Country Situation Analysis for Risk Assessment in Republic of Moldova

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Disaster and Climate Risk Assessment Project of UNDP Moldova

Executive Summary

Moldova's economy, population, and environment are highly exposed and vulnerable to natural hazards. Climate change is expected to amplify meteorological hazards in both frequency and intensity. Disaster risk reduction and climate change adaptation have been assigned a high priority in joint UN-government programmatic strategies for Moldova (2007-2011 UNDAF Outcome 1.5 "improved readiness to prevent and mitigate natural and manmade disasters and crises").

In this context, UNDP Moldova, with both technical and financial support from Bureau of Crisis Prevention and Recovery (BCPR) and in collaboration with the Government of Moldova, has carried out a two-year project "Disaster and Climate Risk Reduction". The objective of the project is to contribute to the reduction of disaster and climate risk in Moldova by achieving the following outputs:

- Disaster and climate risk assessment capacities strengthened and priorities for disaster risk reduction identified at the national level to inform country disaster risk and climate risk management strategies and program development;
- Vulnerabilities reduced and capacities strengthened to manage climate risks at local level;
- Capacity of UN Country Team strengthened to manage disaster and climate risks.

This presented study – Country Situation Analysis for Risk Assessment (CSA) - will contribute to the attainment of the first output which aims at establishing National Disaster Observatory (NDO) and implementing Country Situation Analysis (CSA). A CSA is the first step in the National Risk Assessment process.[1]

The presented analysis examines the current country situation of disaster risk assessment in Moldova and its use in decision making, based on the systematical inventory and evaluation of what exists in Moldova in terms of disaster risk assessment including historic disasters and major hazards prevailing in Moldova; risk assessment studies and projects; availability of data and information for risk assessment, methodologies and tools used; institutions and organizations related to risk assessment as data providers, risk assessment implementers and end users; key professional expertise. On this basis, this report discusses the issues and challenges Moldova is facing in conducting disaster risk assessment on its own; identifies gaps and needs to enhance the country capacity for risk assessment; and presents a set of recommendations for implementing National Risk Assessment (NRA) in Moldova on its own.

Although Moldova is a country with wide Internet access throughout the country, the majority of information still is not transferred in electronic form. Given the fact that this study is specifically oriented towards finding official and confirmed information, and metadata and analyzing the current state of the country with respect to disaster risk assessment, the CSA team considers necessary to mention that the list of information is not exhaustive.

Limitations were encountered from the beginning of the project implementation and were confirmed during the meetings with stakeholders. First of all, often available information is expired and no new information is available. The existing information must be understandable for those who work with it and to the authorities taking decisions based on it. Thus, the level of training must be continuously improved and maintained.

Another issue is that sometimes several institutions are responsible for the same type of information: production and storing. Because the methodology of collection differs from organization to organization, numbers also differ. Thus reports/plans/activities/strategies produced based on, from one side similar information, but from another – totally un-corresponding one, are contradictory and often do not achieve the expected results.

An update is needed also for the equipment and a continuous training of the personnel, to be able to use technical capacity and analyze obtained data in an appropriate manner.

[1] Moldova Disaster and Climate Risk Reduction Project, UNDP, 2011

A sharing of information among authorities based on a specific scheme, updating information and making it available for all involved authorities, having a common data base to be accessed when needed are also problems related to risk assessment and prevention.

The recommendations that can be found at the end of the document provide short specific suggestions on issues that constitute a problem and can be solved with internal capacities and political will.

Acknowledgement

The CSA team is grateful to the stakeholders and the working group who have brought their input in the production of this report by commenting, criticizing and approving the content, and providing additional information and data, for a more objective analysis of the country situation with regard to disaster risk assessment and management procedures.

NOTE

During stakeholder meeting several times was mentioned the fact that the report uses in many cases outdated information (2007 or earlier).

It must be said that this is the official information the CSA team found and gathered. The team also has found other information, but the sources were not trustworthy/unconfirmed/unofficial/contradictory/false. Without confirmation of the correctitude of data, these could not be used in a report.

As response, the team has requested with the Project's help additional information. Indeed we have received more recent information (2007-2011). Still, the updated information did not change the list of recommendations and conclusions regarding the Disaster Risk Assessment (DRA) process in Moldova.

Recommendations were considered as adequate and helpful by most of the participants during the consultations.

Acronyms and Abbreviations

Acronyms	Definition in English
AGeoM	*The State Geological Agency of Moldova*
AI	*Aridity Index*
AM	*Apele Moldovei*
ATU	*Administrative Territorial Units*
BCPR	*Bureau for Crisis Prevention and Recovery*
COP	*Conference of Parties*
CSA	*Country Situation Analysis for Risk Assessment*
CSIRO-Mk2	*Global climate model with slab ocean*
DRA	*Disaster Risk Assessment*
DRM	*Disaster Risk Management*
DRR	*Disaster Risk Reduction*
ECCG	*Eco Counseling Center Galati*
ECHAM4	*The atmosphere general circulation model*
ECMWF	*European Center for Medium-Range Weather Forecast*
EIA	*Environment Impact Assessment*
GCM	*Global Climate Model*
GIS	*Geographical Information System*
GRIP	*Global Risk Identification Programme*
HadCM2	*Hadley Centre Coupled Model version2*
IDNDR	*International Decade for Natural Disaster Reduction*
IGS	*Institute of Geology and Seismology of Moldova*
INGEOCAD	*Agency for Land Relations and Cadastre*
IPCC	*Intergovernmental Panel on Climate Change*
IPROCOM	*State Design Institute*
ISA	*International Sociological Association*
MAFI	*Ministry of Agriculture and Food Industry*
NDO	*National Disaster Observatory*
NGO	*Non-governmental Organization*
NRA	*National Risk Assessment*
NRAF	*National Risk Assessment Framework*
NRIS	*National Risk Information System*
PCF	*Participatory Culture Foundation*
PE	*Potential Evaporation*
PRSP	*Poverty Reduction Strategy Paper*
SEA	*Strategic Environmental Assessment*
SRES	*Special Report on Emissions Scenarios*
SCPESS	*State Civil Protection and Emergency Situations Service*
TACIS	*Technical Aid to the Commonwealth of Independent States*
UN NHDR	*United Nation, National Human Development Reports Resources*
UNDP	*United Nations Development Programme*
UNECE	*The UN Economic Commission for Europe*
WB	*World Bank*

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1 Introduction

The Republic of Moldova is a small landlocked country in the Southeast of Europe (see Figure 1), neighboring Romania to the West and Ukraine to the East. The area of the country is 33,846 km^{2}and its population (as of January 1, 2011[2]) is 3.56 million living in-country, not including the Transnistrian population of 533,000. An estimated 750,000 to 1,000,000 inhabitants work outside the country. The territory of the country stretches from north to south on a distance of 350 km and from west to east 150 km.

The Republic of Moldova is a Black Sea region country. Its southern border extends almost as far as the Black Sea coast, and the access to the Black Sea is open for Moldova through the Dniester estuary and the Danube.[3]

The relief[4] of the Republic of Moldova is represented by hills and flatland areas, with uplands mostly in the central part of the country. The absolute altitudes are within the range of 429 m (Balanesti Hills) and 4 m above the sea level in the Dniester flood land (Palanca village).

The country is located in a temperate continental climate zone, slightly modified by the proximity of the Black Sea and the intrusion of warm wet air from the Mediterranean. Climatic seasons are clearly defined with a short and soft low-snow winter and a long summer which can be very hot and dry. On the whole, Moldova is located in an insufficiently wet zone which results in a high frequency of droughts which negatively affect its economy. For example, between 1990 and 2007 alone, nine droughts were registered in the country.

Since 1991 (Independence), Moldova has faced numerous political, economic and social challenges in transforming from a command economy to a democratic market economy. The country has made significant progress towards macroeconomic and financial stabilization resulting in an environment more conducive to medium-term economic growth and development. Nonetheless, Moldova has faced numerous political, economic and social challenges, even in comparison with other transition economies.

The country is facing numerous natural disasters due to the specifics of the climate and relief, as well as due to climate change issues. In this respect there were launched projects to assess the current state of the Republic of Moldova ‘s situation in the administrative, regulatory, legal, public awareness, disaster prevention and reduction fields.

Figure 1. The geographic map of Republic of Moldova

[2] http://www.state.gov/r/pa/ei/bgn/5357.htm

[3] Second National Communication of the Republic of Moldova under the UNFCCC, 2009. http://unfccc.int/resource/docs/natc/mdanc2.pdf

[4] Map of Republic of Moldova. 2009. www.ezilon.com


UKRAINE
Mohyliv-Podil's'kyy
Briceni
Ocniţa
Edineţ
Donduşeni
Drochia
Rîşcani
Floreşti
Bălţi
Glodeni
Fălești
Sîngerei
Soroca
Soldănești
Rezina
Rîbnita
Orhei
Teleneşti
Călăraşi
Ungheni
Iaşi
Nisporeni
Străşeni
CHIŞINĂU
(Chisinau)
Ialoveni
Hînceşti
Căinari
Cimişlia
Leova
Cantemir
Comrat
GĂGĂOUZIA
Basarabeasca
Cahul
Ciadîr-Lunga
Taraclia
Vulcăneşti
Dubăsari
Anenii Noi
Tiraspol
Bender (Tighina)
Căuşeni
Ştefan Vodă
Grigoriopol
Rîbnita
Balta
Kotovs'k
Bolţoşani
ROMANIA
UKRAINE
Galaţi
Izmayil
BLACK SEA
Nistru
Prut
Dniestr
Lake Ialpuh
Lake Katlabuh
Lake Kitay
Lake Kahul
Lake Brateş
200 m
100 m
0 m
National Capital 645,000 in 2005)
over 180,000
over 100,000
over 10,000
other main city
other city
Chief town of division (canton)
Moldavian divisions have the name of their chief town excepted the autonomous territory of Găgăouzia
MOLDOVA
0 km 15 30 45 km
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1.1 Purposes and Objectives of the Project

In the context of disaster risk reduction and climate change adaptation being assigned a high priority in joint UN-government programmatic strategies for Moldova (2007-2011 UNDAF Outcome 1.5 "Improved readiness to prevent and mitigate natural and manmade disasters and crises"), UNDP Moldova, with both technical and financial support from Bureau of Crisis Prevention and Recovery (BCPR) and in collaboration with the Government of Moldova, has carried out a two-year project "Disaster and Climate Risk Reduction". The objective of the project is to contribute to the reduction of disaster and climate risk in Moldova by achieving the following outputs:

- Disaster and climate risk assessment capacities strengthened and priorities identified at the national level to inform country disaster risk and climate risk management strategies and program development;
- Vulnerabilities reduced and capacities strengthened to manage climate risks at local level;
- Capacity of UN Country Team strengthened to manage disaster and climate risks.

