic of Moldova is a party.

191. The implementation of climate change policies is ensured by the institutions subordinated to the Ministry of Environment, namely: State Hydrometeorological Service, Environment Agency; "Moldsilva" Agency and "Apele Moldovei" Agency.

192. The State Hydrometeorological Service (SHS) is a public institution whose main tasks are to monitor the state and evolution of hydrometeorological conditions in the country; develop meteorological, hydrological, and agrometeorological forecasts; issue alerts on the imminence of dangerous hydrometeorological phenomena; provide hydrometeorological information to the population, central and local public authorities, emergency services and rescuers. SHS manages the National Hydrometeorological Data Fund to support hydrometeorological justification for the design, construction, and operation of various socio-economic infrastructure objectives and to develop long-term economic development strategies. In 2019, SHS joined the EUMETNET Meteoalarm (European meteorological services network, members of the World Meteorological Organization) and issues early warnings in accordance with European standards, benefiting from improved regional integration.

193. The Environment Agency has key functions on monitoring the quality of environment components (air, water, soil), issue environment authorizations, managing environment information and reporting, developing reports on the state of the environment, ensuring the implementation of the monitoring, verification and reporting (MRV) system for GHG emissions, ensuring the process of collecting, validating and processing data and info necessary for inventories and reports on air pollutants and GHG emissions, providing technical support for the development of national

communications, updated biennial reports and biennial transparency reports, accompanied by national inventory reports as a technical annex, in accordance with the provisions of the UNFCCC. The Environment Agency is designated as the national authority responsible for the management and functioning of the National Monitoring and Reporting System (NMRS) of the GHG emissions and other information relevant to climate change.

194. In terms of information and data processing – the National Bureau of Statistics (NBS) is the institution that has the mission to collect, process and disseminate objective, reliable and timely statistics, necessary for the decision-making process, research, forecast and general information of the company. Regarding environment indicators, NBS provides information on the following categories: protection of atmospheric air; land and forest fund; meteorology (temperature, precipitation and wind speed); waste management; use of water resources. The annual statistical report contains annual forecasts that may be relevant to the CCA (e.g. water resources and forests, temperature and precipitation modes).

195. The Ministry of Education and Research (MER) supports the country's climate change policy (including CCA) by promoting dedicated educational programmes, scientific studies and research and innovation programmes.

196. The National Agency for Research and Development (NARD), a public authority subordinated to the Government of Moldova, established by GD 196/2018 is responsible for implementing the national research, innovation, and development policy. The NARD maintains and coordinates the activity of the Republic of Moldova's Office for Science and Technology under the European Union (MOST) in Brussels, Belgium. At the same time, NARD promotes and manages the scientific cooperation activity of national institutions in the fields of research and innovation on a European and international scale, through participation in the EU framework programmes for research and innovation, the previous "Horizon 2020" and the current "Horizon Europe" and transnational and bilateral partnerships based on international treaties and inter-statal agreements. In cooperation with MER and ASM, NARD has the experience of launching and managing research and innovation projects, launched in competitions, covering all six priority sectors stipulated in this document: agriculture, energy, forestry, health, transport and water resources.

197. The Academy of Sciences of Moldova is involved in evaluating the results of scientific projects for various fields, each having its contribution to CCA, while exercising the role of scientific consultancy in shaping strategic visions on the future development of research and innovation directions.

198. In terms of horizontal governance, the Ministry of Finance plays a key role in the country's adaptation planning, as all national and sectoral priorities are defined and implemented through specific budgetary allocations that can facilitate the integration of the CCA into actions at different government levels.

Subsection 1
Regulatory and institutional framework of CCA in the agriculture sector

199. The relevant regulatory framework for adaptation to climate change in the agricultural sector refers to land use, use and protection of natural resources (water and soil), standards and regulations promoting conservative agricultural practices and organic agri-food production, as well as those

regulating financial support and subsidies for agricultural activities. The main acts in this regard are:

1) Law No 115/2005 on organic agri-food production.
2) Law no. 71/2023 on subsidization in agriculture and rural environment.
3) Law nr. 183/2020 on subsidized insurance in agriculture.
4) Government Decision nr. 1157/2008 on the approval of the Technical Regulation "Soil protection measures in agricultural practices".
5) Government Decision nr. 409/2014 on the approval of the National Strategy for Agricultural and Rural Development for 2014-2020 (the National Strategy for Agricultural and Rural Development 2022-2027 is to be approved, as a public policy umbrella document for the strategic planning of the country's agricultural sector).
6) Government Decision nr. 977/2016 on the approval of the Standard Regulation for the exploitation of reservoirs/ponds.
7) Government Decision nr. 455/2017 on distribution of the means of the National Fund for Agriculture and Rural Environment Development.
8) Order of the Minister of Agriculture and Food Industry nr. 79/2016 for the approval of the Requirements for the application of the Conservative Agriculture System.
9) GD 864/2020 on the approval of the Land Improvement Programme to ensure the sustainable management of soil resources for 2021-2025 and of the Action Plan for 2021-2023 on its implementation.
10) GD 985/2020 on the approval of the Regulation on the conditions and procedure for granting advance subsidies for land improvement investment projects for the implementation of the Land Improvement Programme to ensure sustainable management of soil resources for the years 2021-2025.

200. Even though the agricultural sector is assessed as the most vulnerable to climate change among sectors of the national economy, the Fourth National Communication reveals that sectoral legislation does not sufficiently address climate impacts. The lack of specific references to climate change in sectoral normative acts is partially compensated for by the sector's development strategies, which set objectives and measures for adaptation to climate change.

201. National policies in the field of agriculture and rural development are under the responsibility of the Ministry of Agriculture and Food Industry, which took over this role from the Ministry of Agriculture, Regional Development and Environment after government reform following early parliamentary elections in July 2021. Also, two agencies, a special service and several sectoral scientific institutions have been identified that have a contribution to the national process of adaptation to climate change, both from the perspective of development and from the perspective of policy implementation.

202. The institutional framework relevant for climate action in the agricultural sector, the responsibilities assigned to authorities and their relevance to the NAP process, are presented in Table 18.

Table 18. Entities in the agricultural sector and their relevance to the NAP process

Institution/Agency	Responsibilities	Relevance to the NAP process
Ministry of Agriculture and Food Industry (MAFI)	Responsible for developing and implementing policies and strategies in the field of agriculture, rural development, and food security.	
Agency for Interventions and Payments in Agriculture (AIPA)	The Agency's mission is to manage the resources of the National Fund for the Development of Agriculture and Rural Medium (FNDAMR) and the resources of development partners allocated for administration and to implement intervention measures in agriculture. The fields of activity include: ensuring the correct and legal conduct of operations to manage the funds allocated to support agricultural producers; control of the use of funds allocated to beneficiaries; participation in the preparation of subsidy regulations; continuous monitoring of grant beneficiaries' compliance with eligibility criteria and contractual conditions for granting grants; information, communication, presentation of innovations taking place in the process of activity.	AIPA participates in adapting the regulatory framework in the field of agricultural subsidies to the practices of the European Union and ensures the legal and correct management of FNDAMR, as well as other funds to support agricultural producers and rural development, including the aspect of preventing negative impacts and combating the consequences of extreme weather phenomena on the agricultural sector.
Agency for Agriculture Development and Modernization	The agency is responsible for facilitating farmers' access to modern agricultural equipment to ensure increased competitive agri-food production. It supports the development of alternative solutions for modernizing agriculture, providing consultancy and expertise, training, and assistance in business planning in the sector.	It contributes to providing the agricultural sector with efficient technology, including technology that allows the implementation of conservation tillage, and those related to modern irrigation practices and aspects of organic farming that have a tangible impact on the sector's adaptation process to climate change.
Special Service for Active Influences on Hydrometeorological Processes	The main activity of the Special Service is the organization and execution of works aimed at actively influencing clouds in order to reduce hail damage, as well as other works related to active influence on hydrometeorological processes with recognized technologies.	It contributes to reducing the negative impact on the agricultural sector caused by the increased frequency and intensity of hail in the current context of global climate change.
Higher education	The nominated institutions shall be	It contributes to the training of

institutions with their non-legal research and innovation units for agriculture	responsible for: - development and improvement of the conception and structures of education and research; - prioritization of professional training and continuity of the training process; - professional and continuous training of specialists at university level and in accordance with the needs of the national economy; - conducting fundamental and applied scientific research, dissemination and implementation in practice of their results; - providing technical, scientific and advisory services to ministries, departments, economic agents and individuals; - seed production, planting material, reproduction and breeding, etc.	specialists for the agricultural sector, including knowledge of global, regional and local climate change and ways to mitigate its impact on agricultural crops at local and national level. Delivers scientific results from research and innovation activity to solve CCA field tasks.

Source: Based on the Institutional Capacity Assessment Report for the agricultural sector (April 2022 version)

203. The analysis of the implementation of NCCAS 2014-2020 for the agricultural sector identified weak interinstitutional coordination in the process of planning, implementing, monitoring, and reporting climate change adaptation measures. The Institutional Capacity Assessment Report for the Agricultural Sector, developed by FAO with GCF support, reveals current needs, barriers, and gaps for integrating climate change adaptation planning and implementation into the agricultural sector.

