Ministry of Environment of the Republic of Moldova

NATIONAL CLIMATE CHANGE ADAPTATION STRATEGY

DRAFT FOR CONSULTATION

Chisinau

November, 2011

The "National Climate Change Adaptation Strategy" (NCCAS) of the Republic of Moldova has been developed within the UNDP Project "Support to Environmental Protection and Sustainable Use of Natural Resources" implemented by the Climate Change Office (CCO) of the Ministry of Environment (MoEN) with financial support of United Nations Development Programme (UNDP) Regional Bureau for Europe and the Commonwealth of Independent States (RBEC) and UNDP Moldova.

Table of References

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Table of Contents

List of Abbreviations

CHP	Combined Heat and Power Plant
EU	European Union
EWS	Early Warning System
FNC	First National Communication
GCM	General Circulation Model
GDP	Gross Domestic Product
IWG	Inter-ministerial Working Group on Climate Change
MDGs	Millennium Development Goals
NHDR	National Human Development Report
SNC	Second National Communication
SOM	Soil Organic Matter
SRES	Special Report on Emission Scenarios
UNFCCC	United Nations Framework Convention on Climate Change

1Introduction

Moldova is highly vulnerable to climate variability and change. According to a range of studies, including Moldova's Second National Communication (SNC) under the United Nations Framework Convention on Climate Change (UNFCCC)[1] and the National Human Development Report (NHDR, 2009)[2], the impacts of climate change are expected to intensify as changes in temperature and precipitation affect economic activity (more detail on these anticipated impacts is described in the sections following). Furthermore, socio-economic vulnerability to these changes is high. Moldova is one of the least advanced countries in the region – in 2005, Moldova had the fourth lowest Human Development Index out of 20 countries in the region[3]. The economy was in decline before 1991, a process that was intensified with separation from the USSR[4], and Moldova's economy suffered during the recent economic crisis. The impacts of climate change on agriculture are of particular concern – agriculture is a major source of income in Moldova, where more than half the population lives in rural areas and about one third of the labour force is employed in agriculture.[5]

The socio-economic costs of climate related natural disasters such as droughts, floods and hail are significant and both their intensity and frequency are expected to further increase as a result of climate change. During the period 1984-2006, Moldova's average annual economic losses due to natural disasters were about US$61 million, or 2.13 percent of national GDP. More recent events have had a significant impact: the 2007 drought caused estimated losses of about US$1.0 billion; the 2008 floods cost the country about US$120 million.[6] The most recent floods in 2010 are estimated to have had an adverse economic impact on GDP of about 0.15 percent, with total damage and losses estimated at approximately USD 42 million. The floods primarily affected rural and agricultural regions of the country.[7]

Climate change is increasingly recognized as fact of national importance, but so far the national strategic framework lacks integrated climate change mitigation or adaptation measures. Therefore, there is a need for a strategic framework at the national level to ensure that a qualitative, effective and coherent climate change adaptation process takes place. Together with the Low Emission Development Strategy (under elaboration) this will provide for a comprehensive policy framework to deal with the climate change challenge.

Climate change affects all facets of development – it is not specific to any one sector, but rather all development activities need to take account of the risks that climate change may pose to their success. Climate change adaptation further requires coordination and a supportive institutional and legislative environment. It is within this context that this National Climate Change Adaptation

[1]Second National Communication of the Republic of Moldova under the United Nations Framework. Convention on Climate Change / United Nations Environment Progr.; coord. Violeta Ivanov, George Manful. Synthesis Team: Vasile Sorpan, Marius Taranu, Petru Todos, Ilie Boian.– Ch.: "Bons Offices" SRL, 2009. – 316 p.

[2]UNDP, 2009/2010 National Human Development Report, "Climate Change in Moldova: Socio-economic Impact and Policy Options for Adaptation.

[3]Namely 20 Central and Eastern European (CEE) and Commonwealth of Independent States (CIS) countries.

[4]Second National Communication, 2009.

[5]UNDP, 2009/2010.

[6]World Bank, "Project Appraisal Document on a Proposed Credit to the Republic of Moldova for a Disaster and Climate Risk Management Project", July 6, 2010.

[7]Government of the Republic of Moldova. "Post Disaster Needs Assessment, Floods 2010." Supported by the European Union, the United Nations, and the World Bank, with the support of the Global Facility for Disaster Reduction and Recovery (GFDRR), 2010.

Strategy is elaborated. It is intended to serve as an umbrella strategy that creates the enabling environment for specific sectors and ministries to develop their own concrete action plans for adaptation.

This strategy was developed under the direction of the Republic of Moldova Ministry of Environment with the Inter-ministerial Working Group steering the process, and with support from the United Nations Development Programme. The process of elaboration of the strategy involved extensive stakeholder consultation with relevant ministries, research institutions, donor organizations, NGOs and civil society.

This strategy is an essential component for the Republic of Moldova's aspirations to become part of the European Union (EU). The implementation of provisions under the Kyoto Protocol and the UN Framework Convention on Climate Change was already included as one of the objectives of the EU-Moldova Action Plan. Climate Change is one of the chapters of the Association Agreement currently under negotiation between the Republic of Moldova and the European Union.

2Situation Analysis

2.1 Overview of Projected Climate Change Impacts in Moldova

2.1.1. Description of Current Climate Variability

In the Republic of Moldova, climate data, specifically changes in temperature and precipitation, has been measured via the hydro-meteorological monitoring network since 1886. Recordings show a clear increase in both mean annual temperature and precipitation (Table 2-1):

- During the period 1886 to 2007, average annual **temperatures** have increased by approximately 1^0C.
- During the same period, **precipitation** has increased by 60 mm, or circa 11 percent.

Table 2-1: Dynamics of Average Annual Temperature and Amount of Precipitations at the Chisinau Meteorological Station[8&9]

Times series	Air temperature	Times series	Amount of precipitations
1886-1960	+0.5 ^{0}C	1891-1960	+40 mm (+8%)
1960-2007	+0.5 ^{0}C	1960-2007	+20 mm (+3%)
1886-2007	**+1.0 ^{0}C**	**1891-2007**	**+60 mm (+11%)**

Both temperature and precipitation changes have also shown seasonal differences over the previous 100 years. Temperatures have shown the highest increase in the winter, with an average 1.3^{0}C increase; and lowest in the autumn, with only a 0.2^{0}C increase (Table 2-2). The change in precipitation over the past 100 years has shown the biggest increase in autumn (by 32 mm), while in spring it has decreased by 5 mm (Table 2-2).

Table 2-2: Dynamics of Average Annual Air Temperature and Precipitation in the Past 100 Years at Chisinau Meteorological Station[10]

Season	Air temperature	Amount of precipitations
Winter	+1.3 ^{0}C	+9 mm (+9%)
Spring	+0.9 ^{0}C	-5 mm (-4%)
Summer	+0.7 ^{0}C	+20 mm (+11%)
Autumn	+0.2 ^{0}C	+32 mm (+30%)
Annual	**+0.8 ^{0}C**	**+56 mm (+12%)**

An analysis of data provided by the National Hydro-Meteorological Data Fund for the instrumental record period (1890-2007) revealed that **drought affects Moldova on a recurring basis** – over the 117 year period, 22 years were marked by serious drought during the vegetation period (April-September), and 18 years were marked by close to drought conditions (mild droughts). According to National Hydro-Meteorological data, the average frequency of droughts in the Republic of Moldova in a 10-year time span is 1-2 droughts in the North; 2-3 droughts in the central part and 5-6 droughts in the South.

[8]As Chisinau is located in the center of the country, climate conditions are the average for the country as a whole. Chisinau meteorological station also has the longest series of instrumental observation in the Republic of Moldova, and hence is often used as a baseline for weather observations.

[9]National Inventory Report: 1990-2005. Greenhouse Gas Sources and Sinks in the Republic of Moldova. Ministry of Environment and Natural Resources, UNEP, coord.: Violeta Ivanov, George Manful. Authors: Marius Taranu, Vasile Scorpan, Elena Bicova et. al. 2009.352p.

[10]Ibid.

Furthermore, **the frequency of droughts is increasing, with significant impacts on lives and livelihoods**. In the 1990–2007 time span, 9 years[11] were marked by droughts of various intensity, which contributed to a significant reduction in crop yields. In 1990, 1992 and 2003, the droughts continued during the entire vegetation period (April-September), while in other years the droughts occurred in summer. The disastrous drought of 2007 affected over 80 percent of the territory of the country, being the most severe drought in the entire instrumental record period[12].

Floods also affect Moldova on a recurring basis. In the past 70 years, 10 major floods on the great rivers of Moldova (Dniester and Prut) were reported, and three of those occurred in this decade (2006, 2008 and 2010). Large floods on the smaller rivers in the country are also quite common.[13]**The socio-economic costs of climate related natural disasters are significant, with the greatest impacts coming from droughts and floods** (see Figure 2-1 below).

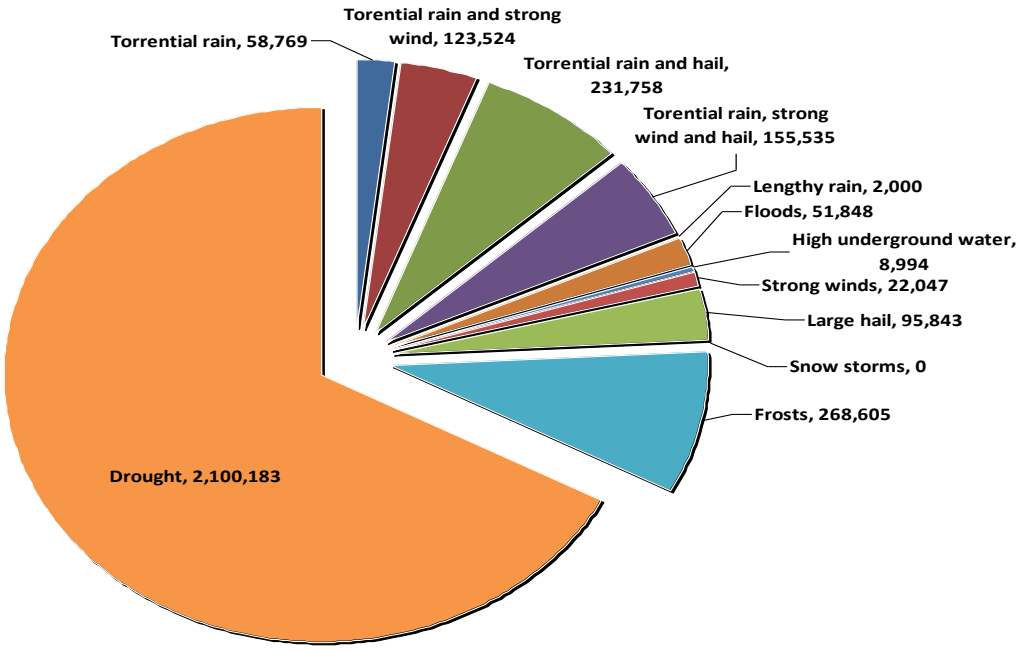

Figure 2-1: Economic Loses (million MDL) from Weather related Hazards 1998-2005, based on SDES data (adapted from World Bank, "Rural Productivity in Moldova – Managing Natural Vulnerability", 2007).

2.1.2. Assessing Future Climatic Risks

Studies undertaken to date to assess future climatic risks in the Republic of Moldova have used the 30-year period 1961 to 1990 as a climatologic baseline, and have studied the influence of climate on relevant sectors within three time horizons: 2010-2039, 2040-2069 and 2070-2099. Three

[11] 1990, 1992, 1994, 1996, 1999, 2000, 2001, 2003 and 2007

[12] National Inventory Report: 1990-2005. Greenhouse Gas Sources and Sinks in the Republic of Moldova. Ministry of Environment and Natural resources, UNEP, coord.: Violeta Ivanov, George Manful. Authors: Marius Taranu, Vasile Scorpan, Elena Bicova et. al. 2009.352p.

[13] National Hydro-Meteorological Data, http://www.meteo.md/pavodok2010/pavodok2010.htm

atmosphere-ocean General Circulation Models (GCMs)[14]were used for the vulnerability and adaptation assessments in First and Second National Communications (FNC, 1998-2000 and SNC, 2005-2009) of the Republic of Moldova under the UNFCCC[15]. The 2009/2010NHDR for the Republic of Moldova uses the results of six GCM experiments based on the A2 and B2marker scenarios of the Special Report on Emission Scenarios (SRES) to downscale climate projections for Moldova.

On the whole, the Republic of Moldova will face warmer and wetter winters but hotter and drier summers and autumns. In the near term, temperatures are expected to increase by 1.7 to 2.0°C, and by the end of this century the increase may amount to 4.1–5.4°C on average. Depending on the GCM experiment, these values vary from 1°C to 6°C. Along with warming, a continuous annual fall in average precipitation is expected. The Republic of Moldova expects maximum warming in winter and in transition seasons (spring and autumn). Moderate increases in precipitation are expected in winter and spring, while summer and autumn precipitation trends are mainly negative (20-30 percent decrease by the 2080s).[16]

Extreme weather events are likely to become more frequent in the future. Projections for Moldova suggest that what were considered as extreme rare events for absolute maximum temperatures under the baseline climate (34-35°C) will possibly become mean maximum summer temperatures. Projections for Europe more generally indicate that the risk of floods increases in northern, central and eastern Europe and that today's 100-year droughts will return every 50 years (or less) in southern and south-eastern Europe (including Moldova)[17].

The climate aridization process may accelerate considerably in the future. Currently, most of the Republic of Moldova's territory is characterized by a dry or sub-humid climate. Aridization, which leads to increased incidence of drought, is predicted to intensify noticeably as early as by the 2040sas compared with the period of 1961-1990. Aridity will be more pronounced during June to October during the plant vegetation period[18].

[14]CSIROMk2 - developed by the Australian Commonwealth Scientific and Industrial Research Organization; HadCM2 - Developed by the United Kingdom Hadley Centre for Climate Prediction and Research; and ECHAM4 - Developed by the German Climate Research Centre.
[15]Using the IS92a scenario.
[16]UNDP, 2009/2010
[17]Lehner, B., P. Döll, J. Alcamo, H. Henrichs and F. Kaspar, 2006: Estimating the impact of global change on flood and drought risks in Europe: a continental, integrated analysis. Climatic Change, 75, 273-299.
[18]Second National Communication,2009.

2.2 Impacts by Sector

The following section describes the projected impacts of climate change by sector for the Republic of Moldova. In addition to describing the physical and socio-economic implications by sector, each section includes a risk analysis of those risks and opportunities posed by climate change to specific regions of the country. This is helping to identify climate risk "hot spots", where more immediate action to adapt to these impacts is required.

In brief, the approach to the risk assessment included an identification of risks and opportunities related to climate change, by sector, based on existing literature; linking future projections of key climate-related variables to these risks and opportunities; assessing how each of the projections could affect risk using a weighting of 1, 2, or 3 (low, medium, high) and finally amalgamating the findings to qualitatively assess and define key risks for each sector, based on expert judgment. In this way, both the probability, as well as the potential impact of climate change, were taken into account in the risk assessment. The methodology used for the risk assessment is described in greater detail in Annex A. This Section is also supplemented by Annex B, which contains a brief overview of identified research needs, by sector, to help facilitate effective adaptation.

Different levels of risk are defined as follows:

- HIGH – high probability of risk due to possible climate change demands the urgent attention of decision makers to develop immediate measures for adaptation;
- MEDIUM – medium probability of risk due to possible climate change should be maintained under review; and
- LOW – low probability of risk due to possible climate change should be maintained under review. It is expected that existing adaptation measures will be sufficient and no further action will be required unless circumstances change.

The ranking for opportunities arising from climate change followed a similar approach and definitions:

- HIGH – high probability of opportunity as a result of climate change to develop new directions in a region;
- MEDIUM – medium probability of opportunity arising from climate change, should be maintained under review; and
- LOW – low probability of opportunity due to possible climate change.

2.2.1. Climate Change Impacts on Agriculture

Agriculture is the dominant sector of employment in Moldova. Following privatization reforms undertaken during the past decade, some 85% of Moldovan households today own agricultural land. The majority of the farms (400,000) are small with an average landholding size of only 1.6 to 1.8 hectares. Together they represent about 45 percent of the utilized land and an overall share of some 72 percent of the total agricultural produce.[19]

Moldova has seen a dramatic decline in agricultural output, in large part due to the change in subsidies and access to markets that were guaranteed in the Soviet era, as well as changes in the

[19] Suter, Rene (2008). "Relief and Technical Assistance Response to the Drought in Moldova". Programme Review Mission Report, UNDP/BCPR.

farming structure (growing share of subsistence, at the expense of commercial farming), land reform and productivity declines related to soil degradation and a lack of irrigation infrastructure. Unfavorable climate conditions, most notably the severe droughts of 2003 and 2007, have also negatively affected production. These conditions will persist and intensify even without climate changes. In 2008, agricultural production totaled MDL 16.50 billion in current prices, or only 63 percent of the 1990 level[20]. The contribution of the agricultural sector to GDP decreased from 31.2 per cent to 7.3 percent, in 2008.According the National Bureau of Statistics of the Republic of Moldova, 31.1 percent of the active population are employed in agriculture.[21]

Possible impact of climate change on agriculture

The combination of long-term changes and the greater frequency of extreme weather events is likely to have adverse impacts on the agricultural sector, and these changes often have many knock-on effects at the macro-economic level. For example direct impacts on agricultural production and declining yields as a result of increased pest and disease problems could further lead to fluctuations in market prices and changes in crops. The combined effect of changes to the water regime could result in insufficient water for irrigation, and increased water competition, which could ultimately result in higher prices and regulatory pressure. Drought will lead to soil degradation, which is a major threat to the sustainability of land resources and may impair the ability of Moldova's agriculture to successfully adapt to climate change. Increased salinity may result in land abandonment as it becomes unsuitable for cropping.

This section outlines direct climate change impacts and their potential socio-economic consequences that are relevant to agriculture, summarized in Table 2-3. These include: changes in temperature, and the effects of heat stress; changes in precipitation amounts, intensity and seasonal distribution; and an increase in extreme and potentially damaging weather events.

Climate change is expected to bring both advantages and disadvantages for agricultural crops in the Republic of Moldova. Although warmer temperatures would increase the length of the growing season, they could also increase crop damage due to heat stress, changes in precipitation patterns, and pest problems. Impacts would vary regionally and with the type of crop being cultivated. Productivity of the winter wheat may decrease from 14.3% (HadCM2 model) to 17.8% (ECHAM4); sugar beet by 6.1% – 6.5% (under all climatic models assessed) and for sunflower a slight decrease from 0.6%(HadCM2 model) to 1.6% (ECHAM4) by 2039. While, according to CSIRO-Mk 2 model, it is possible even a small increase in the productivity by 2.8% compared with the average recorded productivity in the reference period[22]. There are some potential benefits. The longer growing season will potentially increase grass yields, while increased temperatures will increase the potential for growing forage legumes. The longer growing season should also reduce the costs of housing livestock. There may also be benefits for horticulture, both with respect to reducing costs of indoor production and increasing the range of horticultural crops that can be grown outdoors[23].

However, in the Republic of Moldova, most of the impacts on agriculture are predicted to be adverse. Cropping patterns in Moldova have shifted with declines in the industry, with a move away

[20]National Bureau of Statistics (2009), Annual Statistical Yearbook of the Republic of Moldova, 2009.
[21]Ibid.
[22] SNC, 2009
[23]Adaptation to Climate Change in the Agricultural Sector. AEA Energy & Environment and Universidad de Politйcnica de MadridAGRI/2006-G4-05.Report to European Commission Directorate - General for Agriculture and Rural Development, December, 2007

from high value-added products such as fruit and meat, to an expansion of areas sown with wheat and sunflower, and sugar beet. Increased summer temperatures and drought risk could make it difficult to achieve the potential yield increases from increased concentrations of CO_2[24] and perhaps threaten current productivity levels. Some crops will be more vulnerable to hotter and drier summers.