This presented study contributes to attainment of the first output which aims at establishing National Disaster Observatory (NDO) and implementing Country Situation Analysis (CSA). A CSA is the first step in the National Risk Assessment process and should engage all relevant stakeholders.[5]

A CSA aims at evaluating the readiness of a country for implementing National Risk Assessment (NRA), by systematically identifying risk studies, data availability, information needs and requirements, skills and expertise, institutional capabilities, DRR strategy, etc. CSA produces a baseline for the monitoring and evaluation of the DRM progress in a country.

The specific objectives of a CSA are to:

- Understand the current situation of disaster risk assessment and its use in policy and decision making in the country;
- Identify and evaluate what is already done to avoid duplication of efforts and to build on what already exists;
- Engage main stakeholders, generate demands, and ensure support and participation;
- Facilitate the development of national strategy and action plan for conducting Disaster Risk Assessment (DRA);
- Initiate the National Risk Information System through the compilation and integration of the "good" studies.

1.2 Expected Outputs of the Project

The expected outputs include:

- A synthesis report on the country situation in Disaster Risk Assessment and its use in decision/policy making in Moldova
- A comprehensive catalogues of risk assessment studies/projects, publications and reports on risk assessment, data sources (carriers), data and information systems, organizations and institutions

[5]Moldova Disaster and Climate Risk Reduction Project, UNDP, 2011

related to risk assessment, as well as key professional expertise and skills, which can be accessible through an online e-Library[6];

- A set of recommendations and suggestions for implementing Disaster Risk Assessment in Moldova, including strategy, action plan, possible national coordination mechanism and stakeholder engagement.

This CSA report will provide a detailed description of current status, issues and challenges, strengths and weaknesses of the available national risk assessment information, as well as a set of recommendations and suggestions for the national strategy and action plan for implementing DRA towards the development of National Risk Assessment Framework (NRAF). It will also provide essential baselines and critical inputs to the development of an action plan for the national risk assessment, establishment of an institutional framework for national risk assessment and engagement mechanism of all stakeholders in national risk reduction.

[6] http://www.gripweb.org - An Innovative platform and Tool for Information and Knowledge Sharing, based on the concept "Centralized integration, but personalized consumption of risk information and knowledge". With GRIPWeb's iPortal tool, users of GRIPWeb can readily tailor and pack the contents available at GRIPWeb in terms of their own needs to be integrated in their own online systems. GRIPWeb provides an unprecedented opportunity to:

• Collect and access risk information at all levels –regional,national and sub-national – as well as by sector or theme;
• Generate risk baselines and monitor progress (or lack of it) in disaster risk reduction in the countries;
• Showcase achievements in disaster risk assessment and reduction;
• Join an online community of disaster risk assessment professionals;
• Access publications, methodologies and tools;
• Benefit from a service and support portal for risk related issues.

In particular, GRIPWeb revolutionizes the way countries collect, inventory and use their risk information, including country-specific disaster risk profiles, documents, publications, hazard risk maps and datasets, as well as information on projects and programs. GRIPWeb makes it easy to construct risk information management systems at different geographic and administrative levels, by different organizations or sectors, or by different themes. Through the use of modern information and communication technologies. GRIPWeb not only provides an innovative tool for information and knowledge management, but also aims at empowering people by introducing new ways of working and collaborating.In its way of combining global perspective to local insight, GRIPWeb has a pioneering approach to information sharing.

GRIPWeb has been designed to become the world's de facto risk information source for the whole DRR community.

2 Methodology and Approach

2.1 Methodologies

The CSA project was implemented following a 3-step approach (see Figure 1):

Step 1: Inventory of Institutions and Organizations

Through Internet websites were reviewed all academic institutions and governmental agencies that are related risk assessment and studies on natural disaster hazards, as well as those from which can be obtained basic and intermediate data, documents on risk assessment, and an inventory of trained personnel.

Interviews and Inventory: After detecting the agencies and institutions related to natural disasters (hazard, evaluation and risk analysis), a series of interviews were carried out (Annex 4) to have as much information as possible on their work.

Annex 5, Annex 7, and Annex 8 present the templates based on which were performed the interviews as well as were collected the metadata on all sources of information available on Moldovan DRA and DRM.

Step 2: Detailed review and evaluation.

A detailed assessment of all identified projects, reports, publications, methodologies, experts' knowledge and skills, and institutional capacities was conducted, with the aim to find out data, experts and institutions that may be used in National Risk Assessment. These key data were identified based on the interviews and results of Step 1 described above.

Step 3: Overall Country Situation Analysis

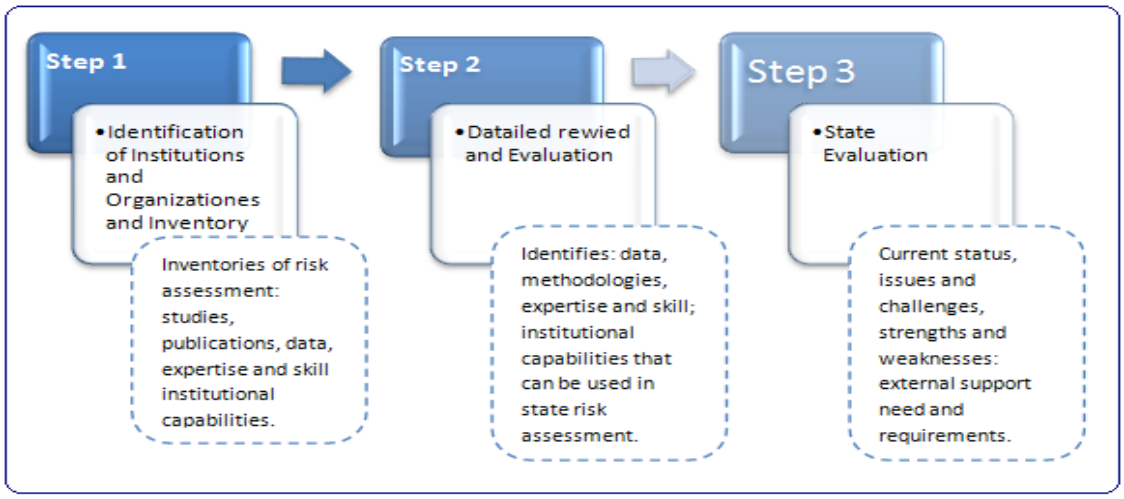
The overall Country Situation Analysis on risk assessment is based on the following characteristics:

- Current status
- Issues and challenges
- Strengthens and weakness
- Needs and gaps

This evaluation is detailed in Chapter 5, and it provides recommendations, which are suggested in Chapter 6.

Figure 2. The CSA process[7]

[7] Project Report on Baja California Situation Analysis (B.C.SA) - Mexico



2.2 Implemented Activities

The project has implemented the following 4 groups of activities:

- Desktop review
- Key informant interviews
- Group discussions
- Multi-stakeholder workshops

Literature Review (Desktop Review)

The project team has systemically conducted a literature review of documents related to risk assessments for all hazards with a focus on sudden onset natural hazards, for all scales (regional, national, state/territory, and local) including national/state/territory processes. The literature review is based on a set of specific templates developed by the GRIP team for each type of documents. Gathered information was placed in the e-Library[8].

Personal interview (Key Informants)

Personal interviews were conducted for key informants who are quite familiar with the situation of risk assessment and its application in the country. Key informants have provided orientations, within their capacity, to the situation evaluation.

The approach was a dual one, consisting in finding the appropriate person and finding the respective motivation, as well as involving higher level personnel (where needed) and motivation for the institution/organization to ensure a complete cooperation and dedication.

Gathered information was placed in the e-Library.

Institutional Interview

The interviews were performed in order to obtain a systematic inventory of what an institution or organization has and can use. The interviews were also based on a specific template.

Gathered information was placed in the e-Library.

Advisory teams and Group discussion

[8] http://www.gripweb.org/gripweb/

The CSA process has helped at creating a network of specialists that would cooperate and collaborate with GRIP at forming a sustainable e-Library put at service to all interested persons and develop existing capacities in order for these to be able to respond to their country's needs of Risk management.

In this respect, the Consultants have formed an Advisory working Group based on the previously formed, within the project, working groups. This group is helping in determining the meaning and importance of existing specific materials, as well as takes active part at the drafting of recommendations and comments for further development of the country in the field.

During the course of the evaluation process, a series of group discussions were held in terms of different themes such as earthquake, flood, drought, windstorm, etc. The meetings were held individually, as well as in small groups. Each theme was brainstormed for the follows aspects:

- Risk assessment studies done
- Methodologies suitable for national risk assessment
- Data availability and gaps
- Professional expertise and skills
- Institutional capacity
- Exiting DRR strategy, legal framework, programmes

In addition, group discussions have offered excellent chances for national practitioners to find common ground for all their areas of specialization under the concept of risk assessment.

Multi-stakeholder workshops

National risk assessment is a multi-disciplinary process involving scientists, engineers, socio-economists, public decision/policy makers. The aim of risk assessment is to provide decision makers with better risk information for sound decision making and thus it is especially important to involve key stakeholders in the process from the very beginning so that they can understand the risk situation better. In this context, multi-stakeholder workshops are the best vehicles for stakeholder participation. During the course of situation evaluation, two multi-stakeholder workshops were organized in terms of an analytic-deliberative approach, a decision-driven process interactively linking risk analysts and decision makers[9].

The first multi-stakeholder workshop has helped at the beginning of the assignment right after the detailed work plan for situation evaluation is in place. This was an orientation workshop aiming to explain the purpose, process, and key outcomes of the activity, and seek extensive supports from all stakeholders. Another multi-stakeholder workshop was held at the end of the situation evaluation process, which served as a scoping workshop for national risk assessment project.

The project has been implemented in the following 3 phases:

Phase 1: The systematical identification and inventory of what exists in the country that is related to national risk assessment and management, including the following contents:

- Risk assessment studies that have been done in the country;
- Data that can be used in risk assessment;
- Institutional capabilities;
- Professional expertise and skills existing in the country; and

[9]Stern and Fineberg (1996): Understanding risk – Informing decisions in a democratic society, National Research Council, National Academies Press: Washington, D.C., 264p.

- Disaster management strategies, action plans, policy, laws and regulations, etc.

Phase 2: The organization of 2 national stakeholder workshops to facilitate the multi-stakeholders engagement and the enhancement of national coordination mechanism for Disaster Risk Assessment and its use in decision/policy making; and

Phase 3: Initiation of National Risk Information System (NRIS) by creating an e-Library using GRIP's Countries + Risk Information Portal.