204. Both assessments conclude that, despite progress in CC mitigation and adaptation policy initiatives, there is room for increased cooperation in decision-making. This means in both sectoral (multi-sectoral) and organizational (national-regional-local) decision-making, as well as improved targeting, ensuring that climate and environment challenges are prioritized. Particular attention requires updating the regulatory framework in the field of irrigation, where, in the context of reducing surface water reserves, the development of regulations on the use of water resources in agriculture is of major importance. It is also necessary to strengthen efforts to create and restore protective forest belts as a key measure to combat desertification, improve soil fertility and reduce soil erosion. This requires cooperation between agriculture and forestry sectors, with a particular focus on capacity building (knowledge and technology) of both forestry specialists and forest beneficiaries, based on ecosystem-based restoration principles.

205. In addition, barriers include insufficient capacities for integrated land-use planning, including for climate-smart agriculture. The level of institutional capacities to integrate climate change adaptation planning and implementation in the agricultural sector is assessed as moderate and there are relevant gaps to be filled for all dimensions addressed by the Sector Review Report. The challenges relate to the capacity of the PCA and LPA to coordinate the integration of climate change into

agricultural policies; alignment of national climate objectives and sectoral adaptation targets; encouraging risk-based decision-making; access to sufficient financial resources; promoting stakeholder involvement; development of monitoring and evaluation systems; providing, managing, accessing and sharing information on the impacts of climate change; as well as different sectoral capacity building needs to improve individual knowledge on adaptation to climate change. As migration has a major impact on most households in the country, institutions with responsibilities in the field of migration will be included in the capacity gap assessment. Government institutions addressing different forms of migration, in particular displacement, migration and planned resettlement, will be included in stakeholders' processes and activities.

206. According to the results of the Institutional Capacity Assessment Report for the Agricultural Sector, integrating climate change adaptation measures requires significant efforts for all analyzed aspects. The main barriers and relevant factors that would allow improving the current level of capacity and priority areas for adaptation to climate change have been well identified in the report and recommended actions have been duly considered when formulating specific objectives and identifying horizontal actions in the Action Plan to this Programme.

Subsection 2
Regulatory and institutional framework of CCA in the energy sector

207. The relevant regulatory framework for adaptation to climate change in the energy sector includes the following normative acts:

1) Law nr. 10/2016 on the promotion of the use of energy from renewable sources.
2) Law nr. 139/2018 on energy efficiency.
3) Government Decision nr. 698/2019 on the approval of the National Energy Efficiency Action Plan for 2019-2021.
4) Government Decision nr. 102/2013 on the Energy Strategy of the Republic of Moldova until 2030.
5) Law nr. 128/2014 on the energy performance of buildings.
6) Law nr. 44/2014 on energy-related products labelling.
7) Law nr. 92/2014 on thermal energy and cogeneration promotion.

208. The relevant institutional framework for climate action in the energy sector, the responsibilities assigned to authorities and their relevance to the NAP process, are presented in Table 19.

Table 19. Energy sector entities and their relevance to the NAP process

Institution/Agency	Responsibilities	Relevance in the NAP process
Ministry of Energy	Responsible for developing and implementing policies in the energy sector	Responsible for developing and implementing strategic documents related to climate change and activities specific to the energy sector
Energy Efficiency Agency	Responsible for implementing national energy efficiency and renewable energy programmes. Public support institution in promoting investments in energy saving and renewable energy projects	Responsible for implementing energy efficiency measures specific to adaptation and resilience to climate change
National Energy Regulatory Agency	Responsible for regulating the energy sector of the Republic of Moldova with competences in the natural gas, electricity, thermal energy and petroleum products market sectors	Responsible for approving regulatory acts for the purpose of harnessing renewable energy
Higher education institutions with their non-legal	Provides scientific support for increasing energy security and energy efficiency, as well as for	It exerts a significant influence on the deployment of new technologies and is therefore essential in identifying

research and innovation units for the energy field	regional and European integration for the national energy system	resilience-building measures and technologies to address the impacts of climate change

Source: Institutional capacity assessment 2021, final report

209. The main issues identified for the energy sector in the Institutional Capacity Assessment, carried out in 2021, are:

1) Insufficient integration of climate risks into plans and strategies in this sector.
2) Lack of information/forecasts on future energy demand in different climate change scenarios, which is a significant impediment to robust investment and contingency planning.
3) Lack of indicators for climate change processes and adaptation targets in planning, monitoring and evaluation processes.
4) Low level of communication between stakeholders. Currently, the sector's development priorities focus mainly on mitigating or reducing GHG emissions. While this is a positive development, there should be greater awareness of the need to build resilience in the energy sector among all stakeholders, including governmental and non-governmental actors, as well as producers and consumers.

210. The capacity assessment showed that the energy sector registered minor improvements in institutional and human capacities for climate risk management and formulation of adaptation measures. This means that significant support and commitment is needed to keep pace with the scale of climate change and avoid significant losses due to severe climate shocks.

211. Based on these findings, recommendations for sector-specific capacity-building actions have been made and a roadmap for their implementation has been proposed. These recommendations focus on five priority areas considered when formulating specific objectives and identifying horizontal actions in the Programme Implementation Action Plan:

1) Improving the legal, administrative and regulatory framework for a climate-resilient and climate responsive energy sector.
2) Improving the availability and use of climate data and information in the energy sector.
3) Improving the integration of climate change information into strategic planning processes in energy sector agencies.
4) Increasing the availability of financial resources and the level of human resources to support adaptation in the energy sector, including taking into account the technical capacities of migrants.
5) Incorporating climate change adaptation aspects into sector management practices.

Subsection 3
Regulatory and institutional framework for CCA in the Forestry sector

212. Aspects of forest management in correlation with adaptation to climate change are set out in

a series of normative acts, of which the most relevant for CCA are:

1) The Forestry Code nr. 887/1996.
2) Law nr. 591/1999 on green spaces in urban and rural localities.
3) Law nr. 1041/2000 for the improvement of degraded land through afforestation.
4) Law nr. 239/2007 of the plant kingdom.
5) Law nr. 1538/1998 on the natural state protected areas fund.
6) Government Decision nr. 106/1996 on measures to ensure the protection of forests, forest belts and other forest plantations.
7) Government Decision nr. 740/2003 for the approval of normative acts regarding forestry management.

213. Currently, some provisions of the Forest Code are outdated, while others need to be brought in line with the requirements of the acquis Communautaire, as well as with international treaties on forests, biodiversity, climate change and desertification. The evaluation of NCCAS 2020 found that the process of amending the normative acts regulating the adaptation of the forestry sector to climate change registers significant delays.

214. There are a lack of economic mechanisms and instruments that would create conditions to stimulate the rational use of natural resources, including forests, and biodiversity conservation. There are no mechanisms established for local public authorities to develop, coordinate and organize the implementation, jointly with state forestry bodies, of local programmes for sustainable development, use, regeneration and protection of forests. The legal framework governing the application of silviculture regime in forests requires important changes, with provisions ensuring increased resilience to prevent loss of forest areas and related ecosystem functions. This is to be addressed as a matter of priority in the second iteration of the NAP process.

215. Partially relevant for CCA and forestry is also the Strategy on biological diversity of the Republic of Moldova for 2015-2020 and the Action Plan for its implementation, which included as action the development of the study on the relationship between ecosystems, biodiversity and climate change and technologies, to ensure the adaptability of forest ecosystems to climate change.

216. At local level – forest management is included in district socio-economic development programmes/strategies. However, the institutional capacity analysis carried out in 2021 found that the importance given to the forestry sector in these programmes in general is minimal, focusing on the quantitative characteristics of regional forest resources, without integrating climate change adaptation aspects.

217. Overall, the analysis of forestry policy documents related to climate change in the Republic of Moldova indicates a relatively low degree of implementation, while the recommended adaptation measures were not associated with financial resources and were not incorporated into annual planning and budgeting processes. Moreover, within NAP-1, with the support of international partners, a sectoral adaptation plan was developed, but the document was not officially adopted by the Government. While the expiration of sectoral policy documents in 2020 provided an ideal opportunity to integrate climate change into the new long-term strategic framework for the forestry sector, little progress has been made in the Government's approval of policy documents for 2021-2040. The draft Strategy for Sustainable Development of the Forestry Sector integrating the principles of sustainable development and climate

change was developed.

218. Local public authorities have an important role in the management of forest resources in the Republic of Moldova and, therefore, strengthening local institutional and human capacities for forest management is equally important. LPA's responsibilities regarding forest management are described in Law no. 436/2006 on local public administration and the Forestry Code, although adaptation to climate change is not mentioned in the officially delineated responsibilities.

219. Non-governmental organizations (NGOs) are quite active in this sector and complement state-led efforts to integrate climate change adaptation into forest management through research and advocacy. They provide an essential contribution to raising society's awareness of forest vegetation issues, and to conducting research related to the protection, management, sustainable use and regulation of forest ecosystems.

220. The institutional framework relevant for climate action in the forestry sector, the responsibilities assigned to those authorities and their relevance to the NAP process are presented in Table 20.