Table 2-3. Summary of Socio-Economic Impact of Climate Change on Agriculture in Moldova

Climate Impact Category	Impact on Agriculture	Social/Economic Impact
Increased temperatures, heat stress	Changes in water requirements	Increased demand for irrigation; Decreased yield of crops; and Changes (positive and negative) in distribution, introduction of new varieties of crops.
	Changes in agricultural pests and diseases	Reduced water quality from increased use of pesticides; Decreased yield and quality of crops; Increased economic risk; and Loss of rural income.
	Changes in crop growth conditions	Pollution by nutrient leaching; Loss of indigenous crop varieties; and Changes (positive and negative) in seed production and seedling requirement.
	Changes in optimal conditions for livestock production	Changes in optimal farming systems; and Loss of rural income.
	Changes in crop distribution	Changes in crop and livestock production activities; Relocation of farm processing industry; Loss of rural income; and Increased economic risk.
Change in precipitation patterns	Changes in hydrological regime; Increased water shortages.	Risks of water quality loss; Increased risk of soil salinisation; Conflicts among water users; Increased groundwater abstraction, depletion; and decrease in water quality.
Extreme events – droughts, floods, hailstorms	Changes in soil fertility, salinity and erosion; Crop failure; Yield decrease; Competition for water; and Increased risk of desertification.	Decrease in water quality from nutrient leaching; Decreased income from crops; Land abandonment; Increased expenditure in emergency and remediation actions; Decreased food security in areas with low economic development; and Increased food prices.

Yields of vegetables and potatoes, both of which are frequently irrigated under current conditions, are likely to be reduced more than the yield of cereals. The summer growth of forage crops also appears likely to be reduced. An increased frequency of extreme weather events may also lead to crop damage or failure[25]. There may also be problems arising from the introduction of new pests and diseases. A large proportion of soils in Moldova's agro-climatic zones are Chernozems. These soils have large organic matter content and breakdown of Soil Organic Matter (SOM) is likely to increase with warmer temperatures. While this breakdown will increase soil fertility in the short term (via

[24]Alexandrov, V. A., and Hoogenboom, G. 2000, The impact of climate variability and change on crop yield in Bulgaria. Agricultural and Forest Meteorology, 104.P. 315-327.

[25]Cuculeanu, V., P. Tuinea, and D. Balteanu, 2002, Climate change impacts in Romania: Vulnerability and adaptation options. GeoJournal, 57.P. 203-209.

release of nutrients) in the longer-term soil fertility is likely to be reduced[26]. The result of long-term research undertaken at the national level[27] indicates that during the last 100 years, the content of SOM in arable soils in the Republic of Moldova has decreased, while the average annual air temperature has increased in the same period of time[28].

Changes in the frequency and intensity of extreme events (e.g., droughts, floods and heavy rains) have been identified as the greatest challenge that would face the agricultural industry as a result of climate change. Extreme events, difficult to both predict and prepare for, can devastate agricultural operations, as has been demonstrated several times in the past. Drought and extreme heat have also been shown to affect livestock operations. Model projections and observed trends suggest that warming would be greatest during the winter months. Although warmer winters would reduce cold stress, they would also increase the risk of damaging winter thaws and potentially reduce the amount of protective snow cover. Climate warming is also expected to increase the frequency of extremely hot days, which have been shown to directly damage agricultural crops. Future changes in moisture availability represent a key concern in the agricultural sector. Climate change is generally expected to decrease the supply of water during the growing season, while concurrently increasing the demand. In addition to the direct problems caused by water shortages, the benefits of potentially positive changes, including warmer temperatures and a longer growing season, would be limited if adequate water were not available. Water shortages are expected to be a main problem in several regions of Moldova in the future.

Assessing the magnitude of risk and opportunities of climate change on agriculture

An agro-climatic characterization of the Republic of Moldova was used to differentiate potential risks and opportunities from climate change on agriculture by characterizing Moldova into agro-climatic zones (Table 2-4). Farming systems determine the capacity to adapt to climate change and the optimal policy options. The farming systems are based on the typology of agricultural holdings: grain field crops, grazing livestock, horticulture and permanent crops. These were selected as they represent the standard national statistical reporting format. The identification of the farming systems assists in the discussion of the risks, opportunities and adaptation options in each zone.

According to the vulnerability assessment of the magnitude of the risk/opportunities of the climate change on agricultural production, the most vulnerable regions in the Republic of Moldova due to possible climate change will be South (the Plain of Southern Moldova, terraces of the inferior Prut and Dniester Rivers**)** and partly Center (Sub-zone II-a, the Plain of Central Moldova and Codrii region, and Sub-zone II, Terraces of the Dniester, Prut, Raut, Prut, Bic, Botna etc. rivers)for which as a result of expert judgment revealed the greatest amount of risks with high probability related to climate change (see Table 2-4).

[26]Adaptation to Climate Change in the Agricultural Sector. AEA Energy & Environment and Universidad de Politйcnica de MadridAGRI/2006-G4-05.Report to European Commission Directorate - General for Agriculture and Rural Development, December, 2007

[27] Ursu, A. ,2000, Soils Degradation and Desertification (in Romanian). Chisinau, 307p.

[28]Taranu, M., Scorpan, V., Bicova, E. et. al. , National Inventory Report: 1990-2005. Greenhouse Gas Sources and Sinks in the Republic of Moldova. Ministry of Environment and Natural Resources/ UNEP, 2009. 352p.

Table 2-4. PriorityRisks and Opportunities for the Republic Moldova's Agro-climatic Zones

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

*****_Sub-zone I-a, the Plain of Northern Moldova_ include districts: Ocnița, Briceni, Edineț, Donduşeni. * **Sub-zone I, the Plain of Northern Moldova, front Dniester hills* include districts Râşcani, parţialGlodeni, municipiulBălţi, Drochia, Sângerei, Soroca, Floreşti, Şoldăneşti, Rezina. [1]Now grapevine is growing inRâşcani,Glodeni, Sângerei and Soroca.[2]Flood increase in frequency and intensity: low - Râşcani and Drochia; high - Sângerei. ******* *Sub-zone II-a, the Plain of Central Moldova and Codrii region* include districts Ungheni, Nisporeni, Străşeni, Hînceşti. ******** *Sub-zone II, Terraces of the Dniester, Prut, Raut, Prut, Bic, Botna etc. rivers* include districts: the South –west of Glodeni, Făleşti, Ungheni, Nisporeni, Străşeni, Teleneşti, Orhei, Ialoveni, Dubăsari, Criuleni, Hînceşti, AneniiNoi, the NourthernCimişlia. [3]Flood increase in frequency and intensity: medium - Glodeni, Făleşti, Orhei, Criuleni, AneniiNoi, Cimişlia and low - Dubăsari. ********* *The Plain of Southern Moldova, terraces of the inferior Prut and Dniester Rivers* include districts: Căuşeni, ŞtefanVodă, Ceadîr-Lunga, Taraclia, Leova, Cantemir, Cahul, UTA Găgăuzia and the Southern Cimişlia. [4]Flood increase in frequency and intensity: high – Leova, low – Stefan-Voda.

For agriculture in the Republic of Moldova, five of the identified risks in Table 2-4 below are considered to be high priority:

- Increased risk of drought and water scarcity;
- Increased irrigation requirements;
- Soil erosion, salinisation, desertification;
- Increased risk of agricultural pests, diseases, weeds; and
- Wheat and maize yield decrease.

Three of these risks concern the consequences of potential changes in the precipitation pattern, with increased rainfall in winter and decreased water availability in summer. Hence strategies need to be considered to conserve as much water as possible over winter to maintain supply during the summer. Much of the adaptation research in the agricultural sector should be focused on strategies for dealing with future water shortages. Such adaptations as water conservation measures and adjustment of planting and harvesting dates could play a critical role in reducing the losses associated with future moisture limitations.

Other adaptation options being studied include the introduction of new species and hybrids, for example, those that are more resistant to drought and heat, and the development of policies and practices to increase the flexibility of agricultural systems. Better definitions of critical climate thresholds for agriculture will also be beneficial for adaptation planning. Of the two opportunities presented in the table, the potential for increased production of some crops, either as a result of the increased yield potentials under the new climatic regimes or an increase in the area over which new crops might be grown, was considered a high priority. Hence attention needs to be given to the promotion of crops that have the potential to flourish in the changed conditions.

2.2.2. Climate Change Impacts on Water Resources

The water resources of the Republic of Moldova are represented by surface waters and sub-surface waters. With regard to surface waters, there are two major river basins in the Republic of Moldova: the Dniester (the largest) and the Prut (the second largest). The natural water regime of the rivers in these basins has been changed by the construction of dams and reservoirs, designed to prevent floods, trap sediment, and provide water for agricultural, industrial and household consumption as well as for fish farming. Ground waters for centralized household and industrial use are withdrawn from ten aquifer complexes.[29]

The sub-surface water grid includes circa 112,000 springs and wells (public and private) and more than 3,000 functional artesian wells. Sub-surface waters are the main source of potable water supply in the Republic of Moldova, for 100 percent of the rural population and 30 percent of the urban population, or 65 percent of the total population of the country. The remaining 35 percent of the population use surface waters as a source of potable water.[30]Approximately 44 percent of the population in the country does not have access to safe drinking water. At present all towns and municipalities and over 65 percent of rural settlements have centralized drinking water supply systems, but only 50 percent of this type of system is in satisfactory technical condition. The rest needs capital repairs or reconstruction.

[29]UNDP, 2009/2010.
[30]Second National Communication, 2009.

According to the NHDR (2009), since 1990, because of economic decline, the decline of heavy industry and falling water use in industry and agriculture, the quality of surface water resources has improved in the major river basins – the waters of the Dniester and Prut rivers are considered to be clean and moderately polluted. However, the waters of small rivers are highly polluted. Ground water does not comply with the national standard for drinking water; often, water hardness in wells exceeds the standards by 2 to 5 times and more. Furthermore, almost 90% of the samples taken from unconfined aquifers exceed the maximum permitted concentration for nitrate, attributed in large part to increased livestock production in households.

Possible impact of climate change on water resources in Moldova

Climate change is only one of many factors that will determine future patterns of water availability and use. Non-climatic factors could aggravate or attenuate the adverse effects of climate change on water availability and quality, as well as have a significant influence on water demand. Population growth and economic development (and, by extension, changes in lifestyles and diets) will play a dominant role (as highlighted above, economic decline is a significant factor in the stability of water resources to date, and hence water withdrawals will be expected to increase with economic recovery). According to the water-intensive target of national economic development, secure supply for all water users will be threatened by climate-related change in water resources already in the 2020s, when the intensity of surface water use will be close to 100 percent. However, taking into consideration ground water supply as well, the point when water scarcity will become a brake to development is likely to set in after 2030[31].Non-climatic impacts could be generated through many realms—from policies and legislation to technologies and infrastructure to land-use patterns and agricultural activities/irrigation[32].

The main direct climate change impacts and their potential socio-economic consequences in the Republic of Moldova that are relevant to water resources are presented in Table 2-5:

Table 2-5. Summary of Potential Socio-Economic Impacts of Climate Change on Water Resources

Climate Impact Category	Impact on Water Resources	Social/Economic Impact
Increased temperatures, heat waves	Annual runoff decrease; Lowering of the groundwater table; and Changes to water quality*.	Reduced water availability for human use; Increase in demand for irrigation; Increased water pollution; Adverse health impacts in low income areas; and Requirement for additional treatment of water for drinking purposes.
Change in precipitation patterns	Changes in hydrological regime; Reduction in stream flow; and Increased water shortages.	Risk of water quality loss; Increased risk of soil salinization; and Conflicts among water users.
Extreme events: floods, droughts***	Increased dilution and sediment loads; and Increased nutrients, pathogens, and toxins transport.	Increased erosion; Damage on infrastructure, land abandonment; and Increased expenditure in emergency and remediation actions.
	Low flows reduce the dilution capacity; Reduced dissolved oxygen; and Increased water shortages	Increased algal blooms, bacterial and fungi content affect human health, agriculture, ecosystems, and water supplies; and Increased risk of desertification.

[31]UNDP, 2009/2010.

[32]World Bank, Water and Climate Change: Understanding the Risks and Making Climate-Smart Investment Decisions", 2009. 174p

*Winter, and especially, transitional months, will be the most affected by water temperature increases. Already by the 2020s, water temperature increases in the Dniester River could exceed 65 percent in March (under SRES B2 scenario). Summer months (especially August) are the most vulnerable to dissolved oxygen (DO). Decreases in DO levels, in combination with the increase in water temperature, affect the ecosystem composition by allowing the invasion of new thermophilic species and dangerous bacteria.[33]

**The coefficient of variation of the stream flow will rise; leading to an increase in the instability of annual flow and an increase in spring and flash floods (the most severe flash flood in August 2008 seems to confirm these assessments). These results are confirmed by European assessments as well[34]: flash floods on the big rivers will increase as an extension of the Central European trend; water stress will grow as a trend common to South-Eastern Europe.

*** The outcomes of climatic modelling[35] show that droughts will become longer and more severe (the drought in 2007 is characteristic in this regard).

Assessing the magnitude of risk/opportunities of climate change on water resources

Although big rivers constitute the main source of water in Moldova, access is unequal. The greatest distance between a settlement and the closest water body in Moldova is about 6 km. Approximately one quarter of the population (1.03 m. people) live in the 6 km buffer zone of the Dniester and Prut Rivers; this zone constitutes one fifth of the national territory and contains 23 per cent of the settlements.

The rest of the country and population (about 3m people) have to rely on various supply systems designed to transfer water from these rivers, or rely on local resources of poorer quality. The northern part of the country (and the central part to some extent) is, currently, more or less water secure, while the southern part suffers from a natural water deficit. At the same time, medium and long distance water transfer systems are almost non-existent in the south. This region is among the most exposed to water shortages.

Moreover, local surface water resources in the south (and, less frequently, in the central part of the country) are at high risk of depletion in drought years (such as 2007, when several reservoirs on the Isnovat River dried up). In such a way, the geographical location of water users will play the most decisive role in the future in ensuring access to a secure water supply. The area of water scarcity, as it extends northwards, has already reached the most populated areas, which place the biggest load on water resources and are most intensive in water use[36].

According to the vulnerability assessment of the magnitude of the impact with the probability of risks due to possible climate change on water resources the most vulnerable regions in the Republic of Moldova will be South, Center, and Mun. Chisinau, for which as a result of expert judgment revealed the greatest amount of risks with high probability related to climate change (see Table 2-6).

For water resources in the Republic of Moldova, eight of the identified risks are considered to be high priority:

- Increased risk of drought and water scarcity;
- Increased irrigation requirements;
- Flood increase in frequency and intensity;
- Decrease water availability from surface sources or ground water;

[33]NHDR 2009/2010 report

[34]Bates B., Kundzewicz Z.W., Wu S., Palutikof J. (eds.), 2008: Climate change and water. Technical paper of the Intergovernmental Panel on Climate Change. IPCC secretariat, Geneva, 210 p.

[35]Climatic modelling conducted for NHDR 2009/2010 report. Moreover, other assessments show that in July semi-desert meteorological conditions set in over the entire country. Thus, conclude the authors, desertification process has already started in Moldova (Constantinov T., Nedealcov M., 2008: Evaluarea fenomenelor climatice nefavorabile. In: T.Constantinov (ed.). Republica Moldova. Hazardurile naturale regionale. Chișinau, p. 57-68.

[36]Sîrodoev I.G., Knight C.G., 2007: Vulnerability to Water Scarcity in Moldova: Identification of the Regions. Buletinul Academiei de Stiinte a Moldovei. Stiintele vietii. 3 (303): 159-166.

- Changes in water demand;
- Water quality affected by higher water temperatures and variation in runoff;
- Higher pollution with pesticides and fertilisers to water due to higher runoff; and
- Changes in river flows both increase and decrease

Table 2-6. PriorityRisks and Opportunities for Water Resources

Detail of magnitude risk/ opportunity		North	Centre	South	Mun. Chisinau
Risk	Water quality affected by higher water temperatures and variation in runoff	LOW	MEDIUM	HIGH	HIGH
	Changes in water demand (increase as a result of population growth, economic development and irrigation requirements)	MEDIUM	HIGH	HIGH	HIGH
	Changes in river flows both increase and decrease	MEDIUM	HIGH	HIGH	HIGH
	Increased risk of drought and water scarcity	MEDIUM	HIGH	HIGH	HIGH
	Increased irrigation requirements	MEDIUM	HIGH	HIGH	HIGH
	Decrease water availability from surface sources or ground water	MEDIUM	HIGH	HIGH	HIGH
	Higher pollution with pesticides and fertilisers to water due to higher runoff	MEDIUM	HIGH	HIGH	HIGH
	Flood increase in frequency and intensity	MEDIUM	HIGH	HIGH	LOW

In this case, no opportunities associated with climate impacts on water resources could be identified.
Moldova's climate has been steadily moving toward drier conditions since the 1990's. Nine significant dry periods or droughts have been recorded since 1990, including a catastrophic drought in 2007 that resulted in losses of up to 75% for major crops such as wheat, maize and sunflower. Drought is becoming endemic in many parts of the country and is increasingly affecting rural livelihoods and development. Adaptation measures for flood and drought impacts include efficient operation of dams, dikes and open channels; wetlands protection (one of the main positive functions of wetlands is to allow groundwater recharge and reduce peak discharges downstream); measures for protection of the irrigation infrastructure from floods; techniques to improve soil texture, aggregation, organic matter content and surface ground cover to manage water usage during dry periods; improved flood forecasting; installation of systems to provide dam break alerts; technical assistance through agricultural extension in coordination with irrigation upgrades to assure dissemination to farmers of techniques to minimize their vulnerability to weather events; and elaboration of effective collaboration between Moldova, Ukraine, and Romania to monitor water discharges, improve weather/flood forecasting and early warning for all downstream countries[37].

2.2.3. Climate Change Impacts on Health

Life expectancy is generally accepted as a key indicator of the overall state of a nation's health. In terms of life expectancy at birth, Moldova is presently in a slightly better position than in the pre-transition period. At the same time, life expectancy in rural areas is shorter than in urban ones (68.2 years and 71.2 years correspondingly), and this is attributed to a variety of factors, including lower levels of access to health care, poor water quality, poverty and cultural factors in rural areas. While the overall health conditions of

[37]Millennium Challenge Account –Moldova: Transition to high value agriculture project. Environment and Social Assessment. Project mission September 28-October 17, 2008. Authors: Sergiu Budesteanu, Jessica Ebbeler, Iurie Gotisan, Rita Klees. Version-final (21 December, 2008).-43p.

the Moldovan population have tended to improve in the last decade or so, the comparative statistics show that the situation in most of the transition countries improved to a greater extent than in Moldova.[38]

The number of beds in hospitals was circa 21.8 thousand or 61.1 beds per 10,000 people; the total number of doctors was 12.7 thousand, or 35.5 doctors per 10,000 population. In 2008, health care expenditures accounted for circa 14.4% of the State Budget. The most frequent types of diseases (as a primary diagnosis per 1000 population for 2008) are: (i) respiratory diseases (88.6 cases), (ii) pregnancy, childbirth and post-natal complications (46.4 cases), (iii) traumas, intoxications and other consequences of external causes (45.5 cases), (iv) infectious and parasitic diseases (38.3 cases), and (v) skin and hypoderm diseases (21.6 cases). Other prevalent diseases relate to the digestive system and blood circulation diseases. The most important causes of lethal events in the country are blood circulation diseases, trauma and intoxications, and malignant tumours, as well as digestive system diseases.[39]

Possible impact of climate change on health in Moldova

It is clear that climate change and extreme weather events have a direct impact on health. However, they can also affect forestry, agriculture and the economy resulting in problems related to food security and poor sanitary conditions that can, in turn, lead to serious mid- to long-term health effects. The health effects of drought could, for example, cause a decrease in food production and result in nutritional problems in the population, making them more vulnerable to disease. In a UNICEF survey conducted in the Republic of Moldova[40], local leaders anticipated that the most severe impact of the 2007 drought would be its effect on the health of the population. In fact, eight out of ten respondents (and 91% of the medical personnel interviewed) considered that it had already done so. However, the long-term effects of drought may be even more devastating. The increasing competition for arable land may eventually result in migration to cities and abroad, and conflict as resources dwindle[41].

This section outlines the main direct climate change impacts and their potential socio-economic consequences that are relevant to health, which are presented in Table 2-7.