On the basis of the detailed evaluation of the above-mentioned aspects, an overall national situation is given, including current status, issues and challenges, strengths and weaknesses, and external support needs in the context of national risk assessment.[10]

[10] Systematic Inventory and Evaluation for Risk Assessment (SIERA), Methodology and Tools, Version 2.2, GRIP, Geneva, 2010

3 Historic Disaster and Major Hazards

3.1 Historic disasters and their impacts

Moldova is prone to various natural hazards, namely hydro-meteorological hazards (hail storms, early frost onset, droughts, and floods) and geophysical hazards, with the hydro-meteorological hazards becoming more frequent and intense in the last few decades. Average annual losses caused by hydro- meteorological events severely affect the rural population of Moldova, which accounts for around 60% of the total population and depends largely upon agriculture for their livelihood.[11].

According to the disaster data from the s Center for Research on the Epidemiology of Disasters (Luviana University, Belgium), the most frequent natural hazards of hydro-meteorological origin on the territory of the republic are: floods, droughts, and strong winds. In the period 1992-2003, 90% of total dangerous natural phenomena are extreme hydro-meteorological phenomena. The level of climatic extremes manifestation and the evaluation of consequent economic loss are based on the risk probable index which represents the correlation between the frequency of change and the manifestation of probability of the climatic extremes.[12]

A survey of perception of risk, undertaken in March 2006 under the aegis of the WB study on Rural Productivity in Moldova, highlights the ranking of concern in Moldova's rayons (districts) over potential hazard events:

Table 1. Perceived Risk of Selected Key Hazards in Moldova – Ranking

	Drought	Hail	Frost	Seismic	Flood	Landslide	Erosion	Waterlogging
Moldova	1	2	3	4	5	6	7	8
Northern	2	1	3	5	5	7	4	8
Central	1	2	4	6	5	3	7	8
Southern	2	4	3	1	5	6	8	7

Below is presented Table 2 that shows key natural disasters as causes of loss to agriculture and annualized estimates of damage, produced by a group of WB experts in 2007. It should be mentioned that some stakeholders, during the second round of stakeholder consultations, have declared that they do not agree with these data. Still, this information was published by WB in a report of 2007 and this is the most recent data available. No other similar available data has been found from later publishing.

Table 2. Key natural disasters as causes of loss to agriculture and annualized estimates of damage[13]

Natural hazards	Estimated Annual Losses (million MDL/yr)[14]	Losses Measured As	Remarks
Erosion	450	Annual cost of foregone agricultural production due to erosion. PRSP and other sources.	Probably additional costs associated with downstream impacts have not been estimated due lack of data.

[11] The rural population increased in the 1990s as people lost urban jobs and moved away from large towns and cities.

[12] Evaluation of climatic risks manifested on Republic of Moldova territory. Tatiana Constantinov, Maria Nedealcov, Present Environment and Sustainable Development, Nr. 1, 2007

[13] Rural Productivity in Moldova – Managing Natural Vulnerability, WB, 2007

[14] Initially the table provided losses in US dollars, but for the purpose of the report, data was transformed in Moldovan Lei, at the official rate of the National Bank of Moldova from October, 2007. 1 USD = 11.47 MDL

Earthquakes	450	IGS. Assumes that the 1986 earthquake has recurrence of once per 30 years. Estimate includes both direct and indirect damage.	Damage to infrastructure. Frequency unclear but, apparently, not rising.
Drought	Max estimate: 230; min estimate: 18	Net loss in crop production for the country. Estimate is dominated by cost and assumed frequency of the 2000 drought catastrophe. **Low estimate** assumes this was a once per century event, since its impact was more severe because it involved coincidental frosts. **High estimate** assumes catastrophic losses recur once every 7 years, and that frequency may increase due climate change. Consultant and staff estimates.	Damage every few years, intermittently very severe. Rising trend in damage, whether due to climate, infrastructure or reporting not clear.
Severe weather, especially heavy rain, hail, wind and frost	More than 86	Direct damages reported to SCPESS, average 1998-2005. Indirect damage not included. Reported hail damage limited to large events, hence under-estimate considering hail events tend to be small-scale.	Annual significant localized damage to crops and infrastructure. Rising trend in damage reports, reason unclear.
Floods	57 (Acvaproject)	Occur irregularly. Acvaproject data from 1947 to 2000 shows average damage 57 mln/year. Average direct damages reported to SCPESS 1998-2005 (no major floods) 6.5 mln/year.	Annual significant localized damage to crops and infrastructure. Rising trend in damage reports; not clear whether due to climate, infrastructure or reporting.
Landslides	15	SCPESS and AgeoM estimate 15 mln annually.	Annual significant localized damage to crops and infrastructure.

For a comparative study, here is table **Table 3** with data received from SCPESS on natural exceptional situations in Cantemir, Hincesti, Stefan Voda and Gagauzia ATU in 2007 with the material damages resulted.

Table 3. Natural exceptional situations in Cantemir, Hincesti, Stefan Voda rayons and Gagauzia ATU in 2007 with the material damages resulted

Date	Type of ES	Name of rayon and settlement	Material losses (thousands lei)
		Rn. Cantemir	
20-24.03	Strong wind	city Cantemir	154.8
		- s. Cociulia	

		- s. Antoneşti	
		- s. Baimaclia	
		- s. Ciobalaccia	
		- s. Bobocica	
		- s.Haragîş	
		- s. Lingura	
		- s. Plopi	
		- s. Hîrtop	
		- s. Taraclia	
		- s. Pleşeni	
		- s. Tartaul	
		- s. Şamalia	
July	Drought	- s. Antoneşti	106400
		- s. Baimaclia	
		- s. Cania	
		- s. Capaclia	
		- s. Chioselia	
		- s. Ciobalaccia	
		- s. Cîetu	
		- s. Cîrpeşti	
		- s. Cîşla	
		- s. Cociulia	
		- s. Coştangalia	
		- s. Enichioi	
		- s. Goteşti	
		- s.Haragîş	
		- s.Lărguţa	
		- s. Lingura	
		- s. Pleşeni	
		- s. Plopi	
		- s. Porumbeşti	
		- s. Sadîc	
		- s. Stoianovca	
		- s. Şamalia	
		- s. Tartaul	
		- s. Toceni	
		- s. Ţiganca	
		- s. Vişniovca	
		rn. Hînceşti	
21.03	Strong wind	- s. Caracui	28.6
26.06	Strong wind	- s. Mireşti	63.7
		- s. Rusca	
5.07	Strong wind	- s. Dancu	61.1
		rn. Ştefan Vodă	
23-24.03	Strong wind	- s. Copceac	105.3

		- s. Volintiri	
		- s. Căplani	
		- s. Cioburciu	
		- s. Olăneşti	
		- s. Marianca de Jos	
4.06	Torrential rain	- s. Copceac	70
27.06	Torrential rain with big hail	- s. Brezoaia	8006.6
		- s. Volintiri	
		UTA Găgăuzia	
21.03	Strong wind	- mun. Comrat	74.2
		city Ceadîrlunga	
		- s. Joltai	
		- s. Beşghios	
		- s. Tomai	
		- s. Baurci	
		- s. Cioc-Maidan	
		- s. Congaz	
17.06	Torrential rain with Strong wind	city Ceadîr-Lunga	158.7
23.06	Strong wind	city Ceadîr-Lunga	28.8
27.06	Strong wind	city Ceadîr-Lunga	54.6
TOTAL			**115206.4**

3.1.1 Historic Earthquake Disasters

Damage and losses caused by geophysical hazards are also significant. Historic records reveal earthquake damage, for example, in 1940, Chisinau experienced a magnitude 7.4 earthquake (maximum intensity being I=9), in 1977 a magnitude 7.2 earthquake, while the 1986 Vrancea earthquake (M=7.0), caused estimated losses equivalent to US$500 million[15].

Moldova lies in the seismic zone of the Carpathian Mountains, which is the youngest and most seismically active chain in Europe. Every year hundreds of shocks occur, most of which cannot be detected without special equipment. The below Table 5 lists significant earthquakes 1945-2010. However, only four of these earthquakes had significant impact, in 1940, 1977, 1986 and 1990. Similarly, in the 19th century, three important earthquakes took place in 1802, 1829 and 1838. As can be seen, the time distribution is very irregular.

The better documented damaging earthquake of a high magnitude occurred on 30 August 1986. There are various estimates of damages resulting from this event, which were significant in rural areas, but amounted to the most in the capital city of Chisinau. According to the joint Red Cross-SCPESS study on hazard mitigation, the earthquake injured 261 people, of which 45 were hospitalized, and left 1200 people without shelter. Damages amounted to 408 million rubles.[16]

To understand the volume of damage resulted from a significant earthquake, the below **Table 4** lists the physical damages and the equivalent in number of people/million of MDL, of the 1986 earthquake:

[15] Using the prevailing exchange rate: US$1=0.8 ruble. Source: Institute of Geology and Seismology of the Academy of Sciences of Moldova and a joint damage assessment by the international Red Cross and the Department of Exceptional Situations (DES).
[16] Rural Productivity in Moldova – Managing Natural Vulnerability, 2007, World Bank.

Table 4. Physical damages of the 1986 earthquake[17]

Injuries	261
Of Which Hospitalized	45
Homeless	1200
Buildings Damaged	7015
Buildings Destroyed	1169
Damages	6420 million MDL
Compensation of Bereaved Families	8397 million MDL
Minimum Damages and Compensation	14550 million MDL

Sources: Institute of Geology and Seismology of the Academy of Sciences of Moldova; Red Cross Moldova and Exceptional Situations Department of Republic of Moldova, 2005, *Opredelenie uviazimosti rayonov I naselenny v Respublki Moldova k chrezvychainym situatsiiam prirodnogo I tekhnogennogo kharaktera*, pp. 38-39.

Below is presented Table 5 that shows the most intense earthquakes starting 1940. This is official information available at the National Bureau of Statistics of Republic of Moldova. As one can see there is no specific pattern and they all have very close coordinates of the epicenter.