Table 20. Forestry authorities and their relevance to the NAP process

Institution/Agency	Responsibilities	Relevance in the NAP process
Ministry of Mediumship	Central public authority responsible for developing, promoting state policy in forestry and hunting	Responsible for developing policy on adaptation to climate change and guiding other structures in the forestry sector
"Moldsilva" Agency	- Performs state administration and unitary sustainable management of forest and hunting funds - Supervises the management of public property transferred to the management of state-owned enterprises where the Agency is a founder (16 forestry enterprises, 4 forestry-hunting enterprises, 3 nature reserves and 1 biosphere reserve) - Coordinates the activity of the Institute for Forest Research and Management	- Responsible for implementing measures to integrate climate change adaptation considerations into forest resource management - Conducts relevant applied research studies through the Institute for Forest Research and Management
State Administration of Roads	Manage forest vegetation with protection functions for car transport infrastructure (roads)	Responsible for integrating climate change adaptation considerations into these areas
S.E. Moldovan Railways	Manage forest vegetation with protective functions for rail transport infrastructure	Responsible for integrating climate change adaptation considerations into these areas

Local Public Authorities of level I and II	- Directly manages forest areas (13.3% of total forest areas) and regulates the use process at local level - Develops and approves local programmes for sustainable development, use, regeneration and protection of forests and other land with forest vegetation, in coordination with national authorities	Responsible for implementing climate resilience measures for local forest resources

Source: Institutional capacity assessment 2021, final report

221. The 2021 Institutional Capacity Assessment identified several issues impeding the effective mainstreaming of climate risks into forestry sector governance and management practices, including:

1) lack of a formal mandate among forest resource management agencies to recognize and address climate risks;
2) weak coordination between forestry sector entities and non-governmental stakeholders, hampering the implementation of sustainable and climate-smart forest management practices;
3) insufficient forest management regulations, considering climate change;
4) insufficient information on the current and potential impact of climate change on the forestry sector.

222. At the same time, the evaluation found that "modest" progress has been made in implementing the recommendations of the 2014 Institutional Capacity Development Plan. Little progress has been made in developing human and institutional capacities to carry out scientific research on the impact of climate change on forests and using this research as relevant and accessible information to support decisions by forest-based stakeholders. Although recommendations have been put forward to clarify the mandates, roles and responsibilities of different actors in the forestry sector, little progress has been made, hampering the integration of climate change issues into the governance of the sector. In addition, very few financial resources have been allocated to support adaptation in the forestry sector or the adoption of innovative approaches in forest management.

223. Based on these findings, recommendations for sector-specific capacity-building actions were formulated and a roadmap for their implementation was proposed in the 2021 Capability Development Plan. The actions recommended in the five priority areas identified in the Plan were considered when formulating specific objectives and identifying horizontal actions.

Subsection 4
Regulatory and institutional framework for CCA in the health sector

224. The provision of healthcare is guaranteed by the Constitution of the Republic of Moldova and is regulated in numerous normative acts. The most important of these is Law no. 411/1995 on Health Protection, which establishes the fundamental principles of healthcare in the Republic of Moldova and ensures equal access to comprehensive and quality healthcare. This law does not include climate change issues. Regarding climate change and human health, the most relevant normative act is

Law no. 10/2009 on state Surveillance of Public Health, which outlines the principles, fields of activity, basic functions, coordination, structure and management of public health services, as well as provisions for the protection of public health in relation to environment. According to this law, among the priority areas of state surveillance of public health are health protection, monitoring of human health in relation to environment, monitoring of the quality of atmospheric air, drinking water and occupational environment. The law also includes a chapter dedicated to the prevention and management of public health emergencies. Issues related to the impact of climate change on health are not directly reflected in any of the public health laws.

225. Government Decision no. 129/2023 approved the National Programme for the prevention and control of priority non-communicable diseases in the Republic of Moldova for 2023-2027, which addresses the subject of the impact of climate change on the population health and proposes some monitoring and mitigation measures, including, through communication and awareness-rising on risks and adoption of a sectoral adaptation plan.

226. Climate-related responsibilities and competences for the health sector include the following:

1) Assessing the risks to public health caused by climate change and incorporating them into health policies.
2) Development and implementation of CCA activities to reduce the impact on public health.
3) Coordinating preparedness for the possible impact of climate change on public health and ensuring a timely and adequate response to climate change threats.
4) Defining the roles and responsibilities of health stakeholders to ensure preparedness and response to the impact of climate change on public health.
5) Identifying and monitoring categories of people who are vulnerable/exposed to the risk of climate change on public health.
6) Development and implementation of clinical guidelines, protocols, standards and operational procedures for the prevention and treatment of climate-change-associated diseases.
7) Inform, train and guide health workers and the public on measures to be taken during extreme weather events, such as heat waves, floods and droughts.
8) Create and maintain a monitoring system and evaluation mechanism to determine the effectiveness of training and measures necessary for implementation.
9) International and regional cooperation on issues related to the health sector and climate change.

227. The institutional framework relevant for climate action in the public health sector, the responsibilities assigned to those authorities and their relevance to the NAP process are presented in Table 21.

Table 21. Health sector authorities and their relevance to the NAP process

Institution/Agency	Responsibilities	Relevance in the NAP process
Ministry of Health	- Responsible for the health system as a whole - Responsible for developing and	It has primary responsibility for incorporating climate change issues into health sector policies

	promoting state policy in the field of public health	
National Public Health Agency (ANSP) and Regional Public Health Centers	Responsible for implementing state policy in the field of public health surveillance, including health threat tracking, disease prevention and control, health emergency management, research, assessment of social determinants of health	Promote and organize the implementation of public health policies related to climate change, monitor the health effects of climate change and conduct research on the health effects of climate change
National Centre for Prehospital Emergency Medical Assistance	Provides pre-hospital emergency medical care	Primary emergency assistance provider for people affected by climate shocks
National Health Insurance Company	Manages the health insurance fund, including the prophylaxis fund, dedicated to disease reduction, prevention measures and implementation of activities to increase preparedness and response to public health emergencies	Responsible for incorporating climate change considerations into the insurance programme as well as medical emergency preparedness activities
Primary medical and sanitary institutions (family doctors' centers)	Ensures the first contact between individuals / families and the health system; provides public health information and primary health care	Responsible for information, prevention, health care measures, including the consequences of climate change at primary level
Hospitals	It provides hospital care to the population and has a role in emergency response	Responsible for emergency preparedness caused by climate change-related health shocks
Nicolae Testemitanu State University of Medicine and Pharmacy	It offers studies, research, nursing and training of doctors and pharmacists	Responsible for incorporating information on the impact of climate change on health into education and training activities

Source: Institutional capacity assessment 2021, final report

228. The institutional capacity assessment identified several challenges to be addressed in the current NAP cycle, including:

1) low awareness and lack of CCA actions in the health sector, although a sectoral Adaptation Plan was developed during NAP-1 (but not formally finalized and adopted);
2) lack of funding for climate change adaptation initiatives in the health sector;
3) lack of knowledge and capacity among health professionals (as well as the general public), limiting the ability to manage climate risks and plan for response to climate change impacts;
4) limited coordination among health stakeholders on information sharing and planning climate-related actions.

229. The 2021 Institutional Capacity Review revealed little progress in terms of human and institutional capacities in the sector, measured against the baseline presented in the 2014 capacity assessment and capacity development plan. There has also been no improvement in management capacity and expanded health services in rural areas, which are likely to suffer health effects due to climate change.

230. Based on these findings, recommendations for capacity-building actions at sectoral level were formulated and a roadmap for their implementation was proposed in the 2021 Capacity Development Plan. They will help close gaps and steer the health sector towards an improved overall capacity to address climate risks and incorporate direct and indirect effects (observed and expected) into sectoral processes. The recommended actions in the five priority areas identified by CDP were considered when formulating specific objectives and identifying horizontal actions in the Action Plan of this Programme.

Subsection 5
Regulatory and institutional framework for CCA in the Transport sector

231. The transport sector is regulated by Law No 1194/1997 on transport which contains general provisions on rail, motorways, air travel, river navigation and other areas. According to the provisions of this law, transport companies are obliged to protect the environment from the negative effects arising from the sector and to bear responsibility for any damage caused to the environment by their activities. This law needs to be updated to include provisions on adapting the sector to climate change.

232. The regulatory framework of the sector also consists of codes regulating road, rail and air transport, developed based on the Association Agreement between the EU and the Republic of Moldova and aimed at harmonizing EU legislation in this field (however, the codes do not contain explicit provisions for adapting that subsector to climate change):

1) Road Transport Code of the Republic of Moldova no. 150/2014.
2) Aviation Code of the Republic of Moldova no. 301/2017.
3) Railway Transport Code of the Republic of Moldova no. 19/2022.

233. The NCCAS 2020 implementation plan included three important activities for the transport sector: (1) Adapting the design of road infrastructure to climate change; (2) Ensuring the sustainability of transport infrastructure by using materials resistant to floods and temperature extremes; and (3) Planning urban transport systems to promote alternative, low-carbon transport (e.g. cycling). However, modest progress has been made in implementing these measures. Following the implementation of NCCAS 2020, minimum requirements for the marketing of construction materials that meet European EN standards were adopted in 2016, and some technical regulations for roads and bridges were adopted in 2018 to ensure better resilience of road infrastructure. These standards have only been in force since January 2021 and the effect of their use is still to be assessed.

234. Institutional framework relevant for climate action in the transport sector and their responsibilities for the NAP process in Moldova, are described in Table 22.