Table 2-7. Summary of Socio-economic Impact of Climate Change on Health in Moldova

Climate Impact Category	Impact on Health	Social/Economic Impact
Extreme air temperatures and heat waves	Excess mortality*; Worsened health conditions of people suffering from chronic diseases; Change in foodborne disease patterns; Change the distribution of infectious diseases; and Increase in the frequency of respiratory diseases.	Reduced economic growth; Increased burden of diseases and health conditions, including water borne diseases; Population displacement; Increased mental and behavioural disorders due to stress; and Loss of education.
Floods	Increased number of deaths and injuries; and Increased water borne diseases.	See above
Drought	Increased hunger and malnutrition.	See above

[38] UNDP, 2009/2010
[39] National Bureau of Statistics, 2009.
[40] UNICEF Moldova, "Drought after-effects upon population of the Republic of Moldova." Chisinau, 2007.
[41] World Health Organization, "Assessment of health security and crisis management capacity", The Republic of Moldova, 2008.

*Information on the heat waves of 2007 in Chisinau was used to study the relations between elevated temperatures and excess mortality caused by these events. The authors (Opopol, Corobov, 2010)[42] have revealed that the excess mortality in April-September totalled 190 deaths, or 6.5% of their number in the analogous period of reference years (2000-2008).
The average daily excess deaths above the threshold hot temperatures (about 25°C, 31°C and 19°C for mean, maximum, and minimum daily temperatures, respectively) were in the range of 2.0-4.4% per 1°C temperature increase. Temperature–excess mortality relationships become stronger with an increasing time lag; maximal effects were mainly revealed after one-three days of a heat impact.

Assessing the magnitude of risk and opportunities of climate change impacts on health

According to the vulnerability assessment of the magnitude of the risk/opportunities of the climate change on health the most vulnerable regions in the Republic of Moldova due to possible climate change will be Mun. Chisinau, South, and partially Center for which as a result of expert judgment revealed the greatest amount of risks with high probability related to climate change (see Table 2-8).

For health in the Republic of Moldova, six of the identified risks are considered to be high priority:

- Increase in heat wave-related deaths;
- Increase in air pollution-related diseases;
- Increased risk of allergic disorders;
- Increased risk of drought and water scarcity; and
- Increase the burden of waterborne and foodborne diseases.

In this case one opportunity associated with climate impacts on health exists: reduction in winter mortality from cold.

However, within these regions, the analysis should take into account that climate changes do not hit different population groups in the same manner: some groups are obviously more vulnerable than others. For example, the health care services infrastructure is much less accessible in rural areas, and the rural population has a much higher share of persons who are not registered with family physicians (62% of the total non-registered) as well as a much higher share of those not holding obligatory medical insurance (27.3% of the rural population vs. 19.9% of the urban population). Moreover, every third person who does not hold medical insurance is from the fifth poorest quintile. Secondly, the rural population (around 60% of the total) is much more dependent on the decentralised supply of water than the urban population, and the decline in the quality of water will affect the rural population (one of the most vulnerable group to intestinal diseases is children).

Another important vulnerability is the risk of malnutrition which appears when severe climate events, such as droughts, floods and hails may ruin crops, leaving small farmers with no food and no income meaning that rural populations will face serious nutrition risks.[43]
The WHO Regional Office for Europe[44] states that the prevention of and response to the health effects of climate change will require a portfolio of action at different levels: from health system preparedness coordinated with meteorological early warning systems to timely public and medical advice and improvements to housing and urban planning. Action within the health system could include: (1) strengthening health security; (2) advocating health to other sectors; (3) sharing good practices in

[42]N. Opopol, R. Corobov, Excess mortality in Chisinau during the hot summer of 2007. The Proceedings of the National Conference: Health in relation to the environment. Chisinau, 15 October 2010, p.22-33
[43]NHDR, 2009/2010
[44]Menne B et al., eds. "Protecting Health in Europe from Climate Change." Copenhagen, WHO Regional Office for Europe, 2008 (http://www.euro.who.int/Document/GCH/Protecting_health.pdf?language=French, accessed 8 August 2008).

intersectoral action; (4) building capacity in the health workforce; (5) providing intelligence; and (6) setting an example by "greening" the health services.

Table 2-8. PriorityRisks and Opportunities for Health

Detail of magnitude risk/ opportunity		North	Centre	South	Mun. Chisinau
Risk	Increase in heatwave-related deaths	LOW	MEDIUM	HIGH	HIGH
	Increase in air pollution-related diseases	MEDIUM	MEDIUM	MEDIUM	HIGH
	Changes in phenological phases and increased risk of allergic disorders	MEDIUM	MEDIUM	MEDIUM	HIGH
	Increased risk of drought and water scarcity*	LOW	MEDIUM	HIGH	LOW
	Flood increase in frequency and intensity**	MEDIUM	HIGH	HIGH	LOW
	Increase the burden of waterborne and foodborne diseases	MEDIUM	HIGH	HIGH	MEDIUM
Oppor-tunity	Reduction in winter mortality from cold	HIGH	MEDIUM	LOW	MEDIUM

*Drought reduces water availability for hygiene; drought increases the risk of forest fires; drought reduces food availability in populations that are highly dependent on household agriculture productivity and/or economically weak.

**Flooding disrupts water supply and sanitation systems and may damage transport systems and health care infrastructure; floods may provide breeding sites for mosquito vectors and lead to outbreaks of disease; floods may increase post-traumatic stress disorders.

In summary, action to improve adaptation to climate change in the health sector in the Republic of Moldova could include: translate earlier conference proceedings into a structured national assessment of the health risks of climate change and bring it to the attention of relevant policymakers; discuss and design adaptation strategies for use by the health sector in identifying climate-related health risks in the country; agree on a lead body to coordinate the public health preparedness for and response to climate change; define roles and responsibilities; review and strengthen existing disease surveillance systems with a view to including further climate-related health outcomes, such as heat-related morbidity and mortality; identify, monitor and target risk groups and vulnerable populations; develop treatment protocols for climate-related health problems; raise the awareness of medical professionals and the public; provide training and guidance for medical professionals and advice for the public on measures to be taken during extreme weather events, such as heat-waves, flooding and drought; set up a monitoring system and evaluation mechanism to assess the effectiveness of preparedness and response measures; consider the cost (and amount) of the energy and CO_2 emissions used by air-conditioning and advocate alternative cooling methods to the public; maintain international and regional cooperation[45].

2.2.4. Climate Change Impacts on Forests

Forestry ecosystems (represented by forestland and other forestry vegetation) cover only 456,000 ha, or about 13.5% of Moldova's territory[46], and play an extremely important role in watershed protection, while at the same time providing a number of direct and indirect economic and environmental benefits to rural communities: fuel-wood, non-wood products, ravine stabilization, landscape beautification and other benefits. Fuel-wood is particularly salient for poorer households, which are unable to afford high household energy costs for gas and electricity.

[45]World Health Organization, "Assessment of health security and crisis management capacity", The Republic of Moldova, 2008
[46]Second National Communication, 2009.

The country's forests are primarily concentrated in the central region (60% of the forest estate), with lower coverage in the northern and southern regions (26 and 14 % respectively).[47]

Table 2-9. Forests distribution in the Republic of Moldova as of 1st of January 2006

Geographic zone	Total surface of the zone, thousands ha	Surface coved with forest, thousands ha	Degree of the forestation, %
North	1149.4	92.9	8.1
Centre	1448.8	209.4	14.5
South	786.9	60.4	7.7
Country total	3385.1	362.7	10.7

The following principle types of forests are represented: oak woods, durmast woods, beech woods, water meadows and mixed varieties woods. The forestry ecosystems are populated by circa 860 species of plants, which account for 43 percent of the total spontaneous floral biodiversity of the country. Of all species of vertebrate and invertebrate animals, about 60 percent can be frequently found in forestry biotic communities. It is also significant that more than 50 percent of all vegetal and animal species included in the Red Book of the Republic of Moldova are part of forestry biomes.

As stated in the Strategy for Sustainable Development of Forestry (2001), the main function of forest resources should be to maintain ecological balance, but the amount of forested area is insufficient to guarantee effective environmental protection. Low forestation has been a major cause of Moldova's high level of soil erosion, landslides and degradation of water resources; it also intensifies droughts. The main causes of forest degradation are: (1) the increase in illicit cutting due to higher prices for wood and fuel; (2) lack of efficient controls on the part of local administrations; (3) low levels of ecological knowledge and culture; and (4) excessive grazing and lack of adequate forest management[48]. A long–term, one-hundred year trend of deforestation has been reversed in the past 50 years and Moldova's current forest policy calls for a further increase in forest cover through afforestation and improved community management of forests for direct uses and watershed protection.

Protection of forests can deliver "triple wins", by i) increasing food production and productivity, (ii) helping to lift people out of poverty, while at the same time (iii) supporting the global environment by storing carbon and conserving biodiversity.

Possible impact of climate change on forest resources

Researchers expect that even small changes in temperature and precipitation could greatly affect future forest growth and survival, especially at ecosystem margins and threshold areas such as Moldova's forests.

Climate change would impact future moisture conditions in forests through changes in both temperature and precipitation patterns. As the temperature increases, water loss through evapotranspiration increases, resulting in drier conditions. Higher temperatures also tend to decrease the efficiency of water use by plants. In some areas of Republic of Moldova, future decreases in precipitation will accentuate the

[47]Personal communication of the national expert, Mr. Ion TALMACI, Deputy-Director of the Forestry Management and Research Institute

[48]World Bank, "Integrating Environment into Agriculture and Forestry Progress and Prospects in Eastern Europe and Central Asia", Volume II, Country Review, November 2007.

moisture stress caused by warming. Changes in the seasonality of precipitation and the occurrence of extreme events, such as droughts and heavy rainfalls, will also be important.

For example, treering analysis of oak and ash trees stems in the center of Moldova revealed reduced ring growth to as little as 50% of the previous year and compared to the multiannual average of the past 10 years was associated with the 2007 drought[49].

This section outlines the main direct climate changes impacts and their potential socio-economic consequences in the Republic of Moldova that are relevant to forests, presented in Table 2-10.

Table 2-10. Summary of Socio-Economic Impacts of Climate Change on the Forest Sector in Republic of Moldova

Climate Impact Category	Impact on Forest Sector	Social/Economic Impact
Increased temperatures, heat waves	Longer growing season; Negative consequences for species sensitive to temperature changes; and Increases in vulnerability to forest fires.	Decrease in the volume of wood production; Transition to the other forms of energy; and Additional costs to the public.
Change in precipitation patterns	Change in the phytosanitary condition* Changes in species composition; and Changes in the types and incidence of pests and diseases.	Modification of forest habitat's capacity for biologic diversity maintenance, environmental protection and provision of specific socio-economic functions.
Extreme events: droughts, fires, wind storms and floods	Reduced growth and biomass production; Increases in forests fires; and Increased seed mortality rate.	Economic losses in forestry sector.

*Within the 2010-2039 period,it is expected that the phytosanitary condition (e.g. plant health) will change significantly in the Northern part of the country where areas with trees drying outwill expand by circa 15-25%. In 2040-2069, the change of the phytosanitary condition determined by the trees drying level in the Northern part of the country will strongly aggravate expanding towards South and South-East. Significant changes under this aspect will take place between 2070-2099. In the Northern part the forests will dry out intensely[50].

Assessing the magnitude of risk/opportunities of climate change on forest resources

The potential lack of summer precipitation with consequent droughts is the main constraint factor on forest growth and productivity. Temperature increase and changes in precipitation are the main factors predisposing forests to various insect pests and fungal diseases. The demand of water during the growing season is normally larger than the amount of rainfall. This indicates that if temperature increase is not coinciding with increased rainfall, water could limit growth to an even larger extent than today. The effect of climate change on individual species can be either positive or negative, depending on the site conditions and regional climate changes.

According to the vulnerability assessment of the magnitude of the impact with the probability of risk due to possible climate change on the forest sector, the most vulnerable regions in the Republic of Moldova will be:South (where there is already the lowest degree of forestation 7.7%), and partially Centre(where there is now the biggest surface coved with forest 209.4thousands ha, or about 14.5% of the total geographic

[49]Second National Communication, 2009.
[50]Second National Communication, 2009.

zone territory) for which as a result of expert judgment revealed the greatest amount of risks with high probability related to climate change (see Table 2-11).

Table 2-11. Priority Risks and Opportunities for the Forest Sector

Detail of magnitude risk/opportunity		North	Centre	South
Risk	Changes in species composition *	LOW	MEDIUM	HIGH
	Possible increase in tree mortality	LOW	MEDIUM	HIGH
	Alterations in species competitiveness	MEDIUM	MEDIUM	HIGH
	Negative consequences for species sensitive to temperature changes	LOW	MEDIUM	HIGH
	Changes in the regeneration rate	MEDIUM	HIGH	HIGH
	Changes in species sensitivity to water shortages	MEDIUM	HIGH	HIGH
	Changes in individual tree density	MEDIUM	HIGH	HIGH
	Increase abiotic disturbances caused by fires, wind storms, flooding and drought	LOW	MEDIUM	MEDIUM
	Changes in the phytosanitary conditions	MEDIUM	HIGH	HIGH
Oppor-tunity	Change in biomass production **	HIGH	MEDIUM	LOW

* Decrease of mesophilic forests areas (beech trees stands, durmast trees stands and oak trees stands) in favour of thermophilic forests of durmast with wig trees and of xerofile pastures.[51]

**Among the mix species the *Hornbeam* and the *Ash tree* may be the most vulnerable species in the new climate conditions determined by climate change. In the first half of the production cycle, starting 2010 the *Ash tree* may feature a 20-40% decrease in biomass growth.[52]

For the forest sector in the Republic of Moldova, seven of the identified risks in the Table below are considered to be high priority:

- Negative consequences for species sensitive to temperature changes;
- Changes in the regeneration rate;
- Changes in species sensitivity to water shortages;
- Changes in individual tree density;
- Changes in the phytosanitary conditions;
- Changes in species composition
- Possible increase in tree mortality

In this case exist one opportunity associated with climate impacts on forest sector: increase in biomass production. S*ycamore maple tree* and *Foul lime* may accumulate over 30% more than normal until 2040, followed by a further decrease in total biomass under environmental change, due to reduced population as a result of species decline; also *Durmast* may accumulate 10-20% more biomass than normal until 2040[53].

The outcome of the vulnerability assessment for the forest sector is shown in Table 2-10.
Adaptation measures in the Temperate Continental bioclimatic zone[54], which also includes the Republic of Moldova's forests, are very versatile. On-going and planned research includes adapted seedlings, biotic and abiotic damages, biodiversity, especially genetic diversity, silviculture treatments, and protection functions of forests. Measures at stand level (forest regeneration, tending and thinning of stands, harvesting) are

[51] Second National Communication, 2009.
[52] Ibid.
[53] Second National Communication, 2009.

aimed at decreasing risks of abiotic disturbances, i.e. fire, wind, drought, as well as biotic disturbances, i.e. pests and pathogens. Building stable diversified forests is an on-going measure and it is planned to improve stand stability by selection of suitable species, provenances and genotypes.

2.2.5. Climate Change Impacts on the Energy Sector

Most of Moldova's installed capacity for energy is obsolete, and energy inefficiency is high. The losses of energy (electricity and heat) transmission and distribution have been excessive in the past and are still considerable, affecting adversely the energy sector's energy efficiency. Due to organizational and technical measures, the losses in the electricity distribution networks dropped from over 40% in 2001 to 11.1-14.0% in 2009[55]. Losses of heat in Chisinau and Balti are as high as 19–21%. Reducing losses of energy networks remains a priority for the energy sector and complies with EU policies.

Given the limited capacity to generate energy domestically, Moldova is heavily reliant on imports for its energy needs – imports made up almost 90% of total energy in Moldova in 2007. This leaves Moldova very vulnerable to disruptions and price hikes in foreign energy supply, and can have significant impacts on human development.[56]

The breakdown of final energy consumption per sector in 2008 is dominated by the residential sector (44.4 per cent), transport sector (23.5 per cent), industry sector (9.8 per cent), commercial and institutional sectors (8.5 per cent) and agriculture sector (3.6 per cent). The breakdown of final fuel consumption per type in 2008 was dominated by natural gases (41.7 per cent), diesel oil (17.3 per cent), electricity (10.9 per cent), gasoline (10.5 per cent), coal (8.3 per cent), liquefied natural gases (2.9 per cent) and firewood (2.9 per cent)[57]. The Republic of Moldova has the potential to employ a greater share of renewable sources, including biomass, solar, wind, hydro and geothermal, and these are governed by the National Programme for developing renewable energy sources (2003-2010).[58]

Possible impact of climate change on the energy sector

As the climate of the world warms, the consumption of energy in climate-sensitive sectors is likely to change. Possible effects of warming, that could be relevant in Moldova, include (1) decreases in the amount of energy consumed in residential, commercial, and industrial buildings for space heating and increases for space cooling; (2) decreases in energy used directly in certain processes such as residential, commercial, and industrial water heating, and increases in energy used for residential and commercial refrigeration and industrial process cooling (e.g., in thermal power plants); (3) increases in demand for energy used to supply other resources for climate-sensitive processes, such as pumping water for irrigated agriculture and municipal uses; (4) changes in the balance of energy use among delivery forms and fuel types, as between electricity used for air conditioning and natural gas used for heating; and (5) changes in energy consumption in key climate-sensitive sectors of the economy, such as transportation, construction, agriculture, and others.[59]

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[55] www.anre.md. Report on the Activity of the National Agency on Energy Regulations for 2009 year.
[56] UNDP, 2009/2010
[57] NBS (2009), Energy Balances of the Republic of Moldova, Statistical Collection, 2008.
[58] UNDP, 2009/2010
[59] Synthesis and Assessment Product 4.5. Report by U.S. Climate Change Science Program and the Subcommittee on Global Change Research: Effects of Climate Change on Energy Production and Use in United States. Authors: Thomas J. Wilbanks, Vatsal Bhatt, Daniel E. Bilello et.al. February, 2008. - 85p.

Changes in supply could also occur – extreme events extreme temperatures can cause damage to energy supply infrastructure, and development of renewable energy sources is very dependent on water, wind and biomass potential, all of which are expected to change under climate change.

The main direct climate change impacts and their potential social economic consequences in Republic of Moldova that are relevant to the energy sector are presented in Table 2-12.

Table 2-12: Summary of Socio-Economic Impact of Climate Change on the Energy Sector in the Republic of Moldova

Climate Impact Category	Impact on Energy	Social/Economic Impact
High Temperatures and Heat Waves	Greater demand for electricity for air conditioning. High temperatures reduce thermal generation efficiency Solar cell efficiency reduced by high temperatures Increased water needs for thermal power plants	Access to air conditioning only available to higher income households. Increased demand and peak demand, taxing transmission and distribution systems Reduced energy generated
Extreme events	Increased damage to supply grids. Alteration in wind speed frequency distribution	Threat to electricity transmission and distribution*. Increased uncertainty on energy output
Droughts	Reduced hydro-power production	Hydropower generation can be seriously affected by drought, 10-30% less electricity generation is expected.
	Decrease of biomass yield	Threat to energy production from biomass reduction. Potential competition between energy and non-energy crops for land and water resources
Low Temperatures and Freezing	Damage to electricity transportation lines	Loss of power; and Cost of repairing lines.
Decreased cloud cover	Increased potential for photovoltaic (PV) production of electricity	Diversification of energy supply; and Reduced pollution.
Rise in wind speed	Increased wind power generation	Diversification of energy supply; and Reduced pollution.

*Almost 300 localities suffered power supply disruptions in January 2009 because of strong winds and related events[60].

Assessing the magnitude of risk/opportunities of climate change on energy sector

Although Moldova mostly covers its energy needs through imports, the National Energy Strategy 2020 envisages strengthening local production capacities by modernising and enhancing the existing Combined Heat and Power Plants (CHPs: 1, 2 and North) as well as constructing new mini-CHPs. Another focus of effort will be boosting production from renewable sources, such as biomass, solar and wind energy. However, climate and water availability projections show that some of these plans may be put at risk under climate scenarios. Currently 65 to 70 percent of total water is used in industrial heating and cooling and hydro-energy production. However, as has been shown, water quantity in Moldova is quite sensitive to climate change effects. Thus, water scarcity will start adversely affecting national development goals by 2020 if only surface water is taken into account. If ground water is added then water scarcity will become a development obstacle by 2030. Furthermore, one of the climate change effects on water supply will be growing instability in annual water flows: growing short-term oversupply due to spring and flash floods and

[60] NHDR 2009/2010

scarcity due to longer and more severe droughts. Hence, growing water scarcity may become the main obstacle to enhancing local hydro- and cogeneration power production. Furthermore, the climate projections show that the anticipated worsening of humidity conditions and growing aridisation may result in a deterioration of the ecological-climatic conditions for plant growing towards the end of the century. In the longer run it represents a serious threat to energy production from biomass.