Table 5. Earthquakes of maximum intensity[18]

Date (day, month, year)	***Time by Greenwich, hour/min***	***Coordinates of the epicenter***		***Depth of the hearth, km***	***Magnitude on Richter scale, degrees***
		Northern latitude	*Eastern longitude*		
24.06.1940	09:57	45^{0}90’	26^{0}60’	115	5,9
22.10.1940	06:37	45^{0}90’	26^{0}50’	140	6,2
10.11.1940	01:39	45^{0}80’	26^{0}80’	140	7,4
07.09.1945	15:48	45^{0}90’	26^{0}50’	80	6,8
09.12.1945	6:08	45^{0}70’	26^{0}80’	80	6,5
04.03.1977	19:21	45^{0}77’	26^{0}76’	94	7,4
30.08.1986	21:28	45^{0}52’	26^{0}49’	130	7,1
30.05.1990	10:40	45^{0}83’	26^{0}89’	90	6,9
06.04.2000	0:10	45^{0}75’	26^{0}64’	132	5,0
03.05.2002	18:31	45^{0}58’	26^{0}33’	162	4,6
05.10.2003	21:38	45^{0}64’	26^{0}44’	150	4,8
27.09.2004	9:16	45^{0}07’	26^{0}05’	150	5,2
27.10.2004	20:34	45^{0}78’	26^{0}55’	90	5,8
14.05.2005	1:53	45^{0}60’	26^{0}51’	140	5,3
18.06.2005	15:16	45^{0}68’	26^{0}71’	130	5,4

[17] Initially the table provided losses in US dollars, but for the purpose of the report, data was transformed in Moldovan Lei, at the official rate of the National Bank of Moldova from October, 2005. 1 USD = 12.59 MDL

[18] http://www.statistica.md/pageview.php?l=ru&idc=324&id=2301

16.02.2006	2:49	$45^0$59’	$26^0$72’	100	4,4
06.03.2007	10:40	$45^0$44’	$26^0$63’	100	4,4
14.02.2007	6:56	$45^0$38’	$26^0$34’	150	4,3
15.02.2007	2:32	$45^0$72’	$26^0$81’	100	4,2
21.03.2008	16:18	$45^0$80’	$27^0$17’	30	4,0
07.05.2008	8:00	$45^0$29’	$30^0$90’	20	5,5
06.09.2008	19:48	$45^0$77’	$26^0$56’	20	4,1
25.04.2009	17:18	$45^0$70’	$26^0$66’	100	5,1
05.08.2009	7:49	$43^0$85’	$28^0$39’	30	5,2
08.06.2010	15:16	$45^0$62’	$26^0$38’	110	4,5
30.09.2010	**5:31**	**$45^0$60’**	**$26^0$35’**	**140**	**4,7**

3.1.2 Historic Weather Disasters

Severe weather hazards of many types affect Moldova. **Moldova’s May-to-August storms are by nature very local and very sudden**. These events include torrential rains (often the cause of the flooding of small rivers noted above), hail and heavy winds, sometimes in combination. Even in the absence of river flooding, in most years, Moldova’s torrential summer rains impose a heavier cost of economic damage than any natural hazards except for erosion, as they wash out roads, damage the electric power distribution network, clog wells, and cause other infrastructural damage.[19]

As for hail, Moldova is particularly affected because its climatic zone, situated between the Black Sea and two mountain ranges, has a relative tendency to produce hail conditions. Hail tends to cause severe but strongly localized damage. SCPESS records report total direct hail damages at about US$5.9 during the period 1998 – 2005, but this is an underestimate, in that the SCPESS records are limited to large events and therefore tend to exclude typical hail damage, which is usually localized. [20]

In addition to more severe exposure to meteorological hazards, climate variability, that may be responsible for repeated severe weather patterns, is expected to have dramatic impacts upon Moldova’s economy and environment. Since the 1980s annual air temperature has increased dramatically (about 0.58 °C per decade). Spring precipitation has risen since the 1980s (by around 6 mm per decade), summer precipitation has declined (by over 13 mm per decade), and variability has been amplified in spring and autumn.

3.1.3 Historic Flood Disasters

Despite Moldova's overall dry climate, it is a country with significant flood risks, and as it is seen from historic data - especially along Moldova's smaller internal rivers. The extent of flood damage is not known since local floods are not always registered, and individual victims and private damages may not be recorded. However, US$180 million of losses are attributed to a pair of floods in the early 1990s: one in the Reut River Basin in 1991,

[19] Rural Productivity in Moldova – Managing Natural Vulnerability, 2007, World Bank.

[20] Rural Productivity in Moldova – Managing Natural Vulnerability, 2007, World Bank.

and another in the Calmatsui in August 1994. Altogether, 67 people have died[21] in floods along the small rivers between 1985 and 2000.[22]Table 6 provides the equivalent in millions of US dollars of the flood damages registered that have occurred during 1947 – 2000 years.

Table 6. Flood Damages 1947-2000 By Flood Type (in mln MDL[23])

	Spring Flood	Summer Flood	Torrential Rainfall	Total
Dniester and Prut	245	408	0	653
Internal	0.12	0	2849	2849.12
Total	245	408	2849	3502

Source: Acvaproject Institute, 2000, *Flood Risks in Moldova*.

Heavy rains result in frequent floods (an average of 1.2 per year, 1992-2005), to which 40% of the settled areas in the country are exposed. Floods result in average annual damages of around five million dollars.[24] In 2008 the country experienced severe torrential rains, which together with releases from upstream in Ukraine, led to flooding in both the northern and southern areas of the country. Moldova incurred $120 million in losses from this event.[25]Flooding occurs relatively frequently in the smaller internal rivers, especially in the region of the Carpathian Mountains, and affects approximately 168 settlements (160 000 people).

On smaller rivers, the level of flood protection depends very much on the technical state of the dams and dikes, which are now in need of substantial repair: the safety of small dams is a major area of concern. On Moldova's smaller, internal watercourses, floods are caused by torrential rain within Moldova, and as a result warning times are short. Summer rainfall is especially unpredictable and dangerous, and Moldova's Central zone (Codru) is at greater risk than the Northern one. Flood monitoring points are a controversial issue, as it could be considered that these are relatively few, but there is information about having more, still these points not being appropriately equipped or data collection is problematic, and flood protection infrastructure has been constructed on the more important watercourses only. At the same time this infrastructure is, in general, deteriorating, and so risk is rising, especially because construction has been expanding in at-risk areas; for example, Hincesti, Basarabeasca, Soldanesti, Orhei, and others. Towns in areas of significant risk include Moldova’s largest – Chisinau and Balti, as well as Soroca, Orhei and many others. A map, prepared in 2007, showing the spatial distribution of the flooding risk caused by natural factors is provided below.

[21]It is noteworthy that no deaths were recorded during that period as the result of flooding of the larger Dniester and Prut rivers and, similarly, the financial damage caused by flooding, was incurred primarily from floods on internal watercourses following torrential rainfall.

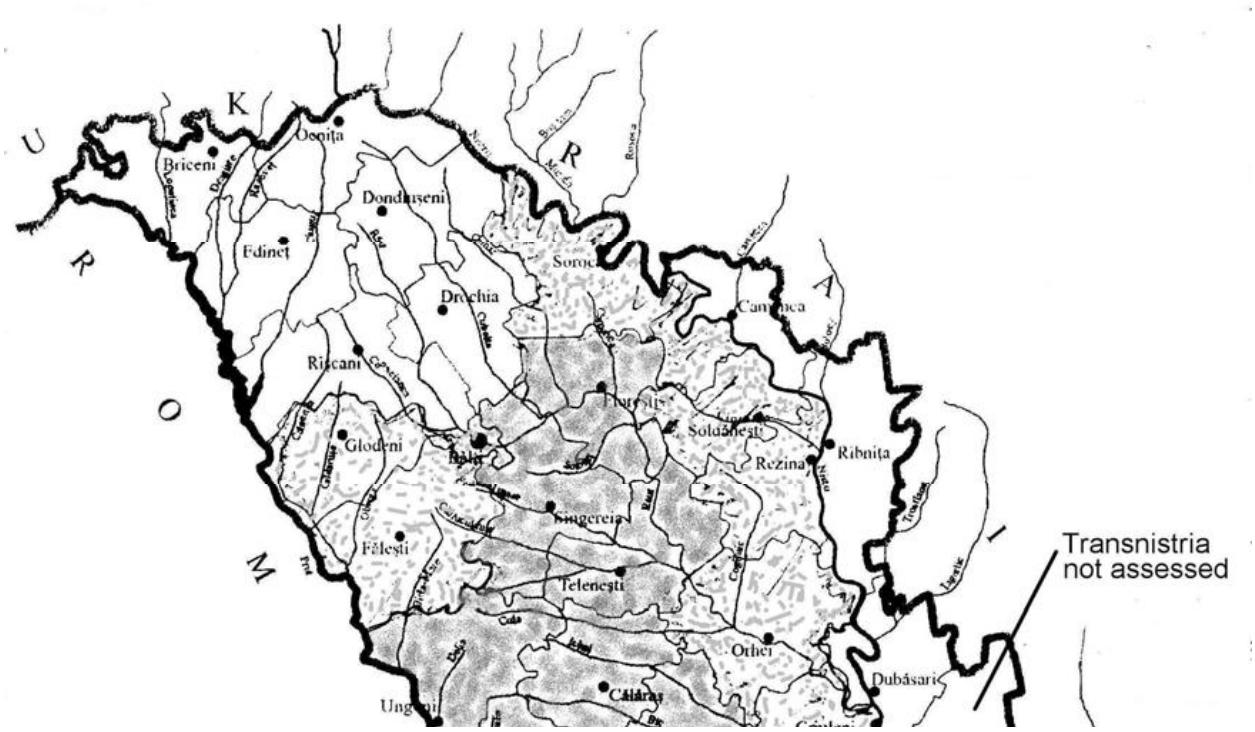
[22]Rural Productivity in Moldova – Managing Natural Vulnerability, 2007, World Bank.