Table 22. Transport authorities and their relevance to the NAP process

Institution/ Agency	Responsibilities	Relevance in the NAP process
Ministry of Infrastructure and Regional Development (MIDR)	Development and implementation of state policy in the transport sector	Responsible for integrating climate change considerations into transport policies
Civil Aviation Authority	Policy implementation, certification, ongoing oversight and control in the field of civil aviation	Implements the requirements of the legislation, certifies, exercises continuous supervision and control of the entire meteorological assistance activity of civil aeronautical activities – collaborates, within the limits of functional competences, to achieve the highest degree of uniformity in normative acts with the standards and recommended practices of the International Civil Aviation Organization on the centralization and exchange of meteorological information to facilitate and improve air navigation
National Road Transport Agency	Implementation of international treaties in the field of motor transport and national legislation on the transport of goods and passengers	Responsible for understanding and planning the impact of climate change on passenger and freight transport
Naval Agency	Implementation of state policies in the field of maritime transport and safety of navigation on inland waterways and in ports	Develops regulations, instructions and amendments to legislation – need to understand the impact of climate change on port infrastructure and river navigability
Railway Agency	Implementation of state policies in the field of railway transport and its safety	Responsible for carrying out state railway policy, understanding and planning climate resilience of structural subsystems of the railway system.
State Road Administration	Maintenance, repair, rehabilitation, development, modernization and administration of national public roads	Responsible for understanding and planning the climate resilience of new roads and for maintaining and operating existing road infrastructure
International	Represents the interests of	Responsible for understanding

Association of Road Transport	Moldovan road transport operators in relations with the European Commission, UN and other international forums	international standards and commitments on climate change and road transport
LPA	- Ensures the safety of car traffic and pedestrians - Maintenance of roads and bridges - Development of urban mobility plans	Integrates climate change adaptation measures into urban transport development planning.

Source: Institutional capacity assessment 2021, final report

235. The institutional capacity assessment identified several issues that need to be addressed in the transport sector in terms of increasing its resilience to climate change. These include:

1) the need to incorporate climate risks and adaptation into policy documents for the sector;
2) lack of climate risk analysis and climate proofing procedures for transport infrastructure investments;
3) lack of knowledge on the impact of climate change and how to incorporate it into sectoral processes;
4) unavailability of financial resources to support the planning, design and implementation of climate-resilient infrastructure.

236. In addition, the 2021 institutional capacity assessment indicates that there has been little improvement in the transport sector in addressing the problems and implementing the actions identified in the 2014 capacity assessment and development plan. This requires increased actions and commitment of transport institutions, as well as additional financial and technical assistance to ensure that climate risks and adaptation are incorporated in transport processes. In this context, recommendations for specific capacity-building actions in this sector were formulated and a roadmap for their implementation was included in the 2021 Capacity Development Plan, which were duly considered when identifying directions of action in the NCCAP Action Plan.

Subsection 6
Regulatory and institutional framework for CCA in the Water resources sector

237. The Republic of Moldova has embarked on a new approach to water resource management, moving to the principles of integrated water resources management, in line with the country's international commitments, as part of global efforts to improve the status of water resources. These principles were established in the Concept of National Water Resources Policy, approved by Parliament Decision nr. 325/2003 applied to the development plans of the sector.

238. Water Law no. 272/2011 and the secondary normative framework regulate the integrated management, protection and efficient use of water resources in the Republic of Moldova, harmonizing

national legislation with the EU Water Framework Directive no. 2000/60/EC. The Water Law introduced the river basin principle into water management, and requires systematic monitoring, pressure assessment, impact analysis and development of action plans. In this context, two river basin management districts were established: Dniester River Basin and Danube-Prut and Black Sea River Basin and developed River Basin Management Programmes for these river basin districts, integrating CCA aspects and Flood Risk Management Plans for them. The regulatory framework in the water sector relevant for risk management and adaptation to climate change also includes:

1) Law nr. 303/2013 on the public service of water supply and sewerage;
2) Law nr. 182/2019 on drinking water quality;
3) Government Decision nr. 590/2018 on the approval of the Concept of the reform of the national system for the management, prevention and reduction of flood consequences;
4) Government Decision nr. 562/2020 on the approval of Flood Risk Management Plans.

239. Health risks related to drinking water safety, which are amplified by the impact of climate change, are presented in the National Programme for the implementation of the Protocol on Water and Health in the Republic of Moldova for 2016-2025 (GD 1063/2016).

240. The relevant institutional framework for climate action in the water resources sector, the responsibilities assigned to those authorities and their relevance to the NAP process are presented in Table 23.

Table 23. Water sector authorities and their relevance to the NAP process

Institution/Agency	Responsibilities	Relevance in the NAP process
Ministry of Environment	- Develops state policy on environmental protection, climate change and management of natural resources; - Implements international treaties in the field of Environment, Climate Change and Natural Resources, to which Moldova is a party	- Responsible for developing climate change policy - Ensuring the activity of the National Commission for Climate Change and chairing its meetings
"Apele Moldovei" Agency	- Administrative authority for the water sector and water resources management - Implements the state policy in the field of water management (integrated management of water resources based on the basin principle) - Responsible for implementing river basin management plans and coordinating water resources management at national level	- Responsible for managing and reducing drought and flood risks, which are among the major impacts of climate change
Environment Agency	- Ensures the implementation of environmental policy at national and local	- Responsible for incorporating climate change considerations

	level - Monitors air, groundwater and surface water quality - Issues Environmental permits (including for special water use) - Manage the Environmental Information System	into water demand management - Responsible for the management and operation of the National System for Monitoring and Reporting GHG emissions and other information relevant to climate change
State Hydrometeorological Service	- Implements the national policy in the field of hydrometeorology - Performs hydrological, climatic and meteorological forecasts and provides relevant information to the Government, economic agents and the public	Issues warnings of imminent dangerous hydrometeorological phenomena (including climate-related ones)
Agency for Geology and Mineral Resources	Implements state policy in the field of geological research and subsoil protection	Responsible for monitoring and quantitative and qualitative groundwater and providing data and information on sustainable abstraction levels
National Agency for Public Health	Provides laboratory support in investigating biological, chemical, physical and radiological factors with impact on public health.	Responsible for the qualitative record of the water used for consumption.

Source: Institutional capacity assessment 2021, final report

241. Compared to the findings of the 2014 Institutional Capacity Assessment, the 2021 assessment reveals that the water resources sector has made "modest progress" in improving professional skills and strengthening institutional capacities for managing climate risks and adapting the sector to climate shocks and stressors. However, there remains a lack of clarity regarding roles and responsibilities related to water management and climate change. Filling these gaps is prioritized within the current NAP cycle, with specific measures included in the NCCAP Action Plan.

Chapter III
GENERAL AND SPECIFIC OBJECTIVES

242. The overall objective of Moldova's Climate Change Adaptation Programme until 2030 is to reduce vulnerability and increase resilience to climate change impacts through systemic transformations in all priority adaptation sectors.

243. This will be achieved through five specific objectives of the NCCAP. Four of these are cross-cutting, while the fifth aims to increase resilience and facilitate adaptation to climate change in the six priority sectors (agriculture, energy, forestry, health, transport and water resources).

Specific objective 1: Development of climate change adaptation capacities and cross-sectoral cooperation

244. It will ensure the strengthening of cross-cutting coordination, increasing the efficiency of cooperation as well as the operationalization of the National Climate Change Commission, which is conceived as an interinstitutional body for coordinating activities in the field of climate change. Improving the functioning of the National Climate Change Commission (NCCC) is a priority during the current iteration of the NAP. This will allow the inclusion of representatives of all relevant institutions from priority adaptation sectors (including institutions responsible for addressing horizontal issues such as displacement, migration and planned resettlement) in the composition of the NCCC. It will be supported by amending the mandates of entities in priority sectors to assign CCA functions and advising them on climate risk estimation to include SACs in sectoral processes. At the same time, by developing and implementing continuous training programmes for the staff of entities with responsibilities related to adaptation to climate change, capacities to use data, information and analysis reports on climate change in planning activities of priority sectors, integrating gender and migration aspects will be strengthened. Training opportunities will be identified, as appropriate, in cooperation with international partners.

Impact indicator	Benchmark 2023	Intermediate target 2026	Final target 2030
Number of NCCC meetings organized	0	4	8

Specific objective 2: Raising awareness on climate change adaptation and disaster risk reduction through reliable and accessible information

245. It will enable improving data, information and knowledge management practices within sectoral entities, including through the information systems, which is an essential prerequisite for addressing climate risks and designing adaptation measures. Companies will ensure the establishment of sectoral databases with relevant CC information, which will be regularly updated. For all sectors, the need to collect and disseminate data on cross-cutting issues (vulnerabilities, gender, migration-environment connection) will also be taken into account. Also, capacities to collect and use climate data for the development and management of information products on climate risks and adaptation to

climate change will be strengthened. Companies will identify relevant personnel for annual continuous training courses and provide incentives for staff who individually develop new skills and competencies that will contribute to achieving climate change adaptation objectives within the institution.

246. As regards disaster risk reduction and adaptation to climate change, integrated information systems on CCA and disaster risk reduction (DRR) will be established. It will also improve research, data collection, risk analysis and information sharing to better map, understand and manage human mobility related to the adverse impacts of climate change.