According to the NHDR, the anticipated rise in the number of days with temperature over 10°C will mean that building heating will be required for a smaller number of days (in Chisinau centralized heating season starts when daily temperature is below 8°C). At the same time, summers and autumns are expected to become hotter and drier. Therefore, demand for the electricity required to ensure air cooling in the buildings is likely to surge. Even without taking climate change effects into consideration, electricity consumption is expected to grow by over 15 per cent over the period from 2006 to 2020. Taking into the equation climate change effects on demand could push demand for electricity still higher.

According to the vulnerability assessment of the magnitude of the impact with the probability of risk due to possible climate change on the energy sector, the most vulnerable regions in the Republic of Moldova will be: Mun. Chisinau, North and partially South for which as a result of expert judgment revealed the greatest amount of risks with high probability related to climate change (see Table 2-13).

Table 2-13. PriorityRisks and Opportunities for the Energy Sector

Detail of magnitude risk/opportunity		North	Centre	South	Mun. Chisinau
Risk	Increase in damage to supply grids which present a threat to electricity transmission and distribution	HIGH	HIGH	HIGH	HIGH
	Increase in energy used for residential and commercial refrigeration and industrial process cooling	HIGH	MEDIUM	MEDIUM	HIGH
	Changes in the balance of energy use among fuel types	HIGH	MEDIUM	MEDIUM	HIGH
	Growing water scarcity may become the main obstacle to enhancing hydro- and cogeneration power production	HIGH	HIGH	HIGH	HIGH
	Decrease of biomass yield	MEDIUM	MEDIUM	HIGH	
Opportunity	Decrease in energy used in residential, commercial, and industrial water heating	MEDIUM	HIGH	HIGH	HIGH
	Wind speed and direction (wind generate potential and efficiency)	MEDIUM	MEDIUM	HIGH	MEDIUM
	Cloudiness (Solar generation potential)	MEDIUM	MEDIUM	HIGH	HIGH

For the energy sector in the Republic of Moldova, five of the identified risks in the Table below are considered to be high priority:

- Increase in energy used for residential and commercial refrigeration and industrial process cooling;
- Increase in damage to supply grids which present a threat to electricity transmission and distribution;
- Changes in the balance of energy use among fuel types;
- Growing water scarcity may become the main obstacle to enhancing hydro- and cogeneration power production; and
- Decrease of biomass yield.

In this case, three opportunities associated with climate impacts on the energy sector exist: decrease in energy used in residential, commercial, and industrial water heating in Mun. Chisinau, Centre and South;

wind speed and direction may increase wind generation potential and efficiency with high probability in South and to a lesser degree in Centre and North; and cloudiness which may increase solar generation potential in South and Mun. Chisinau.

The outcome of the vulnerability assessment for the energy sector is shown in Table 2-12.

In summary, examples of adaptation measures to reduce losses/risks in energy sector to climate change could be as follows:

- **SUPPLY**:
  - (i) ***Mined resources*** (inc. oil and gas, thermal power)could include replace water cooling systems with air cooling, dry cooling, or recirculating systems; improve design of gas turbines (inlet guide vanes, inlet air fogging, inlet air filters, compressor blade washing techniques, etc.); (re)locate in areas with lower risk of flooding/drought; build dikes to contain flooding, reinforce walls and roofs; adapt regulations so that a higher discharge temperature is allowed; consider water re-use ad integration technologies at refineries.
  - (ii) ***Hydropower*** could include: build de-silting gates Increase dam height; construct small dams in the upper basins; adapt capacity to flow regime (if increased);adapt plant operations to changes in river flow patterns; operational complementarities with other sources (e.g. natural gas);
  - (iii) ***Wind***:(re)locate based on expected changes in wind-speeds.
  - (iv) ***Solar:*** (re)locate based on expected changes in cloud cover; and
  - (v) ***Biomass***: introduce new crops with higher heat and water stress tolerance; substitute fuel sources; early warning systems (temperature and rainfall);support for emergency harvesting of biomass; adjust crop management and rotation schemes; adjust planting and harvesting dates; introduce soil moisture conservation practices.
- **DEMAND**: invest in high-efficiency infrastructures and equipment; invest in decentralized power generation such as rooftop PV generators; efficient use of energy through good operating practice.
- **TRANSMISSION AND DISTRIBUTION:** improve robustness of pipelines and other transmission and distribution infrastructure; burying or cable re-rating of the power grid; emergency planning; and regular inspection of vulnerable infrastructure such as wooden utility poles[61].

2.2.6. Climate Change Impacts on the Transport Sector

Transport infrastructure is critical for human development, as it provides a lifeline for delivering key services, and access to markets. The transport sector plays a significant role in the national economy of the Republic of Moldova, its current contribution to the Gross Domestic Product being circa 12.2 percent, and is permanently increasing (from 4.8 percent in 1990, to 12.2 percent in 2008). The transport sector provides jobs to 71 thousand persons, or to 5.7 percent of the employed population of the country.[62]

The Republic of Moldova's transport sector is comprised of the following segments: road transportation, railway transport, air transportation and naval transportation. Because Moldova is geographically small, and landlocked, roads are a key form of infrastructure. Presently 95 per cent of passengers and 30 per cent of freight is transported by road.[63]

[61] WB, "Climate Impacts on Energy Systems: Key Issues for Energy Sector" Authors: Jane Edinger, Walter Vergara, Irene Leino. January 28, 2011. 225p.
[62] NBS, 2009.
[63] UNDP, 2009/2010

However, a number of indicators reveal a very low development standard and poor quality of the roads. Only 5.800 km of a total of 10.500 km of roads have any capital pavement, (either concrete or asphalt). The rest have a so-called "light pavement" and represent mainly the local roads[64]. As shown in a World Bank report, due to the inadequate condition of the road network, about 40 settlements have no year-round access to the national road network and, during the rainy and winter seasons, are virtually isolated from the rest of the country[65].

Long-lasting heat waves can worsen or even destroy the asphalt pavement of the national roads. This phenomenon has already been witnessed both in 2003 and 2007, when longer periods of high temperatures were registered. The most serious damage was to the Chisinau-Balti highway. Even on the newly rebuilt Chisinau – Leuseni national highway, long portions of the road were deformed. The roads from Rabnita and Rezina were almost completely destroyed by trucks carrying cement from the local factories.

Heavy summer rains almost stopped vehicular circulation in downtown Chisinau in 2005, 2008, and 2009 causing additional damage to the pavement of city streets, pavement that is already in a poor condition. The rainfall water collection system is outdated and unable to accommodate heavy rain episodes[66].

Possible impact of climate change on the transport sector in Moldova

The transport sector comprises roads, rail, ports and air, with very different types and ages of infrastructure. The transport sector is vulnerable to the predicted increase in frequency and intensity of storms (wind, rain, snow), which could result in raised costs related to the construction, maintenance, and operations of transportation infrastructure and vehicles. Furthermore, maintenance costs will increase for some types of infrastructure because they deteriorate more quickly at temperatures above 32°C.Construction costs could increase because of restrictions on days above 32°C, since work crews may be unable to be deployed during extreme heat events and concrete strength is affected by the temperature at which it sets. Increases in daily high temperatures would affect aircraft performance and runway length because runways need to be longer when daily temperatures are higher (all other things being equal)[67].

Table 2-14 outlines the main direct climate change impacts and their potential socio-economic consequences in Moldova that are relevant to the transport sector.

Table 2-14: Summary of Socio-Economic Impact of Climate Change on the Transport Sector

Climate Impact Category	Impact on Transport	Social/Economic Impact
High temperatures and heat waves	Changes to pavement integrity, e.g. softening, traffic-related rutting, migration of liquid asphalt; Deformation of railroad lines; and Vehicle overheating.	Accelerated deterioration of transport infrastructure; Restricted transportation of heavy loads, speed limits; Raised fuel consumption; Limitations on periods of construction activity; and Increased costs of both capital investment and operation and maintenance costs in land transportation systems.

[64]Expert-Group, "State of the Country Report", 2008.
[65]World Bank, "Moldova: Transport Strategy Update with Emphasis on the Road Sector", December 2002.
[66]UNDP, 2009/2010
[67]National Research Council (U.S.). Committee on Climate Change and U.S. Transportation.
Potential impacts of climate change on U.S. transportation / Committee on Climate Change and U.S. Transportation, Transportation Research Board and Division on Earth and Life Studies, National Research Council of the National Academies, 2008.

Climate Impact Category	Impact on Transport	Social/Economic Impact
Increase in intense precipitation events	Increase in weather-related delays; Increase in traffic disruptions; Disruption of construction activities; and Disruption of safety and maintenance operations.	Damage transport infrastructure and restrict movement Decreased revenue from transport activities; Disruption to supply of goods; and Increased expenditures on transport maintenance and operation.
Decrease in precipitation	Reduced humidity of the roadbed, especially in spring and autumn; and Restricted development of river transportation.	Reduced risk of landslides and soil erosion; Circulation of vessels impaired; Increased operational costs; and Need for additional engineering works for adaptation.
Less precipitation and higher temperatures in the winter	Effect on local roads that are not covered with an asphalt surface and have shallow roadbeds.	Lower costs for snow and ice control measures on some roads; and Rural communities become separated from the rest of th during the winter season or in rainy periods.

Assessing the magnitude of risk/opportunities of climate change on the transport sector

Projected climate changes are likely to have a particularly significant impact on transportation infrastructure because the Republic of Moldova's transportation system was specified to typical weather conditions, and expected changes in climate extremes could push environmental conditions outside the range for which the system was designed. All modes of transportation are vulnerable to climate change. The impacts will vary depending on the location, mode, and condition of the transportation infrastructure. For example, Southern areas will be subject to a high magnitude of risks such as highway asphalt rutting, health and safety risks from heat stress to highway maintenance personnel and passengers, as well as overheating of diesel engines, whereas the Northern area may experience lower magnitude of risks (Table 2-15).

Table 2-15. PriorityRisks and Opportunities for Transport Sector

Detail of magnitude risk/opportunity		North	Centre	South	Mun. Chisinau
Risk	Highway asphalt rutting	High	High	HIGH	High
	Health and safety risks from heat stress to highway, maintenance personnel and passengers	LOW	MEDIUM	HIGH	MEDIUM
	Low water levels on inland waterways	LOW	MEDIUM	MEDIUM	
	More airport runway length and fuel needed because of less dense air	MEDIUM			MEDIUM
	Rail buckling due to derailment and malfunction of track sensors and signal sensors, increased travel time due to speed restrictions	LOW	MEDIUM	MEDIUM	MEDIUM
	Thermal expansion of bridges, traffic disruptions	LOW	LOW	LOW	LOW
	Overheating of diesel engines	MEDIUM	HIGH	HIGH	HIGH
	Infrastructure deterioration, travel and schedule delays, loss of life and property, increased safety risks	MEDIUM	MEDIUM	MEDIUM	MEDIUM
	Flooding of roads, rails, airport runways, pipeline systems, bikeways and walkways (frequency and magnitude will increase)	MEDIUM	MEDIUM	MEDIUM	MEDIUM
	Loss of visibility from drifting snow, loss of manoeuvrability, lane obstruction, treatment chemical dispersion	MEDIUM	MEDIUM	MEDIUM	MEDIUM
Oppor-tunity	Due to higher temperatures the costs of de-icing planes and removing of snow and ice from the runways may fall substantially	MEDIUM	HIGH	HIGH	HIGH

In summary, examples of adaptation measures to reduce losses/risks in transportation sector[68]to climate change could be follows:

In the case of increased temperatures and heat waves:

- Development of new, heat-resistant paving materials;
- Greater use of heat-tolerant street and highway landscaping;
- Proper design/construction, milling out ruts;
- Overlay with more rut-resistant asphalt;
- Increased on-going maintenance;
- Shifting construction schedules to cooler parts of day;
- Designing for higher maximum temperatures in replacement or new construction; and
- Adaptation of cooling systems.

In the case of increases in intense precipitation events:

- Improve flood protection;
- Conduct risk assessments for all new roads;
- Upgrading of road drainage systems;
- Pavement grooving and sloping;
- Improved asphalt/concrete mixtures;
- Greater use of sensors for monitoring water flows;
- Increases in the standard for drainage capacity for new transportation infrastructure and major rehabilitation projects; and
- Engineering solutions, increase warnings and updates to dispatch centers, crews and station.

2.3 Climate Change, Adaptation and Sustainable Development

2.3.1. Description of the key linkages between climate change impacts, adaptation and sustainable development

"Sustainable development" requires an approach to development that meets the needs of the present generation without compromising the ability of future generations to also meet their needs. Achieving sustainable development in a changing climate is a challenge – it not only requires the transition to a low-carbon pathway to development, but it also presents new obstacles as changing weather patterns reverse development gains and impact key economic sectors.

Climate change presents significant threats to the achievement of the Millennium Development Goals (MDGs) especially those related to eliminating poverty and hunger and promoting environmental sustainability. Reaching the MDGs can be seen as the road map to sustainable human development, and climate change has the potential to undermine, and even reverse progress, on many of the achievements that have been made to date.

[68]National Research Council (U.S.). Committee on Climate Change and U.S. Transportation.
Potential impacts of climate change on U.S. transportation / Committee on Climate Change and U.S. Transportation, Transportation Research Board and Division on Earth and Life Studies, National Research Council of the National Academies, 2008.

One of the most obvious examples is the reversal in development gains that can occur as a result of extreme events, such as floods. The floods in Moldova in the summer of 2010 are estimated to have caused damages and losses totalling MDL 537 million, or USD 42 million. This figure represents damages to assets and property, as well as indirect losses such as production declines and reduced incomes. Within this, the infrastructure sector sustained 66% of the total damages, and the productive sector 25% of the total damages, and it is believed that the repercussions will be felt well beyond 2010.[69]

Table 2-16highlights the Republic of Moldova's targets to achieve the MDGs, and describes the ways in which climate change could hinder progress towards these targets. It shows that all of the MDGs could become less attainable in the context of climate change - not only hampering progress towards those that have not been achieved, but also pulling back progress on those that have already been achieved. For example, depletion of natural resources, decreased availability of potable water, reduced agricultural productivity and increased climate-related disasters could result in destruction of infrastructure for health and education, undermine the livelihood assets of poor people, place additional burden's on women's health and workloads undermining their ability to achieve equality, and increase child mortality and maternal health issues.

[69]Government of the Republic of Moldova, "Post Disaster Needs Assessment, Floods 2010". Supported by the European Union, the United Nations, and the World Bank.

Table 2-16: Possible Implications of Climate Change on Achievement of the MDGs in Moldova

Goal	Target	Trend	Possible Climate Change Implications
Goal 1: Eradicate extreme poverty and hunger	• Reduce the proportion of people whose consumption is under $4.3 a day/person (in PPP terms) from 34.5% in 2006 down to 29% in 2010 and 23% in 2015. • Reduce the proportion of people under the absolute poverty line from 30.2% in 2006 down to 25% in 2010 and 20% in 2015. • Reduce the proportion of people under the extreme poverty line from 4.5% in 2006 down to 4% in 2010 and 3.5% in 2015.	• In 2006, about 1 million people in Moldova (30.2 %) were living in absolute poverty and about 150,000 (4.5 %) people were living in extreme poverty. • In 2007, the impoverished segment of the population declined by about 16,000. • However, the 2005 scenario was repeated in 2008 – poverty rates increased as a result of poor agricultural returns in 2007 (results in agriculture have a delayed impact on poverty rates). • It is worthwhile noting that in 2009, despite severe economic decline, absolute poverty did not grow, while the incidence of extreme poverty declined even further. • As for extreme poverty, in 2007-2009 Moldova had already achieved both the intermediary target for 2010 and the final one for 2015.	• Changes in natural systems and infrastructure will: (i) Reduce the livelihood assets of poor people; (ii) Alter the path and rate of national economic growth; and (iii) Undermine food security. • Economic insecurity given increase in weather extremes. • Loss of biodiversity and less access to natural resources will impact the poorest who rely on these resources for fuel wood, livelihoods.
Goal 2: Ensure access to education	• Ensure opportunities for all children to attend general secondary education. Increase the gross enrollment rate for general secondary education from 94.1% in 2002 up to 95% in 2010 and 98% in 2015. • Maintain the literacy rate for the 15-24 year-old population at the level of 99.5%. • Increase the enrollment rate for pre-school programs for 3-6 year-old children from 41.3% in 2002 up to 75% in 2010 and 78% in 2015, and for 6-7 year-old children from 66.5% in 2002 up to 95% in 2010 and 98% in 2015, as well as reduce by less than 5% the discrepancies between rural and urban areas, between disadvantaged and middle-income groups.	• Despite efforts by authorities to bring children into the educational system, the coverage of the general compulsory education has constantly decreased (from 95.1 percent in 2002 to 90.7 in 2009). • With the current level of literacy of 99.6 percent for young people, achieving the second target of maintaining a high rate of youth literacy is realistic for both 2010 and 2015, but in the long-term there are many risks that arise from the drop in enrollment in compulsory education. • The number of children with pre-school education is continuously increasing (from 44.1 percent in 2000 to 75.5 percent in 2009). • Data show that children in rural areas, children with disabilities and Roma children have a much lower enrollment rate in preschool education. • Achieving the intermediary target of increasing pre-school enrollment is possible, but the perspective is less certain for the final target.	• Climate change could lead to a reduction in the ability of children to participate in full-time education by causing: (i) Destruction of infrastructure (such as schools); (ii) Loss of livelihood assets (increasing the need for children to engage in income-earning activities, time devoted to ensure access to food, water); (iii) Displacement and migration of families; (iv) Ill health resulting from climate change resulting in decreased attendance.
Goal 3: Promote Gender Equality and Empower Women	• Increasing women's representation in decision-making: (i) in local councils from 26.5% in 2007 to 40% in 2015; (ii) in district councils from 13.2% in 2007 to 25% in 2015; (iii) women mayors from 18% in 2007 to 25% in 2015; (iv) women MPs in Parliament from 22% in 2005 to 30% in 2015. • Reducing gender inequality in employment. • Reducing inequality between equality in the labor market by reducing wages gap between women and men with at least 10 p.p. from 2006 until 2015 (average salary of women accounted for 68.1% of that of men in 2006).	• In 2005, women held only 20.7% of Parliamentary seats. Although this figure is higher than in 1998 and 2001 (8.7% and 15.8% respectively), this level of representation is not sufficient to ensure an equal number of seats held by men and women. • At the legislative administrative level, the current structure is more favorable for women. The number of women lawmakers rose from 22% in 2005 to 24.7 % in 2009. • Moldovan women are mostly employed in low paid jobs and occupy lower positions in the job hierarchy where they are employed. In 2008 the average monthly salary of women was 73.3% of the average man's salary, which was an increase of 0.7 % points compared to 2007. • Discrepancies between the salaries of women and men have decreased in recent years, with the average female salary standing at 76.4 percent of the average male salary in 2009.	• Depletion of natural resources, decreased availability of potable water, reduced agricultural productivity and increased climate-related disasters could: (i) Place additional burdens on women's health; and increase women's workload; (ii) Limit women's time to participate in decision-making and income-generating activities; (iii) Reduce the livelihood assets of women. • Women have a greater reliance on subsistence and natural resources for income and are therefore disproportionately affected by climate changes.