[23]Initially the table provided losses in US dollars, but for the purpose of the report, data was transformed in Moldovan Lei, at the official rate of the National Bank of Moldova from October, 2000. 1 USD = 12.27 MDL

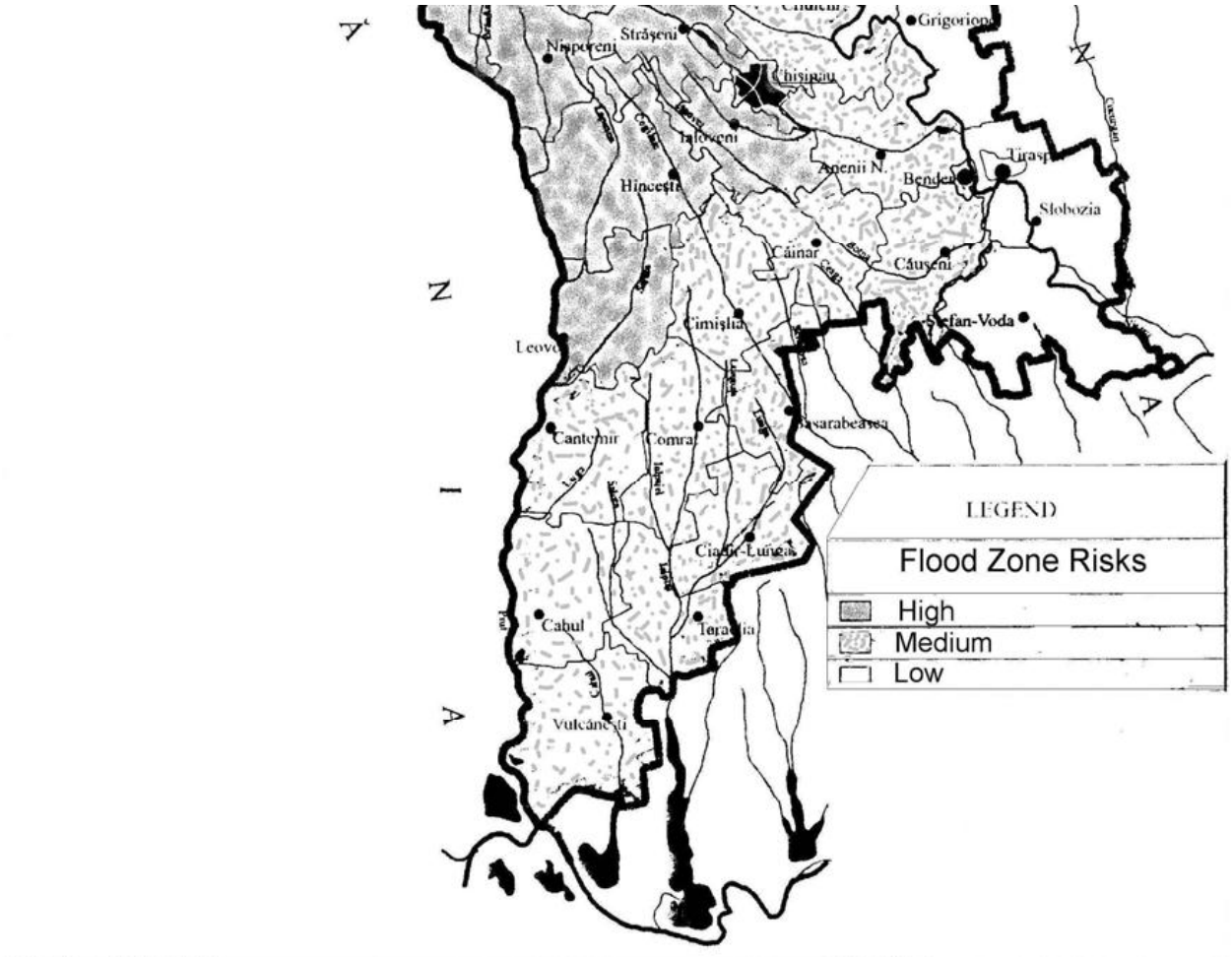
[24]Rural Productivity in Moldova – Managing Natural Vulnerability, 2007, World Bank.

[25] Official estimates.

Figure 3. Risk Zones for Floods Caused by Natural Factors[26]



[26] Rural Productivity in Moldova – Managing Natural Vulnerability, 2007, World Bank.



One of the factors influencing the occurrence of floods, especially on internal small and medium rivers are the dams and reservoirs constructed on the length of these rivers. Below, Table 7 presents the status of legally constructed and approved dams and reservoirs, an assessment made in 2005. It should be noted that this table cannot include illegal dams and reservoirs, which are many, as well as their status.

Table 7. Information on Status of Dams on 01 October 2005[27]

	Rayon, municipality, ATU	Number of Dams Reservoirs	in which			
			In normal Operating condition	In need of Non-Essential repairs	Shows potential Danger of Damage Failure	Proposed for removal from Operational Service
1	2	3	4	5	6	7
1	Total Republic	3804	1706	1673	197	148
2	mun. Chisinau	44	29	10	4	1
3	mun. Balti	19	16	-	3	-

[27] Rural Productivity in Moldova – Managing Natural Vulnerability, 2007, World Bank.

4	Anenii Noi	48	12	31	5	-
5	Basarabeasca	20	20	-	-	-
6	Briceni	211	18	184	7	2
7	Cahul	161	29	121	-	1
8	Cantemir	70	24	18	-	28
9	Calarasi	75	38	28	6	3
10	Causeni	150	7	121	5	17
11	Cimislia	62	3	53	6	-
12	Criuleni	34	19	10	5	-
13	Donduseni	197	192	3	-	2
14	Drochia	158	158	-	-	-
15	Dubasari	5	-	-	-	-
16	Edinet	75	18	46	9	2
17	Falesti	311	139	161	10	1
18	Floresti	93	57	33	2	1
19	Glodeni	212	108	96	-	8
20	Hincesti	88	64	17	3	4
21	Ialoveni	59	10	29	-	20
22	Leova	72	15	50	7	-
23	Nisporeni	66	2	63	0	1
24	Ocnita	238	-	233	0	5
25	Orhei	142	121	-	20	1
26	Rezina	37	1	16	17	3
27	Riscani	277	188	70	18	1
28	Singerei	228	116	93	1	18
29	Soroca	173	171	-	2	-
30	Straseni	43	7	34	1	1
31	Soldanesti	49	10	29	9	1
32	Stefan Voda	109	78	18	9	4
33	Taraclia	14	7	3	-	4
34	Telenesti	99	4	71	14	10

35	Ungheni	120	26	68	23	9
36	UTA Gagauzia	55	5	30	11	-

Flooding on Moldova's transboundary rivers (Prut and Dniester) was eliminated as a significant threat in the past,[28] after being very effectively controlled by infrastructure works undertaken in the 1960s and 1970s.Till recent decades these were considered non problematic. Moreover, flood forecasting is intrinsically easier on the transboundary rivers, because their floods are usually caused by heavy storm rainfall or snowmelt events upstream of Moldova, in the Carpathian mountains. But the situation has changed in the recent years and it is described in more detail in 3.2.1.2.

3.1.4 Historic Drought Disasters

On average, northern Moldova experiences a drought once every 10 years, central Moldova once every five to six years, and southern Moldova once every three to four years.[29]Average annual losses between 1996 and 2004 were around $19 million per year.[30] Abnormally high temperatures and low rainfall over a three-year period resulted in a severe drought in 2007, which crippled Moldova's agricultural sector, resulting in $1.2 billion in losses.[31] The effects of poor nutrition were exacerbated by reduced access to potable water, particularly in rural areas where 45% of the population relies on wells as their main source of drinking water.

The duration of droughts in Moldova varies from a few days to a few months and even to 3 years (e.g. droughts of 1945, 1946 and 1947). In 1990, 1992 and 2003 the droughts lasted the whole vegetation period (April-September). A thorough evaluation of the drought affected area on the territory of Republic of Moldova can be seen in the Table 8 below, segregated by season, indicating the percentage of affected area as well as the level of drought that has occurred, during the period 1945 - 2007.

Table 8. Evaluation of drought affected area on the territory of Moldova[32]

[28] averaging damage of about US$30 million annually (this assessment was done by the WB in the 2007 report).

[29] Drought has become more frequent and intense during the last two decades, appearing nine times (1990, 1992, 1994, 1996, 2000, 2001, 2003, 2007), leading to significant crop losses. In 1990, 1992, 2003, and 2007 drought was observed during the entire vegetative season. In the remaining years drought struck during summertime.

[30] The Moldova International Red Cross and the CPESS of Moldova, 2005, Opredelenie uyiazvimosti rayonov I naselennyh punktov Respubliki Moldova k chrezvychainym situatsiiam prirodnogo I tekhnogennogo kharaktera.

[31] National Hydro-meteorological Service and Ministry of Agriculture and Food Industry.

[32] "Hazardelenaturale", volumul 3, colectiaMediulGeografic al republicii Moldova, autoricoordonatori: ValeriuCazac, Ilieboian, Nina Volontir. Chisinau, Stiinta 2008

Year	Spring		Summer		Autumn	
	affected area (%)	type of drought	affected area (%)	type of drought	affected area (%)	type of drought
1945	-	-	60	catastrophic	40	extreme
1946	100	catastrophic	33	extreme	-	-
1947	39	extreme	-	-	60	catastrophic
1948	-	-	-	-	60	catastrophic
1949	60	catastrophic	-	-	20	extensive
1950	33	extreme	-	-	20	extensive
1951	60	catastrophic	40	extreme	-	-
1953	-	-	40	extreme	60	catastrophic
1954	-	-	73	catastrophic	25	very large
1960	-	-	53	catastrophic	13	extensive
1963	40	extreme	7	local	93	catastrophic
1965	-	-	47	extreme	80	catastrophic
1966	47	extreme	7	local	60	catastrophic
1967	60	catastrophic	40	extreme	93	catastrophic
1968	93	catastrophic	7	local	-	-
1969	7	local	47	extreme	73	catastrophic
1970	-	-	-	-	93	catastrophic
1973	20	extensive	53	catastrophic	87	catastrophic
1975	-	-	7	local	87	catastrophic
1981	7	local	53	catastrophic	-	-
1982	60	catastrophic	-	-	93	catastrophic
1983	20	extensive	13	extensive	93	catastrophic
1985	27	very large	-	-	73	catastrophic
1986	100	catastrophic	13	extensive	100	catastrophic
1990	7	local	67	catastrophic	60	catastrophic
1992	27	extensive	60	catastrophic	40	extreme
1994	87	catastrophic	40	extreme	100	catastrophic

1996	68	catastrophic	49	extreme	44	extreme
2000	75	catastrophic	55	catastrophic	49	extreme
2003	86	catastrophic	61	catastrophic	26	very large
2007	78	catastrophic	77	catastrophic	-	-

It is a phenomenon that is very difficult to qualify and describe. It is sometimes defined in absolute terms (e.g., so many weeks with no rain) and sometimes in relative terms (e.g., rainfall below 50% of average). Alternatively, it is also commonly defined in terms of water management for the purpose of agricultural production: a drought occurs when agricultural production has suffered from lack of water. Drought in that sense is highly dependent upon the possibility of accessing supplementary water, e.g., from irrigation. To add to the complication, droughts have different magnitudes and geographical coverage, from ordinary drought to exceptional ones, from local to national ones.[33]

In any case, following Table 8, one can see the trend of increasing number of catastrophic droughts in all seasons, and especially during summer time, as well as the percentage of affected area is increasing. Thus, more and more of the country territory is affected as the climate changes. (See subchapter 3.3 for future climate scenarios)

The year 2007 was the warmest in the history of instrumental observations in Moldova. Air temperature records were broken in winter, spring, and especially in summer. The warm period was extremely hot and dry. Practically all temperature records have been exceeded while precipitation shortage was all-round (see Table 9 below with a detailed description of the respective year).