247. Adequate information support will ensure efficient planning and decision-making. The collection, use and distribution of information on climate change adaptation and disaster risk reduction is an administrative and methodological challenge due to the variety of information and data. The development and delivery of high-quality, user-friendly climate services, in particular for socio-economic sectors, will be an important source of planning information. This will also entail additional socio-economic benefits, which will help reduce losses from hydrometeorological and climate risks and improve the productive capacity of sectors. Sectoral services will be supported with awareness-raising activities and information relevant to decision-making on cross-cutting issues (vulnerability reduction, gender, migration-medium connection and migration potential for adaptation).

Impact indicator	Benchmark 2023	Intermediate target 2026	Final target 2030
Climate change knowledge management platform created and operational (number of users)	0	20 000	50 000

Specific objective 3: Expand budgeting for climate change adaptation and increase resilience

248. It will enable the introduction of climate budget tagging (CBT) as a tool for mainstreaming climate change considerations in planning and budgeting processes, facilitating the identification and monitoring of climate-related expenditure in budgetary programmes (budget allocations) and identifying funding gaps and investment opportunities. It will contribute to reporting on climate finance in order to identify additional sources for achieving national commitments under international climate change treaties. The use of CBT will generate significant cost savings over time, from reducing losses due to climate shocks, and stress. By making the economic rationale for investing in adaptation, adaptation measures will be prioritized according to the cost-benefit ratio, to ensure that every leu spent on adaptation produces maximum benefits for society. This will also facilitate access to international sources of financing, by demonstrating the net benefits of the proposed measures.

Impact indicator	Benchmark 2023	Intermediate target 2026	Final target 2030
The climate budget tagging system is developed and applied	-	Climate budget tagging is developed	Climate budget tagging is applied

Specific objective 4: Mainstreaming of CCA and disaster risk reduction into sectoral strategic planning and investment planning at national and local level

249. It will enable capacity building to develop adaptation programmes and projects, to incorporate climate change considerations into existing programmes and projects and improve sectoral capacities to monitor climate change processes and impacts, including setting and achieving sector-specific adaptation objectives. Additionally, achieving this objective will facilitate the integration of climate risks and climate change adaptation aspects into planning and budgeting processes within different sectoral institutions and will increase the level of preparedness and response to climate disasters and emergencies. This will also be promoted through the development of the early warning system, which is a basic tool for DRM, and needs to be explored and exploited at the maximum extent. At the same time, the general capacities of the Government to address the relationship between environment, migration and gender will be strengthened. Thus, incorporating gender aspects into climate change adaptation planning, which is a requirement of international climate funders, will contribute to reducing socio-economic disparities between women and men, which generate differentiated vulnerabilities.

Indicator impact	Benchmark 2023	Intermediate target 2026	Final target 2030
Number of strategic sectoral documents integrating CCA aspects	-	3	6

Specific objective 5: Increasing the resilience of priority sectors by financing activities in the field of climate change adaptation and reducing risks and adverse impacts of climate hazards

250. It will ensure the sustainable and harmonious development of the agriculture sector, by reducing vulnerability to climate aridisation, modernizing centralized irrigation and rainwater collection systems, increasing the role of the academic sector in promoting the application of new digital technologies, creating the national gene fund and using green fertilizers. There are measures that, applied as a whole, will contribute essential to adaptation to climate change. Finally, the implementation of insurance programmes against climate risks will be ensured, as well as subsidizing agricultural producers based on climate-resilient development programmes, as well as stimulating the investment of migrants' remittances in the adaptation of the agricultural sector to climate change.

251. For the energy sector, the expected results will materialize in a sectoral regulatory framework related to the design, construction, operation and maintenance of the energy infrastructure, updated depending on the forecasted climate parameters. Additionally, by increasing local energy production capacity and capitalizing on local renewable energy sources, it will be ensured that dependence on certain traditional energy sources (e.g., hydropower) is reduced. The third category of actions will focus on raising awareness and promoting energy efficient products, encouraging household consumers to reduce energy consumption and use energy-efficient equipment, as well as implementing energy efficiency projects in public buildings. It will also consider how to improve the local institutional context and incentives that could motivate migrants and their families left behind in the country to invest in energy efficiency and renewable energy solutions.

252. For the forestry sector, the mentioned objective will result in improving the management of the forest fund and the forest conservation process, as well as increasing the degree of afforestation of the country's territory by planting forest crops resilient to climate change, strengthening forest belt systems for the protection of agricultural fields and communication routes, reconstruction of green spaces in urban and rural localities, as well as the rehabilitation of silvo-pastoral and agro-forestry systems, supported by an updated regulatory framework, ensuring the resilience of forest ecosystems to the effects of climate change, as well as the implementation of sustainable forest management principles.

253. For the health sector, given the dual nature of the impact of climate change on the health sector, adaptation activities will generate benefits at the level of the sector's infrastructure to climate change, as well as at the level of the public health system. The first category will include prioritization and implementation of investment projects in the public health sector, incorporating climate resilience requirements into technical design and engineering. The second category will benefit from increasing allocations from the Prophylaxis Fund of the National Health Insurance Company (CNAM) for adapting to climate change, adjusting existing clinical protocols or developing new protocols on prevention and treatment of diseases related to climate change, as well as improving territorial and institutional plans for preparedness and response to public health emergencies.

254. For the transport sector, the achievement of this objective will result in a regulatory framework, including for waterborne transport, revised and supplemented with climate change adaptation aspects. This will be reflected in updated standards for road construction, operation and maintenance, by incorporating climate resilience requirements into the design and engineering of support infrastructure, thus ensuring the implementation of modern technologies for road construction and maintenance, according to international best practices, as well as adapting feasible solutions, such as climate-resistant paving materials and asphalt coating more resistant to plastic deformations.

255. For the water resources sector, achieving the set objective will contribute to the implementation of integrated water resources management and addressing deficiencies related to lack of data and insufficiency of scientific research, adjustment and proper equipment of the hydrological observations network, by modernizing the hydrological monitoring network on the main tributaries of the Dniester and Prut rivers, collecting and processing the flow of relevant data, as well as their continuous integration into SIA "State Water Cadastre". Also, measures aimed at disaster risk reduction will help revitalize natural wetlands, restore natural shores of small rivers and riparian ecosystems. They will also help prevent, minimize and address climate-related population movements and other migration-related issues.

Impact indicator	Benchmark 2023	Intermediate target 2026	Final target 2030
Amount of funding of actions in the field of CCA	-	2 063 376 286	**4 607 066 384**

Chapter IV
IMPACT

256. The implementation of the Programme will contribute to ensuring climate resilience and facilitating adaptation in the six priority sectors, as well as fulfilling the country's commitments under the Paris Agreement and the updated National Determined Contribution.

257. By implementing the horizontal cross-sectoral measures proposed in Specific Objective 1, the Programme will ensure functional policy coordination on CCA, establishing clearly defined roles and responsibilities and a functioning monitoring, reporting and evaluation mechanism. At the same time, institutional capacities for the efficient implementation of climate change adaptation measures at sectoral level will be strengthened by establishing mandates and responsibilities in the field of CCA for relevant institutions and by providing the necessary staff and budget allocations. The capacity-building activities set out in the Action Plan will ensure the availability of capacities and competences to address the challenges of implementing climate-related policies at central and local level.

258. By implementing measures under the Specific Objective 2, the Programme and its Action Plan will substantially improve the availability and use of climate-related data and information in priority sectors. Thus, complex sectoral data and information will be made available to policymakers, academia, NGOs and the public, while collaboration between government agencies, universities and research institutions to jointly generate climate-related knowledge will be strengthened. At the same time, integrated data and information management in the field of CCA and DRR will be ensured, thus generating significant savings. This will enable informed stakeholders to identify, collect, use and share information related to CCA that is relevant to their work.

259. Through the implementation of the Specific Objective 3, budget allocations for relevant sectors will be partly earmarked for climate change adaptation measures. The integration of CCA considerations into project development at early stages will be ensured using screening and climate budget tagging (CBT) methods, in line with specific capacity-building activities for budget planning specialists and programme managers. As a result, line ministries and sectoral institutions will plan measures to increase climate resilience.

260. Through the actions envisaged in Specific Objective 4, adaptation to climate change and climate DRR will be mainstreamed in a sustainable manner in sectoral plans/projects and regional/local development planning, contributing to increased preparedness for disaster risk management.

261. Participation in local planning of LPAs, local NGOs and identified vulnerable groups will become a practice of involving communities, including migrant population, in CCA planning and disaster response.

262. The implementation of actions under Specific Objective 5 will have a significant positive impact for the identified priority sectors. Thus, for the agricultural sector it will contribute to strengthening the capacity to adapt to climate change, generating increased economic profitability. It will also increase the resilience of agroecosystems through proper soil management and the application of digital agricultural technologies. As a result, it will increase the security and disaster response capacity of agricultural producers.

263. The measures proposed for the forestry sector will contribute to the ecological reconstruction/rehabilitation and expansion of forests and forest belts, with substantial economic benefits. Providing the sector with reproductive material under new climatic conditions will increase

the eco-protective and bio-productive potential of natural forests and preserve forest biodiversity. The restoration of degraded forests and grasslands will also help ensure agricultural productivity by improving river basin functions and protection against hazardous weather. Thus, the ecosystem-based approach will be largely applied by ensuring that forests protect agricultural land, localities, infrastructure, etc. This will have a positive effect by increasing the protection of water resources through afforestation of riparian strips, as well as the resilience of agricultural land through agro-forestry systems.