Goal	Target	Trend	Possible Climate Change Implications
Goal 4: Reduce Child Mortality	• Reduce infant mortality from 18.5 (per 1,000 live births) in 2006 down to 16.3 in 2010 and 13.2 in 2015. • Reduce the under-5 mortality rate from 20.7 (per 1,000 live births) in 2006 down to 18.6 in 2010 and 15.3 in 2015. Maintain the proportion of under-2 children vaccinated against measles at least at 96% by 2010 and 2015.	• In 2009, the situation for infant mortality (12.1 cases per 1,000 live births), as well as the under-five mortality rate (14.3 cases per 1,000 live births) was significantly better than in 2000 (18.3 and, accordingly, 23.2 case per 1,000 live births). • The targets for 2010 and 2015 for both indicators have been already achieved and it is important to maintain progress. • Even though in 2007 the immunization rate reached 96.9 percent, the proportion of children under the age of two years who were vaccinated against measles declined in 2008 (94.4 percent).	• Climate change induced events are expected to erode health and contribute to Increased child mortality, reduced maternal health and the undermining of the nutritional health needed by individuals to combat HIV: (i) Extreme weather events; (ii) Increase in prevalence of certain vector- and water-borne diseases; (iii) Heat-related mortality; (iv) Declining food security; (v) Decreased availability of potable water. • Health impacts will particularly affect children and mothers as they are particularly vulnerable to disaster related, water quality and hunger related diseases. • Health impacts on people already living with diseases as they have an increased vulnerability to climate change. • Increases in heat related mortality and illness associated with weather extremes (heat waves especially).
Goal 5: Improve Maternal Health	• Reduce the maternal mortality rate from 16 (per 1,000 live births) in 2006 down to 15.5 in 2010 and 13.3 in 2015. • Maintain the number of births assisted by qualified medical staff during 2010 and 2015 at 99%.	• In 2008, for the first time in the five years, maternal mortality increased from 15.8 to 38.4 cases per 100.000 births, but in 2009 it declined again (17.2 cases per 100,000 births). • Despite the decline in maternal mortality in 2009, compared to the high level of mortality in 2008, it is not certain that the target for 2010 will be achieved. • Accomplishing the 2015 target largely depends on ensuring constant financing for this area of health-care, in order to strengthen the measures for early identification of at-risk cases. • Regarding the second target of maintaining the high number of births assisted by qualified medical staff, Moldova has made good progress. In 2007-2008 the proportion of births attended by skilled health personnel was 99.5 percent, while in 2009 it grew to 99.8 percent. • The fact that this percentage has been maintained at such a high level with a growing trend shows that the targets for 2010 and 2015 will be successfully met if the necessary financial resources are regularly allocated for the healthcare of mothers and children.	

Goal	Target	Trend	Possible Climate Change Implications
Goal 6: Combat HIV/AIDS, Malaria and other Diseases	• Stabilize the spread of HIV/AIDS infection by 2015. Reduce HIV/AIDS incidence to 9.6 cases per 100 thousand population by 2010 and 8 cases by 2015. • Reduce HIV/AIDS incidence to 11.2 cases per 100 thousand population by 2010 and 11 cases by 2015 in the 15-24-year age group. • Have halted by 2015 and begun to reduce tuberculosis. Reduce the rate of mortality associated with tuberculosis from 15.9 (per 100,000 population) in 2002 down to 15.0 in 2010 and 10.0 in 2015.	• The incidence of HIV/AIDS rose from 4 cases per 100,000 population in 2000 to 19.4 cases per 100,000 population in 2008, and slightly declined to 17.2 cases per 100,000 members of the population in 2009. • A particularly alarming situation can be found in Transnistria, the region in eastern Moldova. While slightly improved in 2009, the situation remains complicated, with an incidence indicator of 42.25 cases per 100,000 inhabitants, as compared to 12.42 cases per 100,000 inhabitants on the right-bank Moldova. • The growth in the epidemic in 2009 does not make it possible to conclude that the intermediate target for 2010 is attainable. Considering the uneven nature of this indicator, the incidence of HIV/AIDS among the population aged 15 to 24 could increase again in the mid- to long-term. • The situation is not much better as regards the third target of reducing the tuberculosis-associated mortality. Death rates associated with tuberculosis fell in 2008 for the first time in three years (going from 20.2 cases per 100,000 people in 2007 to 17.4 cases per 100,000 people in 2008), but the that seems to be more a short-lived episode and in 2009 the tuberculosis-associated mortality grew again, even though not significantly (18 cases per 100,000 members of the population).	
Goal 7: Ensure Environmental Sustainability	• Integrate the principles of sustainable development into country policies and programs and reduce degradation of natural resources. Increase afforestation from 10.3 % in 2002 up to 12.1% in 2010 and 13.2% in 2015. • Increase the share of protected areas to preserve biological diversity from 1.96% in 2002 up to 4.65% in 2010 and 4.65% in 2015. • Increase the share of people with permanent access to safe water sources from 38.5% in 2002 up to 59% in 2010 and 65% in 2015. • Halve the number of people without access to improved sewage and sanitation systems. Increase the share of people with permanent access to safe water sources from 31.3% in 2002 up to 50.3% in 2010 and 65% in 2015. • Increase the number of population with access to sanitation systems from 41.7% in 2002 up to 51.3% in 2010 and 71.8% in 2015.	• Currently, forests cover 11% of the Moldova's territory. • From 2005 to 2007 the percentage of forested land was constant, standing at 10.7%, while in 2008 that figure increased slightly, to 10.9% of the total area of the country. • In 2008 the share of the population with constant access to improved water sources was 53%, including 92.2% of the urban population and 26.7% of the rural population. In 2009 the amount of people who had access to water sources improved further, reaching 55 % of the population. • If the pace of developing and ensuring access to safe water is maintained to repeat the success of 2008-2009, the intermediate target for 2010 could be attained. • The share of the population that had access to improved access to sanitation in 2008 was 45.9%, an unsubstantial rise from 45.4 % year. • The slow advancement of this indicator suggests that the intermediate target for 2010 will not be achieved.	• Climate change will have a direct impact on environmental sustainability because it: (i) Causes fundamental alterations in ecosystem relationships; (ii) Changes the quality and quantity of natural resources; (iii) Reduces ecosystem productivity and services. • Increased water shortages as a result of changes in rainfall patterns, greater periods of drought biological diversity and ecosystems loss, and environmental degradation due to variations in temperature and precipitations.

Goal	Target	Trend	Possible Climate Change Implications
Goal 8: Develop a Global Partnership for Development	• Further develop a transparent, predictable and non-discriminatory trade and financial system based on rules by promoting exports and attracting investments. • Deal with issues associated with Moldova's landlocked status by upgrading transportation and customs infrastructure. • Monitor external debt issue. • ·Develop and implement youth strategies. Reduce youth unemployment to 15 percent in 2010 and 10 percent in 2015. • Ensure access to basic medication. • Build an information society. Double the number of fixed and mobile telephone subscribers from 2006 to 2015 and increase the number of personal computers and Internet subscribers by at least 15 % each year.	• At the end of 2009 the total number of fixed telephone subscribers was 1.13 million, or 32 percent of the population. • The number of internet subscribers is rising continuously. Thus, the share of Internet subscribers rose from 1.2 users per 100 population in 2000 to 37 users per 100 population in 2009. • The number of personal computers is also rising. While in 2000 there were 1.3 personal computers per 100 population, by 2009 this share had increased to 20.5 personal computers. • In 2009, 33 percent of households possessed personal computers. The number of internet users is growing in parallel with the number of personal computers, and while the growth rates differ slightly, both indicators rose in 2009 by nearly 1.5 times from 2007. If these growth rates are maintained, the target of an annual growth rate of 15 percent in the number of personal computers and internet users will be accomplished.	• Climate change could lead to conflicts over diminishing natural resources, directly undermining the prospects of global cooperation and partnership. • Climate change could also affect international trade and the global financial system through: (i) Increased frequency and severity of severe weather events; (ii) Loss of agricultural productivity in some regions; (iii) Loss of natural resources. • Climate change limits the capacity of Moldova to produce and trade primary agricultural products in the world market. • Furthermore, increased mitigation and adaptation costs will expand the debt burden of Moldova. • Dealing with costs of weather related disasters that could affect the Gross Domestic Product, the level of indebtedness, state of public finances, and investments.

Source: *adapted from draft National Report "Millennium Development Goals Report: New Challenges – New Objectives", NHDR 2009/2010*
http://www.undp.md/mdg/MDG1/poverty.shtml, http://www.endpoverty2015.org

2.3.2. Review of key development priorities and policies for their climate resilience

Despite the fact that climate change is a recognized fact of global importance, the national strategic framework in the Republic of Moldova lacks integrated measures for mitigating climate change or adapting to its effects.

An analysis of relevant national policy, including the National Development Strategy, as well as relevant sectoral policies, found that climate change is rarely accounted for, suggesting that activities undertaken as part of these policies may be at risk from climate change. The National Development Strategy is the most robust, making explicit mention of climate change impacts on its targets, and the National Strategy for Sustainable Development of Agriculture also seems to demonstrate linkages between its goals and climate change.

The review undertaken for this strategy echoes the findings of the 2009/2010 NHDR. The NHDR included an analysis of current strategies and the legal framework, and concluded that Moldova urgently needs to put forward adaptation measures that would reduce the potential negative impact of climate change on further development. It also found that some of the impacts of climate change are mentioned sporadically and in differing contexts, but the connection between them and climate change as well as the complex repercussions are mostly omitted. It further concluded that climate change is an issue that needs to be incorporated into different policy areas – whether energy, transport, agriculture or forestry, etc. Therefore, a timely elaboration of national adaptation strategies and the integration of climate change aspects into development cooperation as well as into the relevant national sectoral policies are of high importance[70].

The following table reviews key government policies and strategies for areas of climate resilience. Each policy reviewed is then given a ranking as follows: 1) green=demonstrates some progress towards climate resilience; 2) yellow= requires amendment; and 3) red =more information required.

[70] 2009/2010 NDHR

Table 2-17: Analysis of Climate Resilience of Key Government Policies and Strategies

Key Objectives	Commentary on Climate Resilience of Policy
General	
The National Development Strategy (NDS) for 2008-2011	
• Ensuring a better quality of life by strengthening the foundation for robust, sustainable and inclusive economic growth. • Aspires to Moldova's alignment with European standards and, consequently, to the accomplishment of the European integration goal.	*Evidence of climate resilience:* In the SWOT analysis of the actual situation in the Republic of Moldova, the strategy mentions that while the effects of climate change will intensify, the frequency and severity of natural disasters, like drought, hail, as well as soil erosion will increase. It also states that the worsening of the environmental situation in the Republic of Moldova has a negative impact on human health, as well as on rural development and agricultural production. The MDGs (including MDG 7: Ensure Environmental Sustainability) are emphasized. *Evidence of climate risk:* However, it is also worth noting that, out of the Strategy's five main general objectives, only the last one – regional development – implies working with the environment but it does not respond to any of the issues on which climate change is based and its expected impacts[71].
Agriculture	
National Strategy for Sustainable Development of the Agricultural Complex of the Republic of Moldova for 2008-2015 (Government Decision No. 282 of 11.03.2008. Official Monitor No. 57-60, 21.03.2008)	
Ensuring sustainable growth of the agriculture sector and food processing industry, and a consequent improvement in the quality of life in rural areas by increasing the productivity and competitiveness of the sector.	*Evidence of climate resilience:* One of the reasons to elaborate this Strategy was the excessive vulnerability of the agricultural sector to climate change. The Strategy recognises that climate change can affect food security by erosion, droughts and floods, resulting in dramatic reduction or collapse of agricultural production because of natural disasters. Furthermore, the Strategy includes a range of adaptation measures integrated in Chapter 4 'diminishing agriculture vulnerability related to risk factors and environment protection', including measures to combat erosion and drought, diminishing flood risks, and options for risk transfer.
Health	
National Health Policy of the Republic of Moldova (Government Decision No. 886 of 06.08.2007)	
Creation of optimal prerequisites for the maximum realization of the health potential of every individual throughout their entire life and attainment of adequate life quality standards of the population.	*Evidence of climate resilience:* There are no policy recommendations specifically directed to climate variability and change. *Recommendations:* It should explore with the WHO ways of ensuring adequate surveillance and control of the impact of climate change on health, such as epidemiological surveillance, the control of communicable diseases and the effect of extreme events.[72]
Health System Development Strategy for 2008-2017 (Government Decision No. 1471 of 24.12.2007)	

[71] 2009/2010 NDHR

[72] WHITE PAPER on Adapting to climate change: Towards a European Framework for action. COM (2009)147 of 1.4. 2009.16p.

Key Objectives	Commentary on Climate Resilience of Policy
• Strengthening health system performance and continued improvement of health, financial risk protection of citizens of accession to health services. • Reducing inequalities in the use and distribution of health services and satisfaction of recipients.	See above
Water	
The National Development Strategy (NDS) for 2008-2011	
Increase the share of people with permanent access to safe water sources from 38.5% in 2002 up to 59% in 2010 and 65% in 2015 (Target 10). Halve the number of people without access to improved sewage and sanitation systems. Increase the share of people with permanent access to safe water sources from 31.3% in 2002 up to 50.3% in 2010 and 65% in 2015. Increase the number of population with access to sanitation systems from 41.7% in 2002 up to 51.3% in 2010 and 71.8% in 2015 (Target11).	*Evidence of climate resilience:* There are no policy recommendations specifically directed to climate variability and change. *Recommendations:* • Many policy tools such as land planning, environmental protection and monitoring, and health management are based on stable "old" climate and environmental scenarios which do not take into account variability and change. Sustainable policies at the local, national and transboundary levels should therefore include adaptation to new current and long-term scenarios. • International rivers pose particular management challenges because of potentially competing national interests. Adaptation therefore requires a cross-boundary approach, based on river basins and bio-geographic regions. Effective and sustainable achievement of most of the adaptation measures requires inter-State coordination and cooperation at the level of transboundary river basins.[73]
The Stabilization and Recovery Program of the Moldovan Economy for 2009-2011 was approved on 01 December 2009	
Mobilizing external funds for road maintenance and rehabilitation as well as water and wastewater infrastructure and gas networks.	See above
Program of Water Supply and Sewerage in Communities of the Republic of Moldova until 2015 (Government Decision No. 1406 of December 30, 2005, Decree No. 662 of June 13, 2007)	
• Envisaged the necessity of urgent rehabilitation, technical renewal, and development of municipal water supply and sewerage systems towards meeting the targets of the Millennium Development Goals by 2015. • Implementation of plans for ensuring safety of	See above

[73]UNECE, WHO Regional Office for Europe. Draft Guidance on Water and Climate Adaptation. This document has been prepared for Workshop on Water and Adaptation to Climate Change; Amsterdam, 1-2 July, 2008. 45p.

Key Objectives	Commentary on Climate Resilience of Policy
drinking water and compliance of drinking water quality with requirements, imposed by the EU Directive 98/83. • Reduction by 50% of water-related diseases. • Urban waste water treatment in compliance with provisions of EU Directive 91/271/EEC. • Environment protection for sustainable development.	
Forest	
Sustainable Development Strategy for the Forestry Sector (2001)	
The eco-protective function of forests is manifested more strongly only if the degree of the country afforestation exceeds 15% of a country's territory. For this reason, the forested area of the Republic of Moldova should be extended by around 150 000 hectares. According to the Sustainable Development Strategy for the Forestry Sector, for the period 2003-2020 it is planned to plant new forests on 73 000 ha.	*Evidence of climate resilience:* The direct contribution of the forestry sector to the sustainable development of the Republic of Moldova will be achieved through two basic strategic directions: restoration and bio-eco-protective potential of forests and areas with forest expansion. Specific objectives to achieve these strategic directions clearly account for climate risk: (i) mitigation of the destructive effect of temperature changes, droughts and other negative climatic factors; (ii) reducing soil degradation by erosion, which is affecting over 80% of agricultural lands, impacting the loss of 40-60% of soil fertility; (iii) reducing and stopping the landslide; (iv) improving the quality of aquatic resources; (v) reducing the greenhouse gases emissions through carbon removals; (vi) conservation of biological diversity, as forest vegetation provides refuge and habitat for various species of wild plants and animals that are endangered as a result of anthropogenic impact; (vii) increasing resource potential and the volume of wood products accessories.
The State Program for Regeneration and Afforestration of the Lands of the Forestry Fund for 2003-2020 periods	
Containing specific measures focused on natural regeneration of forests, assisting the natural regeneration of forests, as well as planting new forests. Within the 2003-2020 periods there were planned forest regeneration works on a total area of 95 100 ha	See above
The Program on Use of New Areas and Soil Fertility Enhancement for 2003-2010 (2003)	
Involves the afforestation of the degraded agricultural lands, the reconstruction of the forest protection belts along the roads and railways, the reconstruction of existing and plantation of new forest belts to protect the agricultural lands, ponds and water basins on the total area of 133 100 ha.	See above
Energy	
Energy Strategy of the Republic of Moldova to the year 2020 approved by Government Decision No 958 dated 21.08.2007	

Key Objectives	Commentary on Climate Resilience of Policy
Orientated towards a more efficient, competitive and reliable national energy industry whilst ensuring the country's energy security, the upgrading of energy-related infrastructure, improved energy efficiency and the utilisation of renewable energy sources, and its integration into the European energy market. Foresees an increase of the share of renewable energy sources in the country's energy balance up to 6 per cent in 2010 and 20 per cent in 2020.	*Evidence of climate resilience:* The strategy contains a number of proposals relating to climate change investments. Examples include upgrading of energy-related infrastructure, improved energy efficiency and the utilization of renewable energy sources, promoting energy efficiency in buildings and the uptake of green products. *Recommendations:* Improving the resilience of existing transport infrastructure and energy networks requires a common and coordinated approach for assessing the vulnerability of critical infrastructure to extreme weather events. This provides a basis for strategic choices regarding networks, back-ups and energy security, and for maintaining stable transport networks and services. Adaptation should be considered in the Strategic Policy and Regulatory Framework Review process. Infrastructure projects should take climate-proofing into account based on methodologies to be developed. The implications of making a climate impact assessment a condition for public and private investment will be explored, as will the feasibility of incorporating sustainability criteria — including taking into account climate change — into harmonized standards for construction[74].
Transport	
Road Transport Infrastructure Strategy for 2008-2017, approved through the Government Resolution No. 85 of 01.02.2008	
Focused on 3 priority directions: (i) infrastructure rehabilitation; (ii) institutional framework; and (iii) infrastructure development. The implementation of the Road Transport Infrastructure Strategy for 2008-2017 will have an important positive impact on public health and safety, reducing the number of accidents and air pollution levels as a result of keeping the traffic speed on particular sections of the rehabilitated road more constant.	*Evidence of climate resilience:* No mention of climate related impacts on road improvements. *Recommendations:* Improving the resilience of existing transport infrastructure and energy networks requires a common and coordinated approach for assessing the vulnerability of critical infrastructure to extreme weather events. This provides a basis for strategic choices regarding networks, back-ups and energy security, and for maintaining stable transport networks and services. Adaptation should be considered in the policy and regulatory review processes. Infrastructure projects should take climate-proofing into account based on methodologies to be developed. The implications of making a climate impact assessment a condition for public and private investment should be explored, as will the feasibility of incorporating sustainability criteria — including taking into account climate change — into harmonized standards for construction[75].

[74]WHITE PAPER on Adapting to climate change: Towards a European Framework for action. COM (2009) 147 of 1.4. 2009.16p.

[75]Ibid.

3 Identification of the Problems that Require Intervention of the Government with Implementation of Corresponding Policies

Climate change is going to have a wide range of impacts across all sectors of development in the Republic of Moldova, with particularly profound effects on agriculture and water, both of which are essential to human and economic development. The implication is that the Republic of Moldova may not be able to achieve its goals for economic growth and reach its targets on the MDGs. The cost of inaction could be devastating – natural disasters are already costing Moldova an average loss of $61 million each year. The previous section suggests that, under climate change, these losses are going to intensify.

Responding to the risk posed by climate change will require a coordinated and concerted effort on the part of the Government of Moldova to address those problems that require intervention. Action will be required at all levels:

- At a national level, the Government needs to establish a strong institutional structure and enabling environment to facilitate adaptation to climate change across all sectors and levels of implementation.
- This framework can then provide decision-makers with the appropriate incentives and structures required to incorporate adaptation into sectoral strategies and processes. Each ministry will need to go through a process of identifying the risk that climate change poses to their actions and goals, and the response required to integrate adaptation into existing and planned activities.
- A strong national level framework for adaptation, accompanied by climate-resilient sectoral policies and plans, will help to stimulate and support adaptation at a local level, ensuring that innovation from other actors to respond to climate change does not encounter regulatory or institutional barriers.