Table 9. Weather records of 2007[34]

Date	Record description
	Air temperature
Winter **2006-2007**	Winter 2006-2007 was the warmest for all period of instrumental observations. Average air winter temperature over the territory amounted 0.9-2.8oC, or 4.1-4.6oC above the norm.
Spring	Seasonal mean air temperature in Moldova: 11-13oC or by 2-3oC higher than normal.
23-24 May	*Mean daily* temperature: 24.1oC in Briceni and 27.5oC in Făleşti (23.05) – by 1-4oC higher thanobserved maximums for this day; 21.9oC (Ceadir-Lunga) and 27.5oC (Soroca, Ribniţa) – 1-5oChigher than observed maximums for 24.05 in central and north regions. *Maximal* daily temperatures: 31.5oC (Briceni) and 35.5oC (Ribniţa, Bravicea) – here and in other places (Camenca, Bravicea, Cornești) reached or exceeded by 0.7-1.0oC the May absolute maximum temperatures for all observation period.
25-27 May	*Mean daily* temperatures in the Centre and South were registered between 21.9oC (Briceni) and26.6oC (Făleşti) – by 1.6oC higher than abs historic values for these days. *Maximal daily* air temperature: 30oC in Briceni and 36oC in Dubăsari; in Dubăsari it has

[33] Rural Productivity in Moldova – Managing Natural Vulnerability, 2007, World Bank.

[34] Source: Bugaeva T. & T. Mironova, 2007: Caracterizarea condiţiilor meteorologice şi agrometeorologice din vara anului 2007. Available at: http://www.meteo.md/newsait/vara07.htm; Recorduri meteorologice din 2007. Available at: http://www.meteo.md/newsait/nsrecord.htm.

		reached and in Ribniţa exceeded by 0.5oC the abs maximal temperature in May
Summer		Seasonal mean air temperature over the territory amounted up to 21.0–24.7oC, exceeding the "normal" value by 2.4-3.8oC. On the most part of territory such temperatures were observed for the first time. May-July period was by 3-4°C higher the norm – ***record.***
June 1st decade		*Mean decadal* temperature in Moldova amounted 19.9-23.5oC, or 2.7-4.3oC higher than normal; in some places (Soroca, Bravicea, Bălţata, Chişinău, Tiraspol, Dubăsari) it exceeded record values for all period of observation.
15-17 June		*Daily mean* temperature in Moldova reached 21.5-27.2oC – an absolute record. *Maximum* temperatures in some regions (Camenca, Bravicea, Dubăsari, Ştefan-Vodă, Tiraspol)were 34-35oC, or 0.2-0.4oC above absolute maximum for 2nd decade of June.
26 June		Absolute maximum of this day temperature in Moldova (39.5oC, Făleşti) – 1.5oC higher than previous value. In the South (33.2oC in Ceadir-Lunga and 37.7oC in Leova – 0.1-1.9oC more that the highest absolute maxima for June.
19 July		Maximal temperature – 41oC (Tiraspol, Ialoveni) – new absolute maximum for Moldova.
21 July	The hottest period	Maximal temperature – 41.5oC (Camenca) – new absolute maximum for Moldova.
20-23 July		*Maximal* temperatures (39.5-41.1oC) in Făleşti, Ribniţa, Cornești, Bravicea, Dubăsari, Tiraspol, Ştefan-Vodă, Comrat – 0.4-2.1oC higher than their absolute summer maxima.
23 July		The highest July minimal air temperature – 26.5-26.7oC (Chişinău, Ceadir-Lunga).
24 July		*Degree-days sum*, accumulated for continuous period without precipitation, amounted 10000-15000oC – the highest for all observations period.
July		***The warmest month for all period of instrumental observations in Moldova.*** Mean monthly temperature amounted 24.0-26.0oC, or above 3.7-4.8oC above the normal.
25 August		Maximal temperature – **40.5oC** (Tiraspol) – absolute maximum for August in Moldova.
Season		*Duration of days with heat*: ≥30°C – 45-60, or 3-4 times higher than the norm; ≥35°C – 15-22 against1 (norm); ≥40°C – 5 (for the first time).
		Precipitation
May-June		6-50**%** of normal values
April-June		48-68 days of relative humidity ≤30%: for the first time and 3-4 times less than norm.
Season		*Precipitation sum*: mainly 35-170 mm, or 35-80% of the norm. *Duration of rainless period (days):* in the North – 30-75; in the South – 80-110 days; mean unbroken duration – 20-40 days that is observed one time per 20 years, maximal – 52 days in the South.
		Unfavorable weather events
Season		Practically over all territory there were observed squalls (up to 24 m/s), hail (up to 20-30 mm in diameter), heavy rains and thunderstorms.

3.1.5 **Historic Landslides / erosion Disasters**

In Moldova, 43.7% of settlements are threatened by landslides, and they are increasing every year. Landslides are mainly linked to subsidence from large construction works and widespread deforestation, rather than heavy rainfall events. They are relatively slow-moving and not a major contributor to morbidity or mortality. Most damages are related to local displacement, which may result from damage to buildings and other assets, and loss of cropland. Average annual losses from them amount to $1.3 million.[35]

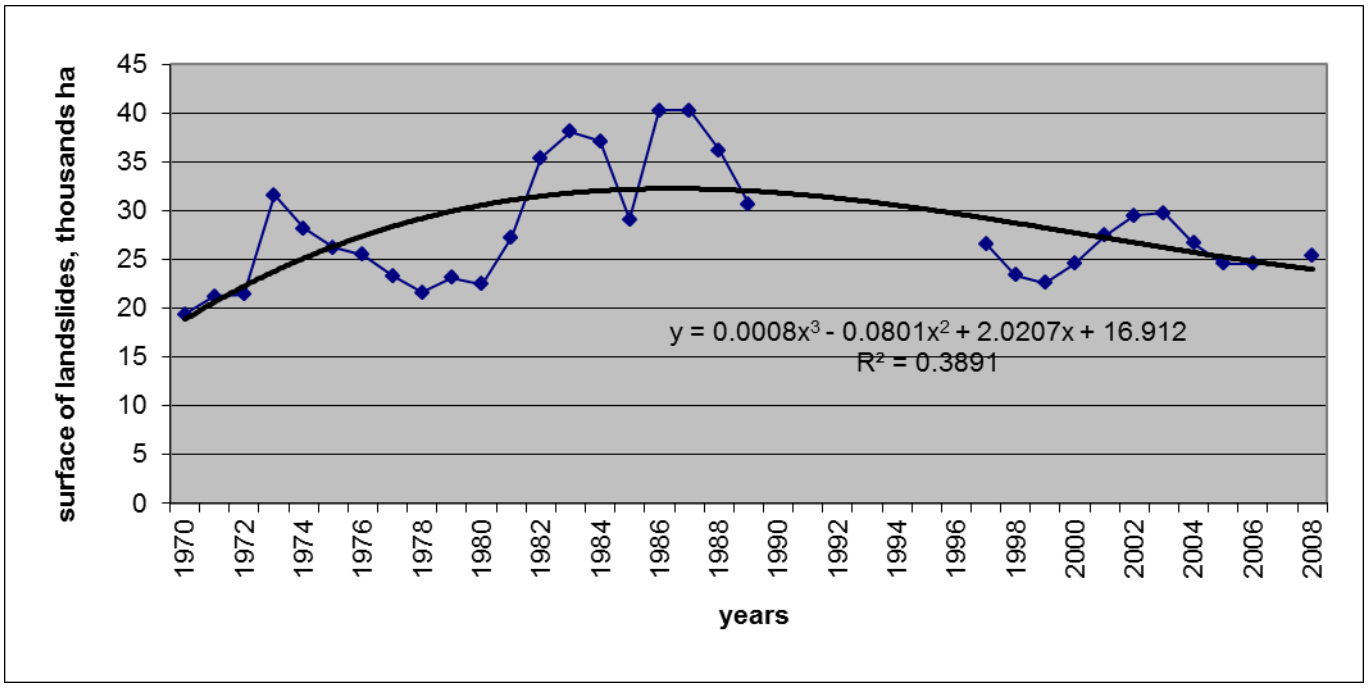
The country is subject to erosion driven by water and by wind, an on-going process that results in irreversible damage to the agricultural resource base, as well as downstream impacts. Moldova's chernozem soils, the country's principal natural resource and historically the key to its economy, are becoming eroded and losing fertility. Most of Moldova's soils, originally of loess origin, are relatively deep, but organic matter content is concentrated in the uppermost one meter where it is vulnerable to erosion. Water erosion occurs as sheet erosion triggered by overland runoff, or as the sequence rill-gully-ravine by which tracts of land are eaten out at increasing width and depth, and wind erosion plays a role in Moldova's southern zone. The rate of erosion depends on four factors: (i) erosivity of rainfall; (ii) topsoil properties; (iii) slope gradient and length; and (iv) land use, cover, and management. Moldova's risk is naturally elevated by the first three factors: high-intensity torrential rains are common; the silty topsoil is highly erodible (more so in drought conditions), and Moldova's terrain is hilly with long slopes.

About 43% of the agricultural land of Moldova is eroded to some degree, with about 6.4% considered "highly eroded". Annual loss of soils ranges from 5 to 10 tons per hectare for slightly eroded land to over 30 tons per hectare for highly eroded soils.

The evolution of landslides in Republic of Moldova is pictured very well by the graphic presentation below (Chart 1). It comprises the situation starting 1970 till 2008. By the medium line in chart we can deduct that landslides are affecting less surfaces in the current years than they did in the 70's – 80's, that can be considered an improvement. Still, it is needed the data of the current years and some well drew maps to have a final conclusion on this issue. In any case, financial damages from landslides still exist and the risk related to this natural hazard needs more response from the authorities, especially at local level.