264. The implementation of actions for the health sector will increase decision-making in financing climate change response and recovery measures for public health. In addition, targeted investments to modernize healthcare facilities to cope with extreme weather events (such as drought, floods, prolonged rainfall, storms, strong winds, heat waves) will ensure not only their resilience, safety and continued operation, but also better protection of patients and staff. Therefore, the Programme promotes the modification of hospital infrastructure to operationalize "green standards" (considering climate-resilient infrastructure, technologies and products recommended for this purpose). Increased access to healthcare in isolated communities, with populations particularly vulnerable to the effects of climate change, is also a priority objective to be achieved by the measures proposed for the sector in the Action Plan.

265. Improving municipal water supply systems to reduce losses and adopting better measures to manage water demand present immediate modest investment opportunities with high returns, identified as priority CCA measures for the water resources sector. The implementation of technical design norms will lead to a rational use of water resources and revision of water supply and sewerage norms for smaller localities (> 2,000-5,000 and 5,000-10,000 inhabitants). Use of relevant existing tools such as rainwater collection, runoff storage basins, etc., is also proposed as an appropriate CCA measure in water management practice. Rainwater storage in at least 100 water accumulation basins in the Central and South Agricultural Zone will increase the climate resilience of these regions. The revitalization of the natural Lower Nistru and Lower Prut wetlands, as well as the restoration of the natural shore of small rivers (meandering, grassing of banks) are also among the CCA actions foreseen in this sector. With the gradual restoration of riparian ecosystems, by optimizing the number of dams built on the tributaries of the Dniester and Prut rivers, water reserves in the most vulnerable districts of Moldova will increase.

266. A set of structural and non-structural measures for flood control is also outlined in the Action Plan, which envisages essential revenues for public safety through improved emergency prevention and preparedness, as well as substantial economic returns from damage and loss reduction.

267. For the Energy and Transport sectors – the Action Plan provides measures to increase the climate resilience of the sector's infrastructure by introducing modern technologies in its construction, operation and maintenance processes. Adapting the construction of energy networks and installations, roads, railways, bridges, etc., to new climatic conditions, will not only increase the resilience of these sectors, but will substantially reduce subsequent maintenance costs. The Plan also includes measures to increase flood resilience of the country's energy and transport infrastructure, which will result in increased safety of roads and energy facilities, as well as significantly reducing the risks caused by infrastructure damage and related losses.

Chapter V
COSTS

268. The estimated value of the financial resources needed to ensure the implementation of the public policy document in the field of adaptation to climate change for the period 2023-2027 is 1,836,354,272 MDL, of which 275,453,140.8 MDL (15%) from the state budget and 1,560,901,131.2 MDL (85%) from THE development partners sources worth over 1 billion MDL, identified at the time of development of the Programme (external sources - UNDP, World Bank, FAO, GIZ, EIB, EBRD, NAP-2, NAP-3, NDA, FPI, LIFE Programme, Embassy of Sweden, EU4Environment - Water and Data, etc.). Table 24 estimates the amounts and indicates the sources for the implementation of the National Climate Change Adaptation Program until 2030 for the period 2023-2027.

Table 24. Estimation of sources for the implementation of the National Climate Change Adaptation Programme by 2030

Funding per year	**2023**	**2024**	**2025**	**2026**	**2027**	**TOTAL**
Total resource type	**91 728 737**	**384 115 511**	**505 512 968**	**452 183 369**	**402 813 687**	**1 836 354 272**
Source type, of which:						
State Buget	13 759 310,55	57 617 326.65	75 826 945.2	67 827 505.35	60 422 053.05	275 453 140,8
External sources (donors)	77 969 426,45	326 498 184.35	429 686 022.8	384 355 863.65	342 391 633.95	1 560 901 131,2

269. Particular attention was paid to avoiding duplication of effort and exploiting synergies between sectoral and inter-sectional interventions, with the objective of minimizing implementation costs. In this respect, a list of horizontal measures has been defined, based on the recommendations of the Capacity Development Plan, and the current National Determined Contribution complemented by sectoral adaptation measures and their relative costs, according to relevant sectoral strategies. These cost estimates were then compared with historical cost information to ensure they were not overstated and to fill any data gaps.

270. The action plan shall contain information on the costs for each measure, considering the total cost of implementation over the planning period (until 2030, including operating costs where applicable). For reporting purposes, costs will be apportioned per financial year during the implementation of the action.

271. Based on the presented approach, the total cost of program implementation is estimated at about MDL 3 billion, most of the funds to be invested in sectoral measures (SO5). Compared to sectors, the highest cost allocation is for the forestry sector (670 026 207 MDL) and the lowest – for the

transport sector (4 517 600 MDL). One of the three gaps in NCCAS 2020 refers to the initial cost estimates for the CCA measures planned in the Action Plan that did not correspond to subsequent expenditures in two of the priority sectors (agriculture and water resources management). Several gaps were also identified in planning and reporting based on CCA funding indicators. These are gaps that the new CCA Programme until 2030 aims to overcome by applying in synergy the CCA budget marking methodology and tools for mainstreaming adaptation.

272. The breakdown of costs by objectives and actions is presented in Table 25 and Table 26 illustrates the breakdown of Programme costs by year.

Table 25. Breakdown of costs of NCCAP 2030 by Specific Objectives and Actions (MDL)

Specific Objectives and Actions	Implementation costs (MDL)
SO 1. Development of climate change adaptation capacities and cross-sectoral cooperation	**11 454 650**
Priority Action 1.1. Operationalization of the Climate Change Adaptation Coordination Mechanism	1 771 650
Priority action 1.2. Strengthening institutional capacities for the effective implementation of CCA measures	2 480 000
Priority Action 1.3. Ensuring continuous targeted training on capacity development for the implementation of CCA policy	6 627 000
SO 2. Raising awareness on climate change adaptation and disaster risk reduction through reliable and accessible information	**15 399 665**
Priority Action 2.1. Ensuring the availability and use of climate data and information in priority sectors	1 858 300
Priority Action 2.2. Targeted capacity building on the collection, management, use and sharing of climate change information	6720 365
Priority Action 2.3. Create a coordinated system for collecting and managing data on disaster risk reduction and adaptation to climate change	2 246 000
Priority Action 2.4. Raising awareness and preparedness of policymakers and the general public on climate risks and adaptation possibilities	4 575 000
SO 3. Expanding budgeting for climate change adaptation and increasing resilience	**1 884 600**
Priority Action 3.1. Integrating CCA aspects into sectoral budgets and ensuring cross-sectoral financial and operational synergies	264 600
Priority action 3.2. Capacity building for integrating CCAs into budget planning and financing at national and local level	1 620 000
SO 4. Integration of AUC and DRR into sectoral strategic planning and investment planning at national and local level	**21 384 000**
Priority Action 4.1. Integrating climate change adaptation aspects into sectoral management practices	1 611 500
Priority Action 4.2. Integrating climate DRR into development planning and	16 830 800

enhancing preparedness for disaster risk management	
Priority Action 4.3. Gender mainstreaming in CCA and DRR planning, and promoting adaptation actions at Community level	2 941 700
SO 5. Increasing the resilience of priority sectors through climate investments and reducing the risks and negative impacts of climate hazards	**1 786 281 357**
Priority Action 5.1. Adaptation of the AGRICULTURE sector to climate change by applying complex agricultural practices, modern adaptation technologies and soil conservation	363 955 000
Priority Action 5.2. Increasing energy efficiency and resilience of the infrastructure of the ENERGY sector by adjusting to forecasted hydrometeorological parameters	58 264 550
Priority Action 5.3. Adaptation of the FORESTRY sector to climate change by applying complex biodiversity conservation practices and ecosystem approach	670 026 207
Priority Action 5.4. Reducing the impact of climate change on public health and healthcare services	38 159 400
Priority Action 5.5. Increasing the resilience of the TRANSPORT sector infrastructure by applying technologies adjusted to forecasted hydrometeorological parameters	4 517 600
Priority Action 5.6. Adaptation of the WATER RESOURCES sector to climate change by efficiently using resources, ensuring their quality and quantity and reducing flood risk	307 924 000
Total	**1 836 354 272**

Table 26. Breakdown of NCCAP 2030 cost per year (MDL)

Years	**2023**	**2024**	**2025**	**2026**	**2027**	**Total**
SO 1	2 208 000	7 297 850	1 948 800		-	11 454 650
SO 2	177 165	4 374 100	5 851 800	3 460 800	1 485 800	15 399 665
SO 3	29 600	1 585 000	270 000	-	-	1 884 600
SO 4	1 140 000	6 281 000	7 664 700	5 958 300	340 000	21 384 000
SO 5	88 173 972	364 577 561	489 777 668	442 764 269	400 987 887	1 786 281 357
Total	**91 728 737**	**384 115 511**	**505 512 968**	**452 183 369**	**402 813 687**	**1 836 354 272**

273. The financing of climate change adaptation actions included in the Programme Action Plan will be made from external technical assistance, which excludes the risk of inability to cover the expenses related to their implementation from the state budget. The involvement of the responsible institutions will be carried out within the limits of budgetary allocations.