This strategy is focused on the first point; the objectives and activities that are put forward in the following sections are intended to build and strengthen the framework at a national level for initiating sectoral action plans and stimulating effective adaptation action in communities.

This strategy aims to address the following problems that require government intervention:

- Mechanisms for gathering and disseminating climate information are weak – there are a number of research needs (see Annex B), and mechanisms for using information to raise awareness and influence decision-making do not exist.
- There is not an institutional structure for addressing and embedding climate risk into policy targets and incentives. The policy review in Section 2 reveals that very few policies explicitly take account of climate risk.
- Coordination mechanisms for climate change across a range of stakeholders and within government need to be strengthened and ensure high level representation from all parties.
- Mechanisms are needed to identify and mobilize national and international financing for adaptation, and ensure that financing flows to the local level to facilitate action on adaptation.
- There is the need for an effective framework for reducing risk and delivering adaptive actions, and mechanisms for encouraging autonomous adaptation by the general population.

4 General and Specific Objectives

The general objective of this strategy is:

> ***To ensure that the Republic of Moldova's social and economic development is resilient to the impacts of climate change, by establishing a strong enabling environment and clear direction for an effective and coherent climate change adaptation process to take place across all relevant sectors.***

This objective is supported by the following three specific objectives:

Objective 1: Improve the management and dissemination of disaster and climate risk information in Moldova.
Rationale: The starting point for promoting climate resilience requires knowledge of climate hazards and impacts, and the physical, social, economic and environmental vulnerabilities to these impacts, in order to take effective and timely action. Decisions have to be made in light of the best information available, to ensure that any action is climate resilient. There are a number of ongoing initiatives in Moldova in this regard that can be built on.

Objective 2: Ensure that climate change adaptation is a national and local priority with a strong institutional basis.
Rationale: A strong policy, legislative and institutional framework for climate risk management is required to support capacity to implement specific sectoral measures in Moldova, based on a sound understanding of the risk (Objective 1). A strong institutional basis will create the platform for capacity development and strengthened inter-sectoral coordination, as well as eliminate barriers to innovation and effective action on adaptation.

Objective 3: Build climate resilience through reducing risk and facilitating adaptation in priority sectors.
Rationale: Climate resilience can be achieved not only by introducing specific adaptation activities, but also through a thorough review of existing and planned activities that can integrate climate risk in order to avoid mal-adaptation and ensure that planned investment is as cost effective as possible.

5 Measures Necessary for Achieving the Strategy's Objectives and Expected Results

The specific measures necessary for achieving the Strategy's objectives contained in the previous section are highlighted below, along with their expected results. Climate change adaptation is a continuous process, and will require that each affected Ministry develop their own climate change adaptation Action Plan for addressing climate risk within their policies and planned activities. The goal of this strategy is for the government to create an effective enabling environment for these activities to take place.

Objective 1: Improve the management and dissemination of disaster and climate risk information in Moldova.

Expected Result: Adequate tools, information and support systems will be in place to ensure that knowledge on climate risk is strengthened on a continual basis, and provides decision-makers with the information that they need to develop effective policies and plans (see Objective 2).

Activity 1.1: Build capacities for gathering, analyzing and disseminating climate risk information, including weather data, climate modelling and impact assessment.

- Establish a joint Government-Science Research body, composed of representatives from the Government of Moldova, Academy of Science, the National Disaster Observatory, the State Hydro-meteorological Service, and others active in climate science and impact assessment, to identify needs and fill gaps.
- Build the capacities of relevant research institutions in Moldova to undertake climate modelling and impact assessment studies, through, for example, the facilitation of study tours and research stays with international centres for climate modelling, grant development, and support to academic organizations to develop new climate scientists.
- Establish the capacities required to undertake regular climate risk assessment, including development of risk maps to identify high risk areas of Moldova for priority action.

Activity 1.2: Establish mechanisms for raising awareness on climate change risk and adaptation measures.

- Use this information to develop a clear government communication strategy on the impacts and possible responses to climate change. This should include the implementation of a public awareness campaign using appropriate media to disseminate information on the likely impacts and importance of climate risk management and adaptation for Moldova, specifically highlighting sectoral impacts.
- Incorporate disaster and climate risk reduction knowledge into school curricula at all levels to reach youth and children with information about climate and disaster risk, and appropriate emergency response and longer term adaptation options.

Activity 1.3: Establish a regional coordination body with Ukraine and Romania to link activities on disaster and climate risk management.

- Investigate existing bodies that coordinate activities across the three countries to identify if any are appropriate for expansion to cover climate change issues such as flooding and water extraction.
- Engage in discussions with relevant counterparts in the Ukraine and Romania to identify appropriate

entry points for coordination, and establish a coordination mechanism and working modalities.

Objective 2: Ensure that climate change adaptation is a national and local priority with a strong institutional basis.

Expected Result: Mechanisms are in place to ensure that government at all levels is able to effectively understand and address climate risk, and use this information to embed adaptation into existing institutional policies and practice.

Activity 2.1: Strengthen inter-sectoral coordination by building the capacity of the Inter-ministerial Working Group for Climate Change (or other appropriate body)to be the implementing body for the strategy.

- Establishing an IWG working protocol, including roles and responsibilities, regular meeting times, and specific mechanisms for coordinating activities across ministries.
- Develop and implement a communication strategy for disseminating information on the implementation of the NAS to relevant ministries, including a feedback mechanism so that the information flow is two-way.

Activity 2.2: Build government capacities to manage and integrate climate change adaptation into policy and practice at both the local and national level.

- Undertake a capacity needs assessment at local and national levels to identify those areas where capacities are strong and those areas where capacity is lacking for managing climate risks (e.g., capacities could include level of climate knowledge, management capacities to respond to climate change, financial capacities to undertake action, and coordination mechanisms).
- Design and implement a capacity building training programme on integrating climate and disaster risk into policy and practice, tailored to the local and national levels, and specific sectoral issues, as appropriate

Activity 2.3: Undertake a climate risk screening of relevant national development policies and plans.

- Produce a list of key national development policies and strategies that may be at risk to climate change.
- Conduct a review of key policies and strategies to identify those areas at risk to climate change, and key entry points for modification/intervention.
- Initiate a process to amend/modify/revise policies as appropriate.

Activity 2.4: Create a mechanism for integrating climate risk into all future policies/plans.

- Create a mandate that all policy revision/creation of new policies are put through a climate screening process.
- Establish a climate screening framework, whereby each key objective/activity proposed under new/amended policies and plans are assessed for the potential impact of climate change on their outcome.
- Initiate a process to amend/modify/revise these activities/objectives as appropriate.

Objective 3: Build climate resilience through reducing risk and facilitating adaptation in priority sectors.

Expected Result: The Government of Moldova is able to deliver key priority adaptive actions, either

through funding, direct provision, or relevant legislation.

Activity 3.1: Conduct a review of current adaptation activities taking place in Moldova, in order to identify the "who, what, where" of existing activities, and identify best practice activities that have the potential for scaling up.

- These activities may be specifically labelled as adaptation projects, or may be development/private sector projects that incorporate climate or disaster risk information.
- This review should include information on the implementing agency (government, donor, or NGO), planned activities, regional/thematic foci, allocated budget, and timeframe, and should be made publicly available via the web or other appropriate mechanism.

Activity 3.2: Develop Climate Change Adaptation Action Plans for each ministry/sector at high risk to climate impacts.

- Identify those ministries that have activities at high risk to climate impacts.
- Develop a mandate for these ministries to identify those activities that are at high risk to climate change, and create action plans for mitigating risk and adapting to climate change.
- Actions should be time bound and measureable, with clear lines of responsibility.
- As part of this action plan, each ministry should develop a list of no/low regrets adaptation options to be prioritized for implementation.

Activity 3.3: Conduct a review and revise relevant legislative documents.

- Review all relevant legislation to identify those areas that do not enable existing or potential adaptation activities (e.g., land use planning).
- Modify legislation as appropriate to ensure it facilitates adaptation at all levels, including autonomous adaptation by individuals, communities and the private sector.

Activity 3.4: Develop a climate risk management/adaptation financing plan.

- Identify sources of funds for financing adaptation, including country funds, as well as donor and international funds.
- Ensure mechanisms are in place for facilitating the flow of financial resources from national level to local level for adaptive action. Funds should be targeted at priority areas (those identified through risk mapping as high risk to climate change in the near term).

6 Expected Implementation Costs, and Stages of Implementation

This section provides an indication of the organization responsible, timeframe, and expected costs associated with the proposed objectives and measures contained in Sections 4 and 5. The strategy is phased into two stages of implementation, as follows:

- **Near term, 2011-2013**: These activities are necessary to lay the foundation for implementation of the strategy, and should be prioritized for immediate implementation.
- **Medium term, 2013-2015:** These activities are not considered finite in their implementation, but rather should be implemented with a view to revising and improving them as time progresses.

This strategy is in line with, and supports, the Government programme "European Integration: Liberty, Democracy, Welfare", which sets forth a policy framework for the governing of the Republic of Moldova for the years 2011-2014. Specifically, this National Adaptation Strategy directly supports the following government priorities as outlined in the Government programme:

- This strategy supports the Government's objectives for environmental protection, and will help to reduce the negative impact of economic activity on environment, natural resources and health of the population; modernizing the national monitoring system for hydro-meteorological conditions; and diminishing natural hazard risks and raising awareness for greater protection.

It further supports specific sectoral objectives within this Government programme, for example:

- Decreasing the susceptibility of agriculture to climatic conditions, and halting the degradation of land resources; and enhancing the responsibility of citizens for their own health, prevention of risk factors, health protection and promotion.

Table 6-1: Expected Implementation Costs and Stages of Implementation

No.	Objectives and Activities	Organization Responsible	Timeframe	Expected Costs
1	**IMPROVE THE MANAGEMENT AND DISSEMINATION OF DISASTER AND CLIMATE RISK INFORMATION IN MOLDOVA.**			
1.1	Build capacities for gathering, analysing and disseminating climate risk information, including weather data, climate modelling and impact assessment.	**Ministry of Environment**; and Academy of Sciences of Moldova	2011-2015	300,000 USD
1.2	Establish mechanisms for raising awareness on climate change risk and adaptation measures.	**Ministry of Environment**; Ministry of Education; Academy of Sciences of Moldova; **Ministry of Youth and Sports;** Local Public Authorities; and Non-Governmental Organization	2011-2015	200,000 USD
1.3	Establish a regional coordination body with Ukraine and Romania to link activities on disaster and climate risk management.	**Ministry of Environment**; and State Chancellery	2011-2013	No need of financial coverage
2	**ENSURE THAT CLIMATE CHANGE ADAPTATION IS A NATIONAL AND LOCAL PRIORITY WITH A STRONG INSTITUTIONAL BASIS.**			
2.1	Strengthen inter-sectoral coordination by building the capacity of the Inter-ministerial Working Group for Climate Change (or other appropriate body) to be the implementing body for the strategy.	**Central Public Authorities**; and State Chancellery	2011-2013	100,000 USD
2.2	Build government capacities to manage and integrate climate change adaptation into policy and practice at both the local and national level.	**Central Public Authorities;** and Local Public Authorities	2011-2015	500,000 USD
2.3	Undertake a climate risk screening of relevant national development policies and plans.	**Central Public Authorities**	2011-2013	100,000 USD
2.4	Create a mechanism for integrating climate risk into all future policies/plans.	**Central Public Authorities**; and Local Public Authorities	2011-2013	150,000 USD
3	**BUILD CLIMATE RESILIENCE THROUGH REDUCING RISK AND FACILITATING ADAPTATION IN PRIORITY SECTORS.**			
3.1	Conduct a review of current adaptation activities taking place in Moldova.	**Central Public Authorities;** and Academy of Sciences of Moldova	2011-2013	100,000 USD
3.2	Develop Climate Change Adaptation Action Plans for each ministry/sector at high risk to climate impacts.	**Central Public Authorities**	2013-2015	300,000 USD
3.3	Conduct a review and revise relevant legislative documents	**Central Public Authorities;** and Local Public Authorities	2011-2013	300,000 USD
3.4	Develop a climate risk management/adaptation financing plan.	**Central Public Authorities;** and State Chancellery	2013-2015	100,000 USD
			TOTAL COSTS:	**2,150,000 USD**

7 Procedures for Reporting and Monitoring

A monitoring and evaluation framework provides a mechanism for monitoring progress against a set of indicators to ensure that the goals of the Strategy are being met in a timely and suitable fashion. This Strategy is not intended as a linear process, but rather is iterative, and should be updated and revised as new information comes to light, and based on lessons learned as the process is taken forward. The following table details recommended indicators for each of the Specific Objectives outlined in the strategy; these should be revised and agreed by the IWG as the implementing body. They are designed as near-term indicators, and clearly will need to amended and updated to reflect progress made.

Table 7-1: Potential Indicators for M&E Plan

No.	Objectives and Activities	Possible Indicators
1. IMPROVE THE MANAGEMENT AND DISSEMINATION OF DISASTER AND CLIMATE RISK INFORMATION IN MOLDOVA.		
1.1	Build capacities for gathering, analysing and disseminating climate risk information, including weather data, climate modelling and impact assessment.	• A joint Government-Science Research body is established. • 3-4 study tours and research stays organized with relevant international centres for climate assessment. • Risk maps generated for the three regions of the country (south, centre, north), and by sector. • High-risk areas identified and prioritized.
1.2	Establish mechanisms for raising awareness on climate change risk and adaptation measures.	• School curricula on climate risk developed and implemented in all schools in high risk areas, and a clear plan in place for implementing in all schools nationwide. • Public awareness plan developed that includes specific actions, timeframes, and organizations responsible.
1.3	Establish a regional coordination body with Ukraine and Romania to link activities on disaster and climate risk management.	• Discussions held and coordination mechanisms identified with Ukraine and Romania.
2. ENSURE THAT CLIMATE CHANGE ADAPTATION IS A NATIONAL AND LOCAL PRIORITY WITH A STRONG INSTITUTIONAL BASIS.		
2.1	Strengthen inter-sectoral coordination by building the capacity of the Inter-ministerial Working Group for Climate Change (or other appropriate body) to be the implementing body for the strategy.	• A clear working protocol for the IWG is established and voted in by all members. • The IWG is meeting on a regular basis with regular participation by all members.
2.2	Build government capacities to manage and integrate climate change adaptation into policy and practice at both the local and national level.	• Capacity needs assessment completed at national and local levels. • Capacity building training programme designed and implemented in high risk areas, with clear, time bound plan for implementing in all areas.

No.	Objectives and Activities	Possible Indicators
2.3	Undertake a climate risk screening of relevant national development policies and plans.	• A climate risk screening methodology is developed and undertaken with three key national development plans. • Screening report written and disseminated that identifies key areas of existing climate risk and proposed modifications for policies.
2.4	Create a mechanism for integrating climate risk into all future policies/plans.	• A clear plan is developed and agreed for modifying policies based on the climate risk screening.
3. BUILD CLIMATE RESILIENCE THROUGH REDUCING RISK AND FACILITATING ADAPTATION IN PRIORITY SECTORS.		
3.1	Conduct a review of current adaptation activities taking place in Moldova.	• Database of existing adaptation activities developed, and made publicly available.
3.2	Develop Climate Change Adaptation Action Plans for each ministry/sector at high risk to climate impacts.	• Adaptation plans for 5-6 sectors developed and agreed.
3.3	Conduct a review and revise relevant legislative documents	• Legislative review completed and clear plan for implementing changes in the near term.
3.4	Develop a climate risk management/adaptation financing plan.	• Financing plan completed. • 4-5 key sources of finance identified.

Furthermore, the IWG should develop a monitoring and evaluation plan, as one of their first tasks under this strategy, which details how often monitoring will take place, how the findings will be reported, who they will be reported to, and the specific mechanism for responding to findings (e.g. if progress is not being met on an indicator, the specific process agreed for deciding what action will be taken, who will implement, etc).

As a general principle, monitoring and evaluation should take place on a regular basis:

- Progress against the specific objectives and activities should be monitored and recorded in a report every three to six months. When an objective has been met or completed, it should be noted as such.
- Findings from monitoring should be incorporated into future planning, and used to identify activities and actions that are not showing significant progress, which may require greater investigation and changes to activities to ensure that the overall goals are met.

Annex A: Description of Methodology for Risk/Opportunity Assessment

To highlight the key economic sectors and regions most vulnerable to climate change (see Section 2.2 of the main report), a vulnerability matrix linking climate drivers with priority risks was developed. The risk analysis was carried out by national experts in three steps, as follows.

Step 1: The risks and opportunities related to climate change were identified from analysis of relevant international and national literature and ongoing studies. Priority risks and opportunities were selected in accordance with historic climate trends and current vulnerability to identified risks and opportunities in different regions of the Republic of Moldova.

Step 2: Future projections of the key climate and climate-related variables were listed and linked with selected risks and opportunities for the five agro-climatic zones for the agriculture sector, in accordance with stipulations of the National Strategy for Sustainable Development of Agricultural Complex of the Republic of Moldova for 2008-2015; or four economic-development regions (e.g., North, Center, South and Municipality of Chisinau) for other sectors, in accordance with the stipulations of the National Development Strategy for 2008-2011 years (the analysis refers to the timeframe 2010-2040).

Step 3: The future projections of the key climate and climate-related variables were then assessed for how they affect priority risks using a weighting of 3, 2, or 1 to denote high, medium or low magnitude of the impact with the probability of their occurrence (**see examples below:** a vulnerability matrix linking climate drivers with priority risks for the agriculture sector). The findings were then amalgamated to qualitatively assess and define key risks for each sector, based on expert judgment, using the following ranking:

- HIGH – high probability of risk due to possible climate change demands the urgent attention of decision makers to develop immediate measures for adaptation;
- MEDIUM – medium probability of risk due to possible climate change should be maintained under review;
- LOW - low probability of risk due to possible climate change should be maintained under review. It is expected that existing adaptation measures will be sufficient and no further action will be required unless circumstances change.

The ranking for opportunities arising from climate change followed a similar approach and definitions:

- HIGH – high probability of opportunity as a result of climate change to develop new directions in a region;
- MEDIUM – medium probability of opportunity arising from climate change, should be maintained under review; and
- LOW - low probability of opportunity due to possible climate change.