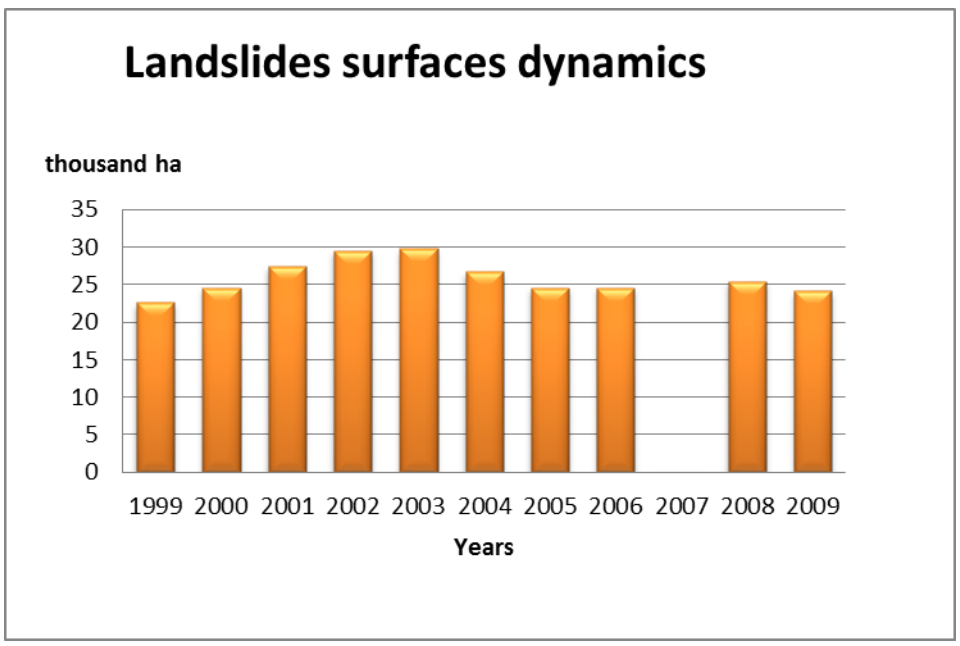
Chart 1.Evolution of landslides surfaces in Moldova 1970-2008

[35] V.A. Osinok, A.P. Sudarev, and E.N. Sheremet (Gosudarstvenoe Agentsvo po Geologii Respubliki Moldova "AGeoM"), 2006, Monitoring opasnykh geologicheskikh protsessov na territorii Moldovy.



The below chart provides an overview of the surfaces affected by landslides over the past decade. As it can be seen the evolution is quite stable, but no major improvement.

Chart 2.Landslides surface dynamics for 1999 – 2009 years



Economic losses are evaluated in the national currency and provided for the 1996 – 2005 years, along with the number of landslides in Table 10A below. In Moldova, in most cases erosion and landslides are studied together. Thus, in part B of the table is presented the range of economic losses, as it is presented in the literature, with regard to surface erosion, ravines and landslides.

Table 10. Economic Loss Due to Landslides

A. Economic loss due of landslides (1996-2005)[36]		
Year	Number of landslides	Costs (Lei)

[36] SDES

1996	17	750,000
1997	64	960,000
1998	90	44,000,000
1999	197	44,000,000
2000	2	150,000
2001	1	3,300,000
2002	2	27,200
2003	4	270,000
2004	6	2,822,100
2005	2	399,000
Average	39	9,667,830

As the Table B below shows, the literature presents a range of estimates of the economic costs of erosion. This report conservatively bases the estimate of the economic costs of erosion on the on-site impact of foregone agricultural production, which is estimated by ISA to be US$40 million per year. [37]

B. Ranges of economic loss from literature[38]		
Source	**Loss**	**Due to**
ISA, PRSP	629-2518 M Lei/yr	Surface erosion
TACIS Prut River	944 M Lei/yr	Surface erosion
PRSP	1500 M Lei/yr	Surface erosion
Land already wasted	4670 M Lei	Ravines
(ISA)	88 M Lei/yr	Ravines
PRSP	200 M Lei/yr	Ravines and landslides
PCF Baseline study	105 M Lei/yr	Landslides
SCPESS (Table A)	10 M Lei/yr	Landslides
PRSP	1400 M Lei/yr	Production loss
PCF Moldova	667 M Lei/yr	Production loss

Table 11[39] below presents the status of Moldova's land and the magnitude of the trend toward deterioration. It should be noted that the eroded area increases by about 7,700 ha per year on average.

[37] An analysis of the costs of Soil Erosion in the United States found that about 75% of costs were due to on-site losses, and that the most significant component of erosion cost is the loss of soil nutrients ("Environmental and Economic Costs of Soil Erosion and Conservation Benefits", *Science Magazine* Vol. 267, Feb. 1995).

[38] Initially the table provided losses in US dollars, but for the purpose of the report, data was transformed in Moldovan Lei, at the official rate of the National Bank of Moldova from October, 2005. 1 USD = 12.59 MDL

Table 11. Key Features of Soil Erosion in Moldova (2005)

	Non Eroded	Slightly Eroded	Moderately Eroded	Highly Eroded	Total
Agricultural Land ('000 ha)	1,211	511	255	135	2,112
Annual Change in Eroded Agricultural Land ('000 ha)	- 7.7	+ 2.6	+ 1.0	+ 4.1	
% of land in the Country in 2005	57.3%	24.2%	12.1%	6.4%	100.0%
Average Annual Losses of Soils per hectare eroded		5-10 tons	10-20 tons	20-30 tons	
Losses in soil fertility		< 20%	20-40%	40-60%	
Annual Average Total Losses of Soils (million tons)					about 26

Source: ISA: data collected and analyzed by the mission (2006).

3.2 Major Natural Hazards

Given the prominent place of agriculture in Moldova's economy, risks affecting rural areas and agriculture further undermine the country's resilience to economic shocks and setbacks. Key risks to rural livelihoods are ongoing erosion, which is causing irreversible damage to Moldova's farmland, and severe weather, including drought, flooding, heavy summer storms, hail, and frost, which reduces the productivity of agriculture and damages rural infrastructure. Landslides are a significant but lesser threat. [40]

There are several major hazards that have a serious impact on Republic of Moldova, which can divided into 2 hazard groups –meteo-hydrological hazards and geological hazards. The meteo-hydrological hazards include floods, draughts, storms, and extreme temperatures while the geological hazards are earthquakes, landslides, and soil erosion.

The study made by the WB in 2007 "Rural Productivity in Moldova – Managing Natural Vulnerability" established the following ascertainment: "The frequency and intensity of meteorological events is increasing in the context of climate change. Moldova also is highly prone to earthquakes may cause disastrous damage and loss to infrastructure in the next few decades. Landslides are a significant, but lesser threat. "The major hazards affect different sectors quite differently due to their nature of origin and the characteristics of the targets.

Thus, Moldova being an agricultural country, this is the area most affected by meteorological hazards, having severe impacts on rural areas and agricultural sector that further affects the country's resilience to disasters, as well as its capacity to respond in time to disaster prevention and mitigation. Soil erosion is a major threat to rural livelihoods, causing irreversible damage to Moldova's farmland. Severe weather events, e.g. drought, flood, rainstorms, hailstorms, and frost, reduce the productivity of agriculture and damages rural infrastructure.

Still, soil erosion and landslides result in continuous damage to the main resource the republic has – the land, annual rain storms and hail causing transient damage, frequent deadly floods, occasional serious drought, and catastrophic earthquakes approximately thirty years apart that significantly damage the infrastructure and may result in loss of life.

[39] Rural Productivity in Moldova – Managing Natural Vulnerability, 2007, World Bank.

[40] Rural Productivity in Moldova – Managing Natural Vulnerability, WB, 2007

3.2.1 Meteo-hydrological hazards

3.2.1.1 Severe weather events

The severe weather events represent one of the following weather events or a combination of two or all three of them:

- Rainstorm
- Hailstorm
- Frost
- Wind storms

Based on the available data from the SCPESS here are the exceptional situations happened in Moldova during the 2007 year.

Table 12. Statistic INDICES regarding the number of exceptional situations in Republic of Moldova in 2007(A) and 2010-2011 (B)

A. Class and type of exceptional situation	Nr of ES	Human losses		Material losses (thousands of lei)
		Deaths, including children	hospitalized	
TOTAL	**150**	**19/4**	**174**	**1237950.1**
Technogenic ES, including:	**118**	**16/4**	**18**	**1013.8**
- finding unexploded munitions	110			
- accidents (catastrophes) on roads	4	10/2	12	337
- sudden collapse of apartment buildings	1	1/1	2	9.9
- finding sources of very dangerous chemical substances	1			
- explosions in buildings	2	5/1	4	666.9
Natural ES , including:	**27**	**3**	**42**	**1236933.3**
- wet snow bonding	1			3856.9
- strong winds	4	1		2295.7
- frosts	1			5371
- strong storms with lightening	2	2		
- big hail	6			43958.8
- drought	1			1002090.8
- torrential rains	5			10050.3
- fire of cereal land	3			219.2
- torrential rains with strong wind	1			200.5
- torrential rains with strong wind and big hail	2			168890.1
- very high temperature	1		42	
Bio-social ES, including:	**5**		**114**	**3**

- human flu epidemics	1	19	
- rare cases of contagious rare illnesses extremely dangerous for agricultural animals	1		3
- human intoxication with food	2	61	
- cases of group infection of contagious illnesses	1	34	

Nr.	Type of exceptional situation	Nr	*Deaths, including children*	Traumatized, including children	Material losses (thousands of lei)
1	2	3	4	5	6
1.	finding unexploded munitions	215			
	Finding or losses of exposable substances or munitions	4			
3.	In bbuilding explosions, insluding explosion in houses built for living or for sociocultural activities	2			56,4
	Open air Explosions	1	2/2		
5.	Accidents at drinking water supply systems of the population	1			
	accidents on roads	1	5/-		40,7
7.	Accidents on crossroads with rail transport	1	8/2	15/2	80
		225	15/4	15/2	177,1
Natural ES , including:					
	Strong wind	3			1735,4
1	2	3	4	5	6
	Big hail	23			40589,4
3.	Torential rain	12			21796,3
	Torential rain with hail	15			23864,8
5.	Torential rain with strong wind	1			7604,7
	Long term rain	1			160
7.	Torential rain with hail and strong wind	3			23161,2
		58			118911,8
Bio-social ES, including:					
	human intoxication with food	**3**		57/5	
Total		**3**		57/5	
		286	**15/4**	**72/7**	**119088,9**

An attentive overview of the Table 13 below immediately reveals an increase in the average monthly speed of wind. A slight increase is in the north – Briceni region, the center of the Republic – Chisinau region suffers from a quite significant increase in average monthly speed of wind, and the south – Cahul region, has a slight decrease in wind speed. It could also be noted that the daylight duration also is increasing. It could be concluded that this is a sign of changing climate in the region and it should be taken into account while making prognosis for short, medium and long terms. But also it would need a more thorough study of the issue.

Higher speed of winds will affect especially the land, because most of it is used in agriculture and there are great territories that are not protected by afforested lines, thus susceptible for erosion. Also, the increase in daylight influences the temperature making it grow, and reduce the humidity – factors that need to be taken into consideration as they also have a great influence on how strong the erosion can be.