Chapter VI
IMPLEMENTATION RISKS

274. In order to identify the risks regarding the implementation of the National Climate Change Adaptation Program until 2030, the lessons learned from the implementation of NCCAS 2020 and its Action Plan, developed in the first NAP cycle for 2014-2020, were analyzed and considered. In addition to sector-specific risks associated with the implementation of concrete adaptation actions, there are several risks common to the national economy and governance structures that will need to be overcome through combined actions. Three types of risks have been identified: (1) related to the external medium; (2) related to planning and budgeting (general or sectoral); and (3) related to individuals and organizations. Those with high (H) and medium (M) probability of occurrence and impact are reflected in Table 6.1, accompanied by risk mitigation measures.

275. The consequences of the pandemic and socio-economic crises are the main external risks with high probability and high potential impact on the implementation of NCCAP 2030. Unsatisfactory interinstitutional coordination is identified as an increased internal risk for achieving the objectives of the Programme, as it can affect all stages of its implementation – planning, prioritization, budgeting and implementation of CCA measures. Insufficient financial resource is also a risk in the high probability category for the implementation of the NCCAP 2030. Therefore, priority should be given to sustainable investments in priority sectors integrating climate change adaptation actions. Among the high-impact risks is the underestimation of the impact of climate change on the country's development prospects, which is proposed to be mitigated through targeted awareness campaigns and continuous policy dialogue between stakeholders.

276. The risks in the medium probability and impact category for the implementation of the 2030 NCCAP may be the lack of specific adaptation programs for priority sectors, although the integration of CCA measures into sectoral development programs is a reliable risk mitigation tool. The potential shift in development partners' priorities and delayed financing of adaptation measures is a high-probability risk, but with medium impact, as it could be mitigated through proper planning and prioritization of investments at national level. Compared to other external and internal risks for the implementation of the Programme, the limited capacity of staff in institutions invested in CCA tasks is assessed as average in terms of both impact and probability.

277. The implementation of the measures set out in the NCCAP 2030 Action Plan (Annex 1) will be reported and analyzed annually, as part of the Programme's monitoring and evaluation (M&E) framework. This will allow potential risks to be identified early and those actions to be taken at the institutional level necessary to remedy the situation.

Table 27. Risks for Programme implementation

Category	Risk	Probability (High/ Average)	Impact (High/ Medium)	Mitigation measures
1-Related to the external environment	Challenges with a negative impact on the social, political and economic situation of the country, which may cause failure to implement actions).	**H**	**H**	- Integrating climate change adaptation considerations into national recovery and resilience plans; - Continuous monitoring, review of actions and identification of alternative solutions where necessary.
1-Related to the external environment	Changing financing priorities of development partners due to crisis management needs.	**H**	**M**	Ensure that CCA and DRR considerations are integrated into national recovery and resilience plan(s), as well as project proposals for financing by development partners.
2-Related to planning and budgeting	Underestimating the impact of climate change on the country's development prospects.	**H**	**H**	Targeted awareness campaigns on climate-related risks and vulnerabilities, as well as adaptation options for priority sectors.
2-Related to planning and budgeting	Insufficient funding of measures set out in the 2030 NCCAP Action Plan as well as sectoral plans incorporating climate change adaptation measures.	**H**	**H**	- Mainstreaming adaptation to climate change in all development projects for priority sectors; - Training of staff from public authorities responsible for implementing CCA actions in priority sectors, in the field of planning and elaboration of project proposals, to access external financing.
2-Related to planning and budgeting	Lack of sectoral climate change adaptation plans.	**M**	**M**	Ensure the integration of CCA actions into sectoral development plans/programmes (most of which are currently in the process of updating for the post-2020 period).

3-Related to individuals and organizations	Frequent changes in composition of Government or governance priorities.	**M**	**H**	- Targeted awareness campaigns on climate-related risks and vulnerabilities and adaptation options for priority sectors; - Continuous political dialogue with all stakeholders to reach consensus on priorities related to the country's sustainable development path and the role of adaptation to climate change.
3-Related to individuals and organizations	Insufficient coordination between ministries and administrative authorities responsible for implementing the Programme.	**H**	**H**	Strengthening the capacities of the National Commission for Climate Change, established by GD nr. 444/2020, for the systematic coordination and monitoring of the implementation of the Programme.
3-Related to individuals and organizations	Limited capacity of staff in the authorities responsible for implementing the Programme.	**M**	**M**	- Elaboration of training programs in the field of CCA; - Continuous professional training of staff from ministries and relevant institutions with responsibilities for the implementation of NCCAP 2030.

Chapter VII
RESPONSIBLE AUTHORITIES/INSTITUTIONS

278. The responsibilities of national authorities, public agencies and institutions involved in the development and implementation of actions in the field of adaptation to climate change are included in Chapter 2 and in the Action Plan of the NCCAP (Annex 1), for each activity in the action directions. This chapter generalizes the institutional framework that will contribute to achieving the objectives set by the NCCAP 2030, presenting the responsible institutions by Specific Objective and Action.

279. SO1 aims to implement policies and strengthen capacities for adaptation to climate change and requires the involvement of all line ministries governing priority sectors, in coordination with the NCCC and under the auspices of the Ministry of Environment. The proactive contribution of the Ministry of Agriculture and Food Industry, the Ministry of Infrastructure and Regional Development, the Ministry of Energy and the Ministry of Health, and their subordinated institutions, is necessary to implement the measures included in Priority Action 1.2, aimed at improving the capacity of action in the field of CCA. Priority Action 1.3 includes targeted trainings for the implementation of CCA policy and requires the involvement of the State Chancellery and IP Moldova State University. The Ministry of Education and Research and the General Inspectorate for Emergency Situations (IGSU) within the Ministry of Internal Affairs will take over the actions aimed at integrating DRR information into university programs (action 1.3.4).

280. SO2 aims to raise awareness about climate change adaptation and disaster risk reduction. It will be carried out under the auspices of the Ministry of Environment, especially the State Hydrometeorological Service, which has an important role in the implementation of Priority Action 2.1. and Priority Action 2.4. The implementation of Priority Action 2.1 requires the involvement of all line ministries with responsibilities related to the CCA, which are the primary holders of data and information related to adaptation to sectoral levels. The General Inspectorate for Emergency Situations will contribute to the implementation of Priority Action 2.3 by collecting data and creating a database with policy-relevant information on DRR.

281. The Ministry of Finance, together with the Ministry of Environment, will play a crucial role in the implementation of SO3, which aims to improve budgeting for adaptation to climate change – both at national and sectoral level.

282. SO4 aims to increase the integration of CCA and DRR in strategic and sectoral investment planning and requires the involvement of all line ministries with competences on CCA, in coordination with the Ministry of Environment. Research institutes within the Ministry of Education and Research will contribute to the implementation of measures included in priority action 4.2 (in particular, action 4.2.1 on mapping vulnerable settlements). The Ministry of Infrastructure and Regional Development, together with the IGSU of the Ministry of Internal Affairs, will contribute to the implementation of priority action 4.2 by developing disaster risk reduction plans and mechanisms (actions 4.2.2, 4.2.3 and 4.2.7). The SHS and the Environment Agency under the Ministry of Environment, as well as the Ministry of Health, have a special role in developing and implementing sector-specific early warning and surveillance systems to support policy decisions (4.2.4, 4.2.5 and 4.2.6). The measures of priority action 4.3, related to gender mainstreaming in CCA and DRM planning at national level, will be coordinated by the Ministry of Environment. The implementation of CCA and DRR activities at community level will require the involvement of local public authorities.

283. SO5 aims to improve resilience for the six priority sectors. The line ministries and their subordinated institutions, described in Chapter 2.2.1, are responsible for implementing each specific objective as follows:

284. Priority Action 5.1. Agriculture – The Ministry of Agriculture and Food Industry, AIPA and research institutes subordinated to the ministry are responsible for implementing measures to increase resilience and reduce climate-related hazards in the sector.

285. Priority Action 5.2. Energy – The Ministry of Energy will promote actions related to improving standards for construction, operation and maintenance of energy infrastructure, taking climate change into account. The National Fund for Regional and Local Development and the energy distribution agencies are responsible for incorporating climate resilience into the design and engineering of energy distribution networks. The Energy Efficiency Agency supports efficient energy use in buildings and industry and will promote sustainable investments in energy efficiency. NAER is responsible for promoting renewable energy sources to increase local energy production capacities.

286. Priority Action 5.3. Forestry - Environment Ministry and "Moldsilva" Agency are responsible for carrying out most of the activities aimed at CCA in the forestry sector. The Ministry of Infrastructure and Regional Development and the Ministry of Education and Research are involved in the realization of the Forest Inventory. They are also involved in all activities regarding the use of modern biotechnologies, in providing the forest sector with reproductive material in the new climatic conditions, and in carrying fundamental and applied research related to the impact of climate change on forest ecosystems, etc. To implement the actions of rehabilitation of silvo-pastoral and agroforestry systems, it is necessary to involve the Ministry of Agriculture and Food Industry, the Agency "Moldsilva", MIDR and MEC. The Ministry of Environment, Moldsilva Agency, Apele Moldovei Agency, MIDR, MAFI and MER will implement actions aimed at creating and strengthening forest belts for the protection of agricultural land, as well as for extending the forest fund (degree of afforestation) of the country.

287. Priority Action 5.4. Health - The Ministry of Health and the National Agency for Public Health are the main actors in implementing the CCA measures envisaged for the sector. The National Health Insurance Company has a substantial role in developing and implementing a financing strategy for investments in the public health sector, incorporating climate resilience requirements.