Table A-1: Vulnerability matrix linking climate drivers with priority risks for Sub-zone I-a, the plane of Northern Moldova

Agriculture: Sub-zone I-a, the plane of Northern Moldova											
Vulnerability matrix linking climate drivers (below) with priority risks (across)	**changes due to decrease in optimal farming condition**	**Wheat and maize yield decrease**	**Grapevine general decrease in yields**	**Fruit general decrease in yields**	**Increased risk of agricultural pests, diseases, weeds**	**Crop quality decrease**	**Increased risk of drought and water scarcity**	**Increased irrigation requirements**	**Soil erosion, salinisation, desertification**	**conditions for livestock production**	**Driving force**
Rainfall – average	1	1		1	3	1	1	1	1	1	11
Rainfall -extreme	1	1		1	3	2	1	1	2	1	13
Drought	1	1		1	2	1	1	2	1	1	11
Temperature – average	1	1		1	3	1	1	1	1	1	11
Temperature –max	1	1		1	3	1	1	2	1	1	12
Temperature –min	1	1		1	2	1	1	1	1	1	10
Humidity	1	1		1	2	1	1	2	1	1	11
Evaporation	1	1		1	2	1	1	2	1	1	11
Irrigation	1	1		1	2	1	1	1	1	1	10
Wind		1									1
Total vulnerability	9	10	0	9	22	10	9	13	10	9	

High (21-30)
Medium (11-20)
Low (1-10)

Table A-2: Vulnerability matrix linking climate drivers with priority risks for Sub-zone I, the plane of Northern Moldova, front Dniester hills

Agriculture: Sub-zone I, the plane of Northern Moldova, front Dniester hills											
Vulnerability matrix linking climate drivers (below) with priority risks (across)	**changes due to decrease in optimal farming condition**	**Wheat and maize yield decrease**	**general decrease in yields**	**decrease in yields**	**agricultural pests, diseases, weeds**	**Crop quality decrease**	**drought and water scarcity**	**Increased irrigation requirements**	**Soil erosion, salinisation, desertification**	**conditions for livestock production**	**Driving force**
Rainfall – average	1	1	1	1	3	1	1	3	2	2	**16**
Rainfall -extreme	1	2	1	2	3	3	1	1	2	2	**18**
Drought	1	1	1	1	2	1	1	1	2	1	**12**
Temperature – average	1	2	1	2	3	2	1	3	2	2	**19**
Temperature –max	1	2	1	2	3	2	1	3	2	2	**19**
Temperature –min	1	1	3	2	2	2	1	2	1	1	**16**
Humidity	1	2	1	2	2	1	1	3	1	1	**15**
Evaporation	1	2	1	2	2	1	1	3	1	1	**15**
Irrigation	1	2		2	2	1	1	2	1	1	**13**
Wind		1					1	1	1	1	**5**
Total vulnerability	**9**	**16**	**10**	**16**	**22**	**14**	**10**	**22**	**15**	**14**	

High (21-30)

Medium (11-20)

Low (1-10)

Table A-3: Vulnerability matrix linking climate drivers with priority risks for Centre Sub-zone IIa, the Plane of Central Moldova and Codrii region

Agriculture, Centre Sub-zone IIa, the Plane of Central Moldova and Codrii region											
Vulnerability matrix linking climate drivers (below) with priority risks (across)	**Changes due to decrease in optimal farming**	**Wheat and maize yield decrease**	**general decrease in yields**	**decrease in yields**	**of agricultural pests, diseases, weeds**	**Crop quality decrease**	**Increased risk of drought and water scarcity**	**Increased irrigation requirements**	**Soil erosion, salinisation, desertification**	**of conditions for livestock production**	**Driving force**
Rainfall – average	2	2	2	1	3	2	2	3	3	2	**22**
Rainfall -extreme	2	3	2	2	3	3	1	1	3	2	**22**
Drought	2	2	2	1	2	2	2	2	2	1	**18**
Temperature – average	1	2	2	2	3	2	2	3	3	2	**22**
Temperature –max	2	2	2	2	3	2	3	3	3	2	**24**
Temperature –min	1	1	2	1	2	2	1	2	1	1	**14**
Humidity	2	2	2	2	2	2	2	2	2	1	**19**
Evaporation	2	2	2	2	2	2	2	2	2	1	**19**
Irrigation	2	2	2	2	2	1	2	2	1	1	**17**
Wind		1				1	1	1	1	1	**6**
Total vulnerability	**16**	**19**	**18**	**15**	**22**	**19**	**18**	**21**	**21**	**14**	

High (21-30)
Medium (11-20)
Low (1-10)

Table A-4: Vulnerability matrix linking climate drivers with priority risks for Centre Sub-zone II, the Terraces of the Dniester, Prut, Raut, Bic, Botna etc. rivers

Agriculture, Centre Sub-zone II, the Terraces of the Dniester, Prut, Raut, Bic, Botna etc. rivers											
Vulnerability matrix linking climate drivers (below) with priority risks (across)	**changes due to decrease in optimal farming condition**	**Wheat and maize yield decrease**	**Grapevine general decrease in yields**	**Fruit general decrease in yields**	**Increased risk of agricultural pests, diseases, weeds**	**Crop quality decrease**	**Increased risk of drought and water scarcity**	**Increased irrigation requirements**	**Soil erosion, salinisation, desertification**	**conditions for livestock production**	**Driving force**
Rainfall – average	2	2	2	1	3	2	2	3	3	2	**22**
Rainfall -extreme	2	3	2	2	3	3	1	1	3	2	**22**
Drought	2	2	2	1	2	2	2	2	2	1	**18**
Temperature – average	2	2	2	2	3	2	2	3	3	2	**23**
Temperature –max	2	2	2	2	3	2	3	3	3	2	**24**
Temperature –min	1	1	2	1	2	2	1	2	1	1	**14**
Humidity	2	2	2	2	2	2	2	2	2	1	**19**
Evaporation	2	2	2	2	2	2	2	2	2	1	**19**
Irrigation		2	2	2	2			2	1	1	**12**
Wind		1				1	2	1	1	1	**7**
Total vulnerability	**15**	**19**	**18**	**15**	**22**	**18**	**17**	**21**	**21**	**14**	

High (21-30)

Medium (11-20)

Low (1-10)

Table A-5: Vulnerability matrix linking climate drivers with priority risks for South, the Plain of Southern Moldova, terraces of the inferior Prut and Dniester Rivers

Agriculture: South, the Plain of Southern Moldova, terraces of the inferior Prut and Dniester Rivers											
Vulnerability matrix linking climate drivers (below) with priority risks (across)	**changes due to decrease in optimal farming condition**	**Wheat and maize yield decrease**	**Grapevine general decrease in yields**	**Fruit general decrease in yields**	**Increased risk of agricultural pests, diseases, weeds**	**Crop quality decrease**	**Increased risk of drought and water scarcity**	**Increased irrigation requirements**	**Soil erosion, salinisation, desertification**	**conditions for livestock production**	**Driving force**
Rainfall – average	3	3	2	2	3	2	3	3	3	2	**26**
Rainfall -extreme	3	3	3	3	3	3	1	1	3	3	**26**
Drought	3	3	2	3	3	3	3	2	2	3	**27**
Temperature – average	3	3	2	3	3	2	2	3	3	3	**27**
Temperature –max	3	3	2	2	3	2	3	3	3	3	**27**
Temperature –min	1	1	1	1	3	2	1	2	1	1	**14**
Humidity	3	3	2	2	2	2	3	3	2	3	**25**
Evaporation	3	3	2	2	2	2	3	3	2	3	**25**
Irrigation needs	3	3	2	3	3		3	3	1	3	**24**
Wind		2				1	3	1	1	1	**9**
Total vulnerability	**25**	**27**	**18**	**21**	**25**	**19**	**25**	**24**	**21**	**25**	

High (21-30)
Medium (11-20)
Low (1-10)

Annex B: Research Needs

This Annex identifies areas where additional research would strengthen the knowledge base to determine risks and opportunities associated with climate change, and to develop effective adaptation policy, for each sector discussed in the main strategy. It reflects the views of each of the National Team involved in elaborating this strategy.

Research needs to strengthen the knowledge base in agriculture

1. *Concerning climatic impacts, research needs to address not only change in temperature and precipitation and its impacts on agriculture, but also the interaction with hazards, directly or indirectly arising from atmospheric conditions, such as rainfall, flood, frost, drought, hail, heat waves, seasonal shifts (length of growing season, bud break, quality aspects), and changes in pest and disease patterns.*
2. *Crop specific evaluations should be conducted to determine changes in seasonal development, characteristics of production, cultivation methods, etc., under climate change.*
   Crop models are required to assess the impacts of climate change and increased atmospheric concentration of CO_2 on various crops, pastureland and livestock. Further, crop simulation models need to be interfaced with Geographic Information Systems (GIS) in order that these models can be applied for regional planning and policy analysis.
1. *In addition, different tools should be used to examine the socio-economic impacts of climate change. A variety of approaches, such as economic regression models, microeconomic and macroeconomic models, and farm models should be used.*

Research needs to strengthen the knowledge base in health

1. *Available risk assessment data, including the short-, medium- and long- term effects of climate change on public health, need to be thoroughly reviewed and considered before developing a national programme and plans for crisis preparedness and response. Importantly, all health statistics (data on communicable diseases, non-communicable diseases, ambulance call-out, hospitals, etc.) need to be utilized in risk assessment and in identifying vulnerabilities in the health sector.*[76]
2. *Quantitative research is required to identify the regions of the Republic of Moldova most vulnerable to the adverse health effects of climate change. These areas will require focused adaptation measures, including better health clinics and tools, education of the public in these areas about how they can cope with new health concerns.*
3. *The Ministry of Health may wish to translate past conference proceedings and scientific articles on climate change into an official assessment of the risks associated with climate change and to establish criteria for developing a heat–health action plan, including a heat–health warning system.*[77]
4. *Improved disease burden estimates need to be established, based on latest climate models to estimate (i) heat-related mortality statistics based on existing mortality and population data at the national level and in key cities of the Republic of Moldova; (ii) the impacts of projected changes in climate, taking into account various forms of acclimatization; and (iii) climate - water and foodborne diseases relationships using panel data on income and health to project cause-specific deaths and disability-adjusted life year (DALY) rates by demographic group.*
5. *In depth studies on the socio-economic assessment of climate change in the health sector would be beneficial, including: (i) the health 'damage' costs of climate change under different mitigation scenarios; and (ii) the costs of preventing death, illness and injury under different mitigation scenarios (i.e. adaptation measures).*

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[76] World Health Organization. Assessment of health security and crisis management capacity The Republic of Moldova, 2008

[77] Ibid.

Research needs to strengthen the knowledge base for water

1. *Climate change poses a threat to transboundary basins. Evidence suggests that the challenges and conflicts among the riparian states depend on the degree of variability and uncertainty associated with the resource availability. Projected changes in water resources variability due to climate change can impact the water balance and consequently the hydro-political balance in transboundary basins. Administrative instruments for transboundary basins, such as treaties and agreements, should be reviewed for the impact of climate change on those treaties.*
2. *An assessment of climate change impacts on water resources is required that focuses on: (i) defining critical thresholds in water resource; (ii) improving the capacity to calibrate state-of-the art rainfall runoff models; (iii) understanding of the economic and social impacts of climate change on water quantity, supply, and demand including irrigation, drinking-water supplies, recreation/tourism, hydropower and industry, and system losses.*
3. *Enhance capacity to develop and implement river basin-level hydro-economic to assess future water resources development and the viability of associated development, such as hydro-electric development, waste treatment and irrigated agriculture.*
4. *On-going or planned pre-feasibility or feasibility studies for irrigation and land use projects are needed, and should be required to include an assessment of the physical and economic impacts of climate change.*
5. *Improve the capacity of water management structures and institutions to deal with projected climate change, and the social, economic and environmental costs and benefits of future adaptations, is required. Structural adaptations such as new reservoirs, canal linings, and groundwater extraction can be analysed with simulation models. In addition, operational adaptation, changed allocation priorities, and pricing structures can be evaluated.*

Research needs to strengthen the knowledge base for forests

To date, climate change research in the Republic of Moldova related to forestry has focused primarily on biophysical impacts; much less attention has been devoted to socio-economic impacts and the ability of forest managers to adapt to climate change. Research needs include:

1. *Combine agricultural, forest resource and environmental economics to conduct studies of the socio-economic impacts of climate change.*
2. *Establish the climatic thresholds that correspond to the distribution limits of a forest type or species and develop a bioclimatic model to predict future steady-state forest distributions under a range of plausible climate change scenarios.*
3. *Collect historical analogues and life-history information to estimate how long it might take for the forest boundary to migrate a given distance, and use this information to speculate about what may happen during the transition period and to modify the steady-state prediction if it is unlikely to be reached in the assessment period.*
4. *Calibrate a biogeochemistry model to predict changes in productivity and carbon stocks in each forest type, with and without the effects of elevated CO_2 concentrations (and, where appropriate, nitrogen deposition) and then use an economic and demographic model to project the demand for forest products and the land area which is likely to be available.*
5. *Improve understanding of adaptive capacity including the inherent adaptive capacity of trees and forest ecosystems and the socioeconomic factors determining the ability to implement planned adaptation measures.*

Research needs to strengthen the knowledge base in the energy sector

Because many components of the energy sector are capital intensive and require long-term planning, there could be significant financial implications stemming from climate-induced changes to the consumption and production of energy. Estimates of changes in energy use to climate change are needed to help ensure energy demand is met, and to allow the development of adaptation policies that may prevent, reduce, or more equitably share losses brought about by climate change:

1. *Assess the possible effects (both positive and negative) of climate change on energy consumption: (i) effects of climate warming on energy use for space heating; (ii) effects of climate warming on energy use for space cooling; (iii) market penetration of air conditioning and heat pumps (all-electric heating and cooling), and changes in humidity.*
2. *Conduct studies of possible effects (both positive and negative) on energy production and supply: (i) assessment of impact of increase temperatures and droughts on hydro energy potential; (ii) impacts of climate change on energy production from biomass; (iii) wind resources changes (intensity and duration); and (iv) electricity transmission and distribution.*
3. *Research on efficiency of energy use in the context of climate warming, with an emphasis on technologies and practices that save cooling energy and reduce electrical peak load.*
4. *Assessments should be focused on linkages and feedbacks among climate change effects, adaptation, and mitigation; linkages between effects at different geographic scales; and relationships between possible energy effects and other possible economic, environmental, and institutional changes.*

Research needs to strengthen the knowledge base for Transport

Transportation professionals typically plan 20 to 30 years into the future. Many decisions taken today, particularly about the location of infrastructure, help shape development patterns and markets that endure far beyond these planning horizons. Similarly, decisions about land use, zoning, and development often create demand for long-lived transportation infrastructure investments. Thus, it is important for transportation decision makers to consider potential impacts of climate change now in making these investment choices because those impacts will affect how well the infrastructure responds to climate change. The impacts of climate change on transport have had limited research in Moldova, and so many of these recommendations are focused on initial steps to improve understanding in this sector. Research needs include:

1. *Establish a process for better communication among transportation professionals, climate scientists, and other relevant scientific disciplines and a clearinghouse for transportation-relevant information on climate change, in order to facilitate more detailed assessments.*
2. *Examine the long-term impacts of climate change on the transport sector in light of climate change projections to determine whether, when, and where the impacts could be consequential, particularly in light of the long planning horizons for transport infrastructure.*
3. *Analyze options for adapting to these impacts, including the possible need to alter assumptions about infrastructure design and operations, the ability to incorporate uncertainty into long-range decision making, and the capability of institutions to plan and act on mitigation and adaptation strategies at the state and regional levels.*
4. *Identify entry points for incorporating climate change information into long-term capital improvement plans, facility designs, maintenance practices, operations, and emergency response plans*.

Annex C: Summary of Adaptation-related Work Undertaken to Date in the Republic of Moldova

Table C-1: Summary of Adaptation-related Work Undertaken to Date in the Republic of Moldova

Name of Project	Implementing Organization	Total Funds/Years	Highlights
General			
Enabling Activities for the Preparation of the First National Communication under the UNFCCC	UNDP/GEF	1997-2000 US$ 0.315 million	• Summarized findings: (i) of air pollution survey; (ii) production of first GHG inventory; (iii) national and regional climate change patterns; (iv) vulnerability and adaptation of the natural and artificial ecosystems to climate change, etc. • Findings were used to make climate change forecasts that became basis for mitigation recommendations.
Enabling Activities for the Preparation of the Second National Communication under the UNFCCC"	UNEP/GEF	2005-2009 US$ 0.405 million	• Include a national inventory of anthropogenic emissions by sources and removal by sinks of all GHGs not controlled by the Montreal Protocol for the period 1990-2005, and a general description of steps envisaged to implement the Convention. • Addressed urgent and immediate domestic issues related to climate change, takes full consideration of the capacity buildings needs of the Republic of Moldova in various thematic areas as highlighted in Decision 2/CP.7, and hence capacity building elements are incorporated in all proposed activities.
National Human Development Report, 2009/2010 Climate Change in Moldova, Socio-Economic Impact and Policy Options for Adaptation	UNDP	2009 US$ 0.100 million	• Focused on the impact of climate change on Moldova's environment, society and economy. • Discusses adaptation options and their potential synergies with the overarching development goals of the country. • Highlights areas where action is needed in terms of adaptation to climate change, and explains the implications for sectoral and cross-sectoral development policies.
Regional Project "Support for Kyoto Protocol Implementation"	EU TACIS	Started in 2008.	• Promote the energy efficiency activities and broader use of flexible Kyoto Protocol mechanisms. • Adoption of the climate change mitigation and adaptation strategies. • Local capacity strengthening and public awareness-raising.
Agriculture			
1).The Rural Finance and Small Enterprise Development Programme (RFSEDP);	IFAD	Since 1999, IFAD has financed four projects with	Focused on the provision of rural financial services products relevant to IFAD's target group, along with complementary technical assistance and support for rural enterprise development. Assisted in the expansion of some 411 rural enterprises, creating 6,000 additional jobs. Enterprises supported through the project have shown growth rates of up to an impressive 9 per cent annually, demonstrating sound

Name of Project	Implementing Organization	Total Funds/Years	Highlights
2). The Agricultural Revitalization Project; 3). The Rural Business Development Program (RBDP) 4). Rural Financial Service and Marketing Programme (RFSMP)		a contribution US$ 48.2 million: (RFSEDP) USD 8 million; (ARP) USD 14.5 million; (RBDP) USD 13 million; (RFSMP) USD 18.95 million.	implementation performance and sustainability. Improved agricultural services and market access for a large number of other rural people. Create as well job opportunities and income-generation opportunities through on and off-farm productive activities to reduce rural poverty in the country. Enhance Moldova's horticultural value chain. Support rural financial services, develop the rural commercial infrastructure and provide extension services of knowledge and technical expertise required for participation in national and international markets with the aim of making profits. Focused on areas with the highest concentrations of rural poor people.
Rural Investment and Services	IBRD/IDA/SIDA	Phase I (2002-2006) USD 19.69 million Phase II (2006-2010) USD 26.42 million.	Phase I: • Aimed at fostering post-privatization growth in the agricultural sector by improving the access of new private farmers and rural businesses to legal ownership status, knowledge, and finance. • Addressed the lack of access to investment and working capital by the new private farmers, rural entrepreneurs, and rural households. • In 2002-2004, the banking sector portfolio increased by 144 percent in agriculture and 120 percent in agro-industry. • Around 300,000 farmers were reached by 540,000 extension activities through a network of 35 private service providers and over 400 local consultants/advisers. Phase II: • Continue priority interventions in policy, legal, and regulatory reforms, institutional capacity building, technical assistance, and investment. • Facilitated the development of business activities for over 1,600 soon-to-be entrepreneurs; the opening of credit lines for private farmers and rural entrepreneurs with limited or no access to the commercial banking sector; and the financing of 1,200 sub-loans, most of which were to first-time borrowers.
Agricultural Pollution Control	IBRD/GEF	2004-2009 USD 10.95 million	Improve regulatory frameworks, organic farming, and best agricultural practices by farmers and agro-industry in order to reduce nutrient discharge from agricultural sources into the Danube River and Black Sea. Provided grants to entrepreneurs and rural enterprises for investing in sustainable agricultural practices and will train rural advisory service providers in crop nutrient management, conservation tillage practices, crop rotation, and planting of buffer strips. Supported manure management and agro-forestry practices, wetland restoration, and monitoring of soil and water quality. Assisted Ministry of Ecology and Natural Resources (MENR) and Ministry of Agriculture and Food Industry (MAFI) in developing a Code of Good Agricultural Practices and strengthened the capacity of government institutions to promote organic farming and land use management.

Name of Project	Implementing Organization	Total Funds/Years	Highlights
			Under the supervision of the Institute of Pedology, Agrochemistry and Soil Protection 'N. Dimo", demonstration fields were set up to monitor the impact of environmentally friendly agricultural practices such as crop rotation, nutrient and manure management, conservation tillage, strip cropping, grassed waterways, and buffer strips in vineyards. Micro-terraces were created between vineyards planted on sloped land to protect them from soil erosion. Grass was also seeded to hold soil and keep moisture in the micro-terraces. Manure management practices have been adopted with the assistance of local farmer associations. The price of composted manure is expected to increase and further generate additional income for farmers. Agro-forestry development has been addressed through the planting of 132 ha of buffer strips. Made progress in wetland restoration and soil quality monitoring. Wetland restoration includes the introduction of nutrient filtration through hydrologic enhancement practices, improved water quality monitoring, and a tree planting program covering 6.6 ha. Seven stations to measure soil runoff and nutrient loss have been installed in test/demonstration fields.
Moldova Soil Conservation Project	Forestry Agency "Moldsilva" under the Clean Development Mechanism of the Kyoto Protocol	Started in October 2002 The Project is scheduled for 21 years. The cost per ton of reduction in CO_2 equivalent is USD 5.3.	Focused on restoration of degraded agricultural lands to productive uses, at the first stage through afforestation of 20,300 hectares (target already completed by end of May 2006); community-based land management; carbon sequestration and reduction of greenhouse gas concentrations. Selected 1,891 land plots for afforestation are located in 383 villages in 11 districts all over the country (except the administrative-territorial units on the left bank of Dniester. There were planted trees and shrubs adapted to local conditions (poor soils) on 14 495 ha of degraded pasturelands and has been built community capacity to manage 5 400 ha of these lands. During 2005-2006, forests planted have sequestered an estimated gross amount of 78 401 tons of CO2 and approximately 56 000 tons of CO2 were presented for payment to the Prototype Carbon Fund (PCF). During the next phase, the project is reforesting 19 768 ha of degraded state-owned and communal agricultural lands throughout the country with the goal of restoring degraded lands and enhancing sustainable supplies of forest products to local communities. Thus, during 2002-2007 Forestry Agency Moldsilva planted more than 40,000 ha of new forests. The total resultant reductions in the GHG emissions will be around 3.6 million tonnes in CO2 equivalent (during the first 20 years), including 1.9 million tonnes already contracted by the World Bank Prototype Carbon Fund and BioCarbon Fund for 2004-2017. The transaction value is about USD 7 million, which will cover about 37 percent of the total investment needs (USD 19 million) for the implementation of the Project, and the remainder amount will be funded by the Forestry Agency "Moldsilva".
Health			
Health Services and Social Assistance Project (HSSAP)	WB	07-Jun-2007 31-Aug-2011 USD 44.36 million	Increase access to quality and efficient health services with the aim of decreasing premature mortality and disability for the local population Improve the targeting of social transfers and services to the poor in line with the Medium-Term Expenditure Framework (MTEF) for 2007-09. Specifically, two interventions will have a positive mitigation impact to food price shocks: (i) interventions to

Name of Project	Implementing Organization	Total Funds/Years	Highlights
			reduce nutritional vulnerability of at-risk pregnant women, lactating mothers, and infant young children through the provision of nutritional supplements; and (ii) a temporary cash transfer to social institutions which provide food to children, elderly, mentally or physically handicapped and other vulnerable groups to compensate for food price increases during the upcoming 2008/2009 winter season. The existing HSSAP has committed the donors' resources to the large-scale, medium-term systemic reform and to policy development and institution building while the additional financing will be able to overcome the constraints of the already made commitments and address the current extraordinary situation. While the existing project supports a strengthening of the overall health and social protection systems, it did not envisage specific measures to help protect poor families, women, and children in the advent of such an acute and persistent food price crisis. Nonetheless, Bank engagement in both health and social protection in Moldova provides a solid strategic basis and framework with which to support additional financing in order to respond to this crisis.
Water Resources			
	Millennium Challenges Corporation (MCC) US	2010 USD 102 million	Improve existing irrigation infrastructure; Ensure sustainable access to water resources; Facilitate increased agricultural productivity and comprehensive incomes. Provide support to Moldova in transition to high-value agriculture in order to increase production of fruits and vegetables with high added value through: improved irrigation, access to finance, and technical assistance/capacity development.
Sector Policy Support Programme (SPSP) in the Water Sector	European Commission	In 2009 signed with the GoM an agreement EUR45 million	Strengthen the efforts of all participants in the water supply and sewage sector by ensuring better interaction of selection of priority areas and creating a common database on implemented projects.
National Water Supply and Sanitation Programme	World Bank	a loan of USD 14 million	Rehabilitation and development of water supply and sewage systems of which: Balti, Cahul, Moldova, Floresti, Orhei, Soroca, Ungheni (USD8 million); Water systems in 50 villages (USD4 million); Strengthen institutional capacities of the Ministry of Environment and Apele Moldovei (USD1 million); Energy efficiency (USD1 million).
Environmental Infrastructure Project	World Bank, GEF	2007- 2011 USD 4.562 million	Provided to construct a waste water treatment plant in Soroca.
Environmental Infrastructure Project	World Bank, European Commission	2009-2012 EUR 2.8 million	Provided to construct a wastewater treatment plant in Orhei.
Social Investment Fund (SIF) Project	World Bank	2009 USD 8.9	WSS infrastructure development (system rehabilitation); The beneficiaries included the cities of Briceni and Durlesti, as well as the villages of Molovata, Steţcani,

Name of Project	Implementing Organization	Total Funds/Years	Highlights
		million	Samalia, Pojăreni, Recea, Cruglic, Soldăneşti, Decebal, and Gornoe.
Support municipal utilities in most reform-minded municipalities	EBRD	loan of up to EUR 10 million	Comprise the regionalization of water companies by expanding their operations into neighboring localities Structured as priority investments focusing on the water utilities Committed to adjust the tariffs and introduce cost recovery of their water companies to ensure financial viability. Strengthen municipal utilities to ensure provision of adequate supply of drinking water improve wastewater treatment facilities with environmental benefits for the Prut and Nistru river basins and ultimately the Black Sea.
Drinking water supply project	Turkish Administratio n for Cooperation and Develop - ment (TICA)	USD 6.56 million	• Drinking water supply project for the city of Ciadir-lunga, stage II (Gagauz Yeri).
Develop WSS systems. The list of implemented projects include: Water and Sanitation in Rural Areas „WATSAN”	Swiss Agency for Development and Cooperation (SDC)	since 2000 around EUR 1 million annually	• Priority areas are the Nisporeni, Hincesti, Straseni, Calarasi, Ialoveni and Leova districts. • Increasing access to safe drinking water and improving service quality in Iurceni (Nisporeni), Mireşti (Hincesti), Goreşti (Nisporeni) villages; • Wetland wastewater treatment in Rusca/Prison; • Wastewater treatment plant in Negrea, Sarata and Galbena villages (Hincesti District); • Improving environmental protection and security of water supply sources; • Rationalizing tariffs for water supply and sewerage services.
Development of WSS systems	Austrian Development Agency (ADA)		• Projects completed are: rehabilitation of water supply system in Cantemir, Phase I; Rehabilitation of water supply system in Cantemir, phase II. • Currently, is implementing a drinking water supply project to the city of Nisporeni.
Rehabilitation of WSS	Kuwaiti Fund for Arab Economic Development (KFAED)	since 2004 loan of 6.5 million USD	• Rehabilitation of WSS systems (Străşeni, Hînceşti, and Taraclia, as well as the villages of Sărata Veche, Risipeni, and Carbalia)
Development assistance.	Czech Republic	official about 900 thousand EUR per year	• Protection of water catchment sources in the city of Iargara; • Wastewater treatment plant construction in the city of Leova; • Systematic monitoring of quality of water sources.
Forest			

Name of Project	Implementing Organization	Total Funds/Years	Highlights
Community Forests Development The total value of the net removals from the respective Grant implementation will be around 260 thousand tones in CO_2 equivalent. The cost per ton of reduction in CO_2 equivalent is USD 5.3.	Forestry Agency "Moldsilva".	2004-2007 Grant of the Government of Japan USD 919,900	• Contribute to ensuring the sustainability of forest planting activities • Improved well-being of the population in rural areas via better management of community forests and pastures targeted at public forests covers 50 participating communities. • Expected to produce a positive impact on the respective community forests and pastures, better management capacity, environmental and economic benefits. • Implemented activities: (i) improving the productivity of 2000 ha of pastures owned by local communities; (ii) reconstruction and/or restore of 340 ha of forests and other types of forest vegetation owned by local communities; (iii) development of 5900 ha of managed forests and other types of forest vegetation on the lands owned by local communities.
Moldova Community Forests Development Project	WB/Forest Agency Moldsilva	started in November 2006, USD 28.2 million, with a credit period of 30 years	• Establish community forests and shelterbelts on 10,600 ha through: (i) the afforestation of eroded and unproductive land, (ii) the application of agro-forestry practices, carbon sequestration and reduction of greenhouse gas emissions, (iii) improving the local and regional forests and pastures resources, • Reduction of erosion through: (i) stabilization of landslides and improvement of the hydrologic regime, (ii) increased access to resources such as timber, firewood, and non-wood forest products, (iii) creation a basis for the sustainable development at the local and regional level. • Introduced to participatory community forestry and pasture management practices approximately 320 communities (some 380,000 people). • The cost per ton of reduction in CO_2 equivalent is USD 7.4. • The total resultant reductions in the GHG emissions will be 3.8 million tonnes in CO_2 equivalent. The Forest Agency Moldsilva has already signed an agreement (May 26, 2009) with the BioCarbon Fund of the World Bank for buying 550 thousand tones of reductions in CO_2 equivalent.
Program to support local communities for the sustainable and integrated management of forests and for the carbon sequestration through afforestation	Grant of the Government of Japan/ Forest Agency Moldsilva, Forest Management and Research Institute	2009-2013 USD 975 900, of which USD 600 000 will be allocated to support the local communities in achieving the sustainability of the new	• Ensure the sustainability of new communal forests created through: (i) capacity building for forest management and reforestation activities at the local level, (ii) the special program on integrated management of forests and interventions targeting afforestation of degraded agricultural land, planting of forest belts for environmental protection and creating a local environmental network; • Ensure global benefits through: (i) carbon sequestration and reduction of greenhouse gas emissions, (ii) generating revenues for local communities from forest products, to help reduce poverty in rural areas. • Envisaged activities are: (a) improving the productivity of 800 ha of communal pastures; (b) reconstruction and/or restoration of 1200 ha of forests and other forest vegetation owned by local communities; (c) development of 3200 ha of managed forests on the land owned by local communities. • The total resultant reductions in the GHG emissions will be 102 thousand tonnes in CO_2 equivalent. The cost per ton of reduction in CO_2 equivalent is USD 9.6.

Name of Project	Implementing Organization	Total Funds/Years	Highlights
		created forests.	
Biodiversity Conservation of the Lower Dniester River	WB/GEF	2002-2005 USD 975 thousand	• Improve biodiversity conservation efforts along the Lower Dniester River • Create a national park in the lower Dniester River Basin, • Build local capacity for its management, and promote sustainable management of forests and meadows in the protected area. • Supported the protection of transboundary wetlands in the Dniester Delta region by improving collaboration with Ukraine. • Included reforestation and afforestation efforts such as the creation of ecological corridors between fragmented forests and pilots on community resource management. • Facilitated community involvement in decision-making and included sustainable resource use in project activities (i.e., financed micro- credits for small-scale green businesses).
Transport			
Road Sector Program Support Project	WB/ EBRD	29-Mar-2007 30-Jun-2011 USD 48.7 million	• Reduce road transport costs for road users by improving the condition and quality of road network and the way it is managed. • This will be achieved by: (1) the road network recovery component which will rehabilitate about 400 lane-km of main roads (equivalent to about 160 to 200km of main roads) and thereby reducing user costs in the short term; (2) the institutional strengthening component which will improve the capacity of the State Road Administration to manage effectively the road network and to carry out road maintenance, rehabilitation, and investment programs in an transparent manner.
Energy			
Energy-II in the Republic of Moldova Project	WB, SIDA, IBRD/IDA and the Ministry of Economy and Commerce	the initial loan offered for 2004–2008 was USD 35 million, and the additional funding endorsed for 2009–2012 is USD 11 million	• Electricity System Upgrade*:* improvement of metering in the electricity transmission network; • Rehabilitation and upgrade of power system dispatch and telecommunications; Upgrade of substation equipment: it is at the stage of completing, this component includes modernization of operating substations 110 and 330 kV of Moldelectrica; • Priority rehabilitation of the transmission network: this component covers the most urgently needed repair of a number of 110-kV and 330-kV high-voltage lines, which sustained damage from an ice storm in November 2000 and from strong winds in early March 2002 and due to other reasons; • Environmental upgrades in the transmission system: it is 95% completed, this component consists of physical mitigation measures for appropriate disposal of old PCB-containing condenser batteries; • Improved access to heating during the heating season (about 120 days in a year) for approximately 35 institutions (including schools, hospitals, kindergartens (pre-schools), orphanages) and 37 apartment houses; • improved access to heat was ensured to approximately 8,400 schoolchildren, approximately 1 million patients and visitors of the polyclinics and hospitals, and about 2,130 families whose apartments were connected to new heat plants during the last two heating seasons (2006/2007 and 2007/2008). • The additional funding of USD 11 million approved for 2009-2012 will be used to ensure improved access

Name of Project	Implementing Organization	Total Funds/Years	Highlights
			to heating for about 18 public institutes and social assistance centres located in 10 administrative units (districts) of the Republic of Moldova.
Project on Energy Efficiency	SIDA	OnJuly 27, 2009. grant in amount of 16 million Swedish Kronor	• Provision of Technical Assistance in the implementation of the Extended Heating Component of Energy II Project (*Packages B8 and B9 - financed by the Word Bank through the Additional Financing Agreement dated March 16, 2009*); • Performance of a Feasibility Study for the Reconstruction of the Heating, Ventilation, DHW, DCW and Sanitation Systems at the Medical Centre for Mother and Child; • Installation of a New Boiler Plant, Heating and DHW Substations, Reconstruction of Distribution Pipes, Internal Heating and DHW systems at the Children's Phthisiopulmonology (Tuberculosis) Centre in Tirnova village.
Reducing Greenhouse Gas Emissions through Improved Energy Efficiency in the Industrial Sector	UNIDO/GEF	approved by GEF Council in May 2010, USD 4,252,500, from which USD 960,000 are provided by GEF	• Improve the energy efficiency of Moldovan industrial sector leading to reduced global environmental impact and enhanced competitiveness. • Establishment of policy, legal and regulatory frameworks that promote and support sustainable industrial energy efficiency and stimulate the creation of a national market for IEE products and services; • Increased adoption by Moldovan industries of energy efficient technologies and energy management as integral part of their business practices; • Accelerated and increased adoption by Moldovan industries of energy efficient practice and technologies as result of showcasing and disseminating successful national IEE projects.
Renewable Energy from Agricultural Wastes	WB/GEF, CONSOLIDATED AGRICULTURAL PROJECTS MANAGEMENT UNIT (CAPMU)	2005-2008 USD 2.63 million	• Large-scale efficient use of biomass which should replace the imported fossil fuel and trigger the introduction and promotion of the primary agricultural waste (biomass) for generation of heat based on efficient technologies. • Remove obstacles to popularization of biomass procession technologies, showing the best practice examples (11 model units have been installed and commissioned with the total capacity of 2720 kW) of using biomass-based energy systems as an alternative to fossil fuel and sustainable solution for the energy supply problem for the rural communities and agribusinesses; • Encourage the development of the market for baled straw and the post-project replication of the biomass production and distribution business among agricultural companies; • Increase in the number of public buildings, which have switched to biomass-based heating systems as result of the lessons learned from the project implementation results; • Promotion of an awareness-raising campaign on the use of renewable energy, extension among the public and promotion of the replication strategy.
Project Proposal:Construction of a Co-Generation Plant with	CDM/ State Enterprise “Tirotex” in	intended project lifetime is 25	• Reduction of GHG emissions and more efficient use of primary energy sources in generation of electricity and heat (including: to ensure the quality and reliability of electricity supply; • Abandonment of obsolete equipment in the boiler section of the above enterprise; reduction of the

Name of Project	Implementing Organization	Total Funds/Years	Highlights
the Capacity of 31 MW at State Enterprise "Tirotex" in Tiraspol, Moldova is currently under consideration by the Designated National Authority	Tiraspol, Republic of Moldova.	years (2009–2034)	enterprise's fuel consumption and associated costs; reduction of GHG emissions from burning of fossil fuel for power generation). • The average annual reduction of GHG emissions will vary between 47,640 and 54,760 tonnes in CO_2 equivalent. The cost per ton of reduction in CO_2 equivalent will make EUR 10.
Project Proposal: Biogas Production from Sugar Beet Press Pulp at Südzucker Sugar Factory in Drochia, Republic of Moldova currently under consideration by the Designated National Authority	CDM/ Südzucker Moldova S.A., a joint German / Moldovan company	Earliest project start date is 2012 year, while the expected first year of CER delivery is 2013.	• Abate GHG emissions stemming from the decay of sugar beet press pulp utilize an anaerobic digester in which the sugar beet press pulp will be transformed to biogas, which in turn will be captured and used to generate heat. • Replace heat generation from fossil fuels with heat generation from biogas. • The total amount of emission reductions expected for the 10-year crediting period is 203 660 t CO_2eq. Of this 88 200 t CO_2eq will be generated form the replacement of natural gas and 115 460 t CO_2eq, from the reduction of methane emissions.

Annex D: Mainstreaming Guidelines

Introduction

Responding to the risk posed by climate change is going to require a coordinated and concerted effort on the part of the Government of Moldova. In particular, at a national level, the policy framework will need to not only support, but also stimulate and scale up effective response to climate change at all levels. This National Adaptation Strategy is intended to serve as an umbrella strategy that creates the enabling environment for specific sectors and ministries to "mainstream" climate change adaptation and risk management into their existing and future strategies and action plans.

What is "climate change mainstreaming"?

Government ministries are typically aligned along sectors – agriculture, health, etc. However, there are many cross cutting issues that affect the ability of multiple ministries to achieve their objectives, and indeed the ability of the government as a whole to reach its goals for sustainable development and achievement of the MDGs. Climate change is one of these cross-cutting issues – it can significantly undermine sectoral planning if it is not integrated, or mainstreamed, into ministry plans and priorities.

Mainstreaming climate change risks and adaptation into the national framework requires several steps to ensure that information about climate-related risks, vulnerability, and options for adaptation is incorporated into planning and decision-making in key sectors as well as into existing national assessments and action plans. Broadly speaking, these steps include:

- Understanding climate risks and existing knowledge on adaptation;
- Assessing the institutional and policy implications of key threats posed by climate change (as identified in the previous step); and
- Modifying existing and developing new sectoral policies and plans that are climate-resilient.

This Annex is a guidance note that provides a very brief overview of the rationale and the kinds of activities that might be undertaken under each of these three steps. Some initial work has already been completed as a part of the development of this strategy, and can be used as a platform to build a participatory and consultative process that facilitates mainstreaming across key ministries in Moldova.

Key steps for mainstreaming

There is no formula for mainstreaming – it will differ by country depending on the key climate risks faced, the degree to which climate change is already incorporated into policies and plans, as well as institutional factors such as governance and political will. Nonetheless, these steps can help to guide the process.

1) Understand climate risks and existing knowledge on adaptation.

Rationale: Government policies, programmes and priorities are unlikely to result in actions that prevent or reduce climate impacts unless they are built upon a strong understanding of the main risks posed by climate change, and incorporate the lessons learned from adaptation action that has already been taking place.

Key Actions:

- Engage with relevant stakeholders, such as research institutions, to understand the latest thinking on climate risks and key hotspots (building on the analysis that is already included in this strategy and relevant research as it comes out).

- Map existing adaptation programmes to understand the "who, what, where" of current activity, as well as lessons learned and opportunities for scaling up.

2) Assess institutional and policy implications of key threats posed by climate change.

Rationale: The overall national approach to managing climate risk, both in national development plans as well as in more specific sectoral policies, creates a platform and framework for action at the meso and micro levels, and is critical for creating a strong enabling environment for adaptation in communities. The national level policy framework can be strengthened by identifying existing objectives and priorities that may be at risk from climate change, and modifying these priorities to be more climate-resilient (see Step 3).

Key Actions:

- Review key government development and sectoral policies, as well as planned projects and activities, assessing their goals and objectives through a climate lens to determine those areas of current policy/projects that are most at risk to climate change.
- Assess capacities to undertake climate risk management at a national and local level.
- Identify and appraise options to manage risk. Elaborate risk management decision-support options and adaptation priorities. These options may be at the policy level, may relate to activities such as capacity building or establishing institutional structures, and/or may include adaptation activities at a local level.

3) Modify existing and develop new sectoral policies and plans that are climate-resilient.

Rationale: Sectoral policies and plans that account for climate change impacts will result in actions that are sustainable and viable under climate change, ensuring that government budgets are spent to maximum benefit on activities that are viable in the longer term. This enabling environment at the national level is critical to facilitating autonomous and planned adaptation at the local level.

Key Actions:

- Building on the previous two steps, prioritize activities and amendments to policies, and engage with the appropriate bodies/processes to modify existing policies and plans.
- Institute a process for policy making that includes climate criteria, whereby all new policies are developed using a climate lens.
- Prepare implementation plans and identify adaptation funding to support revisions.
- Ensure mechanisms are in place to track performance and make adjustments. This process is not linear, and new information on climate risks, as well as adaptation approaches to minimize impacts, needs to be mainstreamed on an ongoing basis.

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