288. Priority Action 5.5. Transport - The Ministry of Infrastructure and Regional Development is designated to monitor the implementation of CCA measures in the transport sector. In cooperation with MIRD, the Institute for Standardization of Moldova is responsible for reviewing and improving the construction, operation and maintenance (O&M) of road infrastructure, considering climate change. The integration of climate resilience requirements into the design and engineering of transport infrastructure is the responsibility of the State Administration of Roads, the State Enterprise Moldova Railways and the Naval Agency.

289. Priority Action 5.6. Water resources - The Ministry of Environment and the "Apele Moldovei" Agency are the main institutions responsible for implementing CCA measures in the sector. The Environment Agency has an important role to play in carrying out the necessary assessments of climate change and its impact on water resources. The State Hydrometeorological Service is responsible for hydrological monitoring and ensuring the delivery of reliable data on water resources and the impact of climate change on them. The Ministry of Infrastructure and Regional Development is involved in all measures related to the adaptation of norms and standards of water supply and sewerage,

as well as flood protection infrastructure, taking climate change aspects into account. Regarding the application of authorized use, measurement, and taxation of water in the context of climate change – coordinated actions of several institutions are needed, such as the Agency "Apele Moldovei", MIDR, MAFI, Ministry of Environment and Ministry of Finance.

290. To be able to fulfil its organizational objectives of coordinating and integrating adaptation to climate change into development planning at national, sectoral, and local level, the Ministry of Environment needs strong political support and considerable institutional coordination. This is necessary to complete the reform of subordinated institutions and clearly define their functions, as well as operationalize and strengthen the National Climate Change Commission. As regards line ministries and their subordinate agencies, awareness raising activities and improved capacities will be needed. This is to ensure the implementation of appropriate adaptation actions, aimed at increasing the resilience of sectors to climate change and climate disasters.

Chapter VIII
REPORTING, MONITORING AND EVALUATION PROCEDURES

291. Climate change adaptation monitoring and evaluation (M&E) has several purposes. These include tracking and evaluating progress, communicating adaptation processes and outcomes, and providing new information and lessons learned to guide future decisions.

292. The Paris Agreement requires monitoring of the following:

1) implementation of the adaptation process;
2) the effectiveness of adaptation measures;
3) progress towards the overall adaptation target.
4) progress in achieving the NDC and its adaptation actions.

293. The periodic assessment and final assessment of any strategic policy document in the Republic of Moldova is also provided for in the Regulation on planning, development, approval, implementation, monitoring and assessment of public policy documents, adopted by Government Decision 386/2020.

Framework for monitoring and evaluating adaptation to climate change

294. According to international experience, as well as lessons learned from NAP-1, the M&E framework for adaptation to climate change in the Republic of Moldova should focus on responsibility, learning and knowledge management. It was also found, based on the evaluation of the implementation of NCCAS 2020, that a more robust M&E framework, based on indicators, is needed to improve the collection and distribution of CCA-relevant data, ensuring a timely and better-informed decision-making process.

295. The following results and impacts will be assessed through the NAP M&E framework:

1) Results of implementation of adaptation and resilience plans, strategies and actions.
2) The degree of vulnerability reduction.
3) Level of increased resilience to climate change (national and local).

296. The monitoring framework also includes process-level results on coordination, integration of the CCA into sectoral policies, capacity development and knowledge management, which influence all levels and will focus on agreed priority sectors, i.e., health, forestry, energy, transport, water resources and agriculture.

297. The indicators of the NAP M&E framework refer to 3 levels of results, as provided in Government Decision nr. 444/2020: Macro (cumulative impact at national level); Meso (result at sector or region/district level); and Micro (result at the level of projects, programs). Taken as a whole, they will provide information about:

1) Climate impact or risks: impacts that changing climate parameters may have on socio-economic and ecological systems.
2) Adaptation actions: information about measures that are implemented to prevent adverse effects on climate change.
3) Adaptation results: information and assessments of the results of taken adaptation actions.
4) Processes: Information about processes such as coordination, capacity development, knowledge management and integration of CCA aspects into sectoral policies, which generally improve adaptive capacity and influence adaptation actions and outcomes.

298. These types of indicators and descriptions will then provide information on the following chain of results: Climate change parameters - Climate impacts or risks - Proposed and taken actions - Results of actions - influenced by Adaptive capacity (Process).

299. The NAP monitoring and evaluation framework and its indicators correspond to the criteria of availability, representativeness, continuity, and rigor and measure the degree of achievement of the General Objectives, Specific Objectives and Adaptation Measures to CC. It was also aligned with the already existing indicators, established in the National Development Strategy "European Moldova 2030", updated NDC and existing sectoral plans. Where appropriate, the proposed indicators are adjusted to international indicators, taken over by the Republic of Moldova (especially at Macro level). Another consideration for the M&E framework is the identification of a limited number of indicators, feasible for reporting. Thus, not all indicators for the 94 measures included in the NCCAP 2030 Action Plan are included in the CCA's M&E framework, as it is intended for monitoring, reporting and evaluation at national level (e.g. for decision-makers and to a lesser extent monitoring the implementation of adaptation measures at sectoral and local level).

300. The indicators on the implementation of adaptation measures at macro level will reflect the level of achievement of the main Objective of NAPCP 2030, namely "to develop and strengthen the capacity of the Republic of Moldova to adapt and respond to the current or potential effects of climate change". They will also quantify the level of "sustainable social and economic development, resilient to the impact of climate change", as envisaged in the updated NDC, as well as the achievement of the country's sustainable development priorities set out in the NDS "European Moldova 2030" and the implementation of Moldova's international commitments under the Paris Agreement and the Sendai Framework for Disaster Risk Reduction. The anticipated results at macro level are:

1) low vulnerability;
2) low economic and social impact of climate change;
3) improved adaptability;
4) increase financial investment to adapt to climate change.

301. The results at Meso level correspond to the directions of action and measures to be implemented at sector level. The result is similar for each of the priority sectors: agriculture, energy, forestry, health, transport, water resources, i.e., increasing the resilience of that sector.

302. The indicators are different for each sector. They were agreed with industry specialists and stakeholders, and some of the indicators reflect targets that are already embedded in existing sectoral strategies. Indicators/results at micro level are not included in the overall M&E framework as results

are part of Local Action Plans. These activities and indicators will be reported by the entities implementing them and the results will feed into the sectoral M&E framework.

Operationalization of the monitoring and evaluation framework of the national adaptation process

303. The National Commission for Climate Change, created by Government Decision nr. 444/2020 on the establishment of the coordination mechanism for activities in the field of climate change, provides the institutional framework for monitoring, reporting and verification of the national process of adaptation to climate change, in collaboration with central public authorities, the private sector and civil society.

304. The administration of the database, the monitoring and reporting of indicators, as well as the development of the annual report on the progress made in the field of climate change are carried out by the National Office for the Implementation of Environmental Projects.

305. The conclusions of the institutional capacity assessment report and the NCCAS 2020 implementation evaluation report reveal certain deficiencies related to the activity of the National Climate Change Commission and climate change governance, including monitoring adaptation to CC. As a result, specific actions to strengthen the capacities of the National Commission were included in the NCCAP 2030 Action Plan.

306. The Environment Agency subordinated to the Ministry of Environment is responsible for monitoring the quality of the Environment, developing the system of statistical indicators in the field of Environmental Protection and preparing and publishing the National Report on the State of the Environment in Moldova. The agency is also responsible for creating and managing databases and registries, managing information for its areas of activity, and ensuring public access to environmental information, including monitoring, and reporting on climate change.

307. The National Bureau of Statistics (NBS) is the main producer of official statistics and coordinator of the National Statistics System (NSS), which provides relevant, truthful, and timely statistical data and information. Regarding environment indicators, NSS holds information about atmospheric air protection, urban infrastructure, land and forest fund, meteorology (temperature, precipitation, and wind speed), waste and use of water resources.

308. At international level, reporting the results of adaptation to systemic changes could be part of reporting national SDGs through the established system of "Voluntary National Reporting". Similarly, reporting on resilience and adaptation could also be part of the biannual reporting for the Sendai Framework for DRR, and Biannual Updated/Transparency Reports to UNFCCC.

309. At national level, reporting on CCA will be aggregated under the auspices of the NCCC, following the NAP M&M Framework, based on regular reports on the implementation of existing plans and strategies at local level, including by sectors, which will integrate adaptation targets and indicators. General reports on NAP implementation will be a source of information for national and international reporting processes on socio-economic and human development indices.

Monitoring, evaluation and reporting of the implementation of NCCAP 2030

310. The monitoring of the implementation of this Program is carried out by the Ministry of Environment, which will periodically assess the degree of achievement of indicators and objectives. Based on the information collected annually from the institutions responsible for implementing the measures and systematizing these results, the annual progress report is developed.

311. During the implementation period of the Program, an interim evaluation (years 2023-2027), carried out by March 31, 2027, and a final one (2028-2030), carried out by March 31, 2031, is provided. The results of the mid-term review will influence decisions related to the implementation of measures for the next implementation period, and based on the results of the final evaluation, the next planning stage in the field of climate change adaptation will be decided. The annual progress reports and evaluation reports will be debated in the National Commission on Climate Change and then presented to the Government for examination.

312. The Ministry of Environment will publish the annual and the interim progress reports and final evaluation reports of the Programme on the authority's official website.