Table 13. Average monthly wind speed for the 2007-2010 years

WIND SPEED, DURATION OF DAYLIGHT

	Meteorological station and observation years											
	Briceni (North)				Chişinău (Center)				Cahul (South)			
	2007	2008	2009	2010	2007	2008	2009	2010	2007	2008	2009	2010
Average monthly wind speed, m/s												
January	2,8	3,2	1,8	2,3	2,2	2,2	3,1	3,2	4,1	3,7	3,4	3,9
February	3,0	2,4	1,8	3,2	1,9	2,0	3,3	3,6	4,6	3,7	4,0	4,3
March	3,4	2,8	2,5	2,8	2,1	2,2	3,1	3,6	4,7	4,4	3,9	4,1
April	2,5	2,6	2,7	2,8	1,9	1,9	3,8	3.0	3,4	4,1	3,8	3,6
May	2,3	1,9	2,2	2,4	2,0	2,8	3,0	2,9	4,1	3,2	3,5	3,1
June	1,7	1,7	2,1	2,1	1,8	2,6	3,1	3,2	3,2	2,7	3,1	3,2
July	1,5	2,1	1,9	1,6	1,9	3,4	3,0	2,8	3,7	3,1	3,0	2,6
August	1,2	1,6	1,4	1,7	1,6	2,9	3,4	2,8	3,3	2,9	3,2	2,9
September	1,8	1,7	1,5	2.0	1,8	3,2	2,6	2,7	3,4	3,3	2,9	3,1
October	1,6	1,9	2,1	2,2	1,5	2,9	2,6	3.0	2,8	3,1	3,0	3,6
November	2,6	2,5	2,7	2,6	2,1	3,1	2,8	3,3	3,8	3,3	3,1	3,4
December	2,3	2,8	2,6	2,3	1,8	3,8	2,7	3,1	3,3	4,3	3,2	3,1
Annual average wind speed, m/s	**2,2**	**2,3**	**2,1**	**2,3**	**1,9**	**2,8**	**3,2**	**3,1**	**3,7**	**3,5**	**3,8**	**3,4**
Duration of daylight, hours	**1791**	…	…	**1874**	**2320**	**2188**	**2327**	**2226**	**2031**	…	…	**2207**

Table 14. Maximum wind speed

Maximum wind speed, m/s													
Briceni (North)													
Year	**Month**	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**	**XI**	**XII**	**Max**
2007		23	16	18	19	13	15	12	11	13	14	16	13	23
2008		24	15	17	16	18	14	13	15	11	13	14	16	24
2009		12	12	18	15	18	15	14	11	16	14	14	17	18
2010		12	15	15	18	14	14	20	15	15	13	15	17	20
2011		13	26	18	21	14	17	12	12	16	15	19	13	26
Chişinău (Center)													
Anii		**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**	**XI**	**XII**	**Max**
2007		17	14	17	15	14	16	20	12	13	11	15	14	20
2008		17	14	17	19	18	21	19	20	16	18	17	16	21
2009		18	16	16	15	20	22	22	17	21	16	12	15	22
2010		14	19	15	14	15	15	14	15	14	13	15	17	19
2011		11	24	19	23	17	18	13	16	13	14	17	11	24
Cahul (South)													
Anii		**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**	**XI**	**XII**	**Max**
2007		28	21	22	18	19	23	17	18	17	16	25	18	28
2008		19	16	21	18	16	19	14	18	17	18	16	19	21
2009		17	17	19	16	18	18	19	14	13	14	16	16	19

2010		14	21	17	16	17	18	15	13	14	14	16	17	21
2011		14	20	16	24	17	22	13	17	13	16	13	14	24

Source: The State Hydrometeorological Service

Several types of severe weather events affect Moldova, but the largest share of damage is caused by convective events from May to August, and by May frosts. The May-to-August storms are by nature very local and sudden: hail, torrential rains causing floods on small rivers, and strong winds. As for flood risk mitigation, these very damaging events highlight Moldova's need for improved forecast capacity able to resolve and provide warning of sudden local events. Relatively small incremental investments, primarily in forecasting workstations, would be required for a focus on storms (as distinct from flooding). To forecast May frosts, warnings would also require microclimate mapping. The WB report in 2007 has concluded that "hail risk mitigation via anti-hail rockets is expensive and the benefits are uncertain. Hence further expansion of the service is not advocated. However, reconfiguring the existing anti-hail radar coverage could greatly assist high resolution weather forecasting capacity to help mitigate the impacts of severe weather as well as flooding."[41] After consulting stakeholders, it was found that the positions with regard to the hail protection are diverse and need a more thorough, separate study.

The IPCC Glossary defines *an extreme weather event* as "an event that is rare within its statistical reference distribution at a particular place". Criteria of "rarity" vary from place to place and are normally calculated as rare as (or rarer than) the 10th or 90th percentile values. Following this criterion, in the Chişinău baseline climate 27.1°C could be considered as an extreme mean summer maximum temperature *(Tmax)* and 33.9 °C – as extreme absolute maximum temperature. Since the 1980s, these thresholds have increased to 28.2 °C and 35.3 °C, respectively, and while in 1961-1990 the mean summer Tmax never exceeded its 99% extreme threshold (28.4 °C), this has been already exceeded in the current climate (30.2 °C) and is likely to be exceeded on several occasions in the future. In particular, by the end of the 21st century *Tmax*could increase by 6.4 °C on average for two emissions. The last figure is close to the upper limit of European regional estimations for Moldova.[42]Table 15, Table 16, and Table 17 provide the absolute monthly and annual minimum values, absolute monthly and annual maximum, and monthly average for air temperature during 2007-2010 years, respectively. The biggest contrast is observed with the annual minimum values –a continuous increasing during the four years.

Table 15.The absolute monthly minimum for air temperature during 2007-2011 years

AIR TEMPERATURE (absolute monthly and annual minimum values)															
															Celsius degrees
	Meteorological station and observation years														
	Briceni (North)					Chişinău (Center)					Cahul (South)				
	2007	2008	2009	2010	2011	2007	2008	2009	2010	2011	2007	2008	2009	2010	2011
January	-10,7	-18,6	-14,9	-27,4	-17.7	-9,1	-15,3	-12,1	-21,8	-16.0	-8,4	-17.0	-10,6	-21,2	-15.1
February	-18,1	-12,4	-8,7	-14,9	-13.8	16.0	-9,8	-6,6	-11,8	-12.1	-15,8	-9,7	-5,7	-10,7	-11.3
March	-2,1	-3,4	-8.0	-10,4	-13.6	-0,3	-0,7	-6,2	-8,8	-9.1	-1,8	-0,2	-5,5	-8,7	-10.7
April	-0,5	0,9	-0,2	1,7	0.7	0,6	3,2	1,9	2,9	1.2	1,9	3,1	1,2	3,4	1.9
May	-2.0	4,5	3,9	7,5	3.1	3,3	6,3	7,3	9,3	4.3	4,1	6,6	8,2	8,5	4.9
June	10,4	1,5	8,4	9.0	10.1	14,2	8,8	11,1	12,7	11.5	13,4	8,8	11,8	10,6	12.1
July	11,4	10,9	10,4	13,3	8.4	12,6	13,7	13,9	13,9	10.6	12,3	12,7	15.0	14,5	12.6
August	9,8	8,9	9,2	7,9	9.5	13,5	10,2	13,5	11,8	13.2	11,6	10,2	13,1	12,7	11.9
September	3,6	4,8	5,5	5,8	5.5	8,2	4,8	8,8	7,8	8.1	5,9	5,1	7,2	8,4	9.4
October	-0,3	0,8	-2,6	-3.0	-5.2	1,9	2,8	-1,1	-2.0	-2.2	2,6	3,6	0.0	-2,5	-2.2

[41]Rural Productivity in Moldova – Managing Natural Vulnerability, WB, 2007

[42]UN National Human Development Report 2009/2010

November	-7,9	-5,9	-3,6	-6,3	-7.1	-4,9	-5,5	-3,3	-0,9	-4.6	-4,9	-3,8	-5,2	0.0	-5.7
December	-11,9	-13,3	-19,7	-13,6	-9.6	-8,8	-11,9	-16,8	-12,1	-7.8	-9,8	-12,3	-16,7	-10,7	-7.6
Absolute annual minimum value	**-18,1**	**-18,6**	**-19,7**	**-27,4**	**-17.7**	**-16.0**	**-15,3**	**-16,8**	**-21,8**	**-16.0**	**-15,8**	**-17.0**	**-16,7**	**-21,2**	**-15.1**

Table 16.The absolute monthly maximum for air temperature during 2007-2011 years

AIR TEMPERATURE (absolute monthly and annual maximum values)															*Celsius degrees*
	Meteorological station and observation years														
	Briceni (North)					Chişinău (Center)					Cahul (South)				
	2007	2008	2009	2010	2011	2007	2008	2009	2010	2011	2007	2008	2009	2010	2011
January	13,1	10,4	6,0	3,6	9.0	13,5	9,6	8,7	11,3	9.1	15,0	9,5	11,5	15,4	9.0
February	8,0	18,2	13,0	6,7	13.0	15,8	19,1	13,9	13,3	13.4	16,2	19,3	14,9	14,1	8.1
March	19,0	17,5	15,3	21,3	18.5	20,0	20,5	18,2	20,6	20.4	22,0	20,9	19,9	21,1	21.6
April	23,4	21,5	24,0	22,7	22.8	21,1	21,8	22,9	22.0	22.6	23,2	23,9	23,5	22,5	22.4
May	32,0	27,5	29,3	26,6	28.9	34,2	26,5	28,5	25,9	29.7	32,9	27,5	28,6	28,9	29.2
June	33,8	30,8	31,4	32,3	32.0	35,4	32,1	34,5	34,1	31.4	36,6	33,7	34,0	33,8	32.7
July	35,6	32,2	33,5	32,5	33.3	39,5	33,5	36,3	32,8	33.6	39,4	33,5	37,9	32,4	34.8
August	34,7	34,0	31,6	35,3	30.5	39,1	37,5	33,7	36,6	31.3	38,4	37,9	34,4	36,8	31.6
September	24,8	30,0	29,2	24,7	29.6	27,6	32,6	32,6	26,4	32.3	27,8	32,5	32,5	28,1	33.3
October	23,0	22,5	25,4	14,1	24.9	24,3	23,7	26,0	15,4	26.6	24,8	24,6	25,7	16,4	27.5
November	9,4	18,4	15,6	20,9	11.9	11,0	19,9	18,4	22,8	12.9	11,6	22,0	18,6	23.0	14.0
December	7,4	15,4	11,6	9.0	11.8	9,2	16,2	14,2	13.0	14.3	10,0	17,0	16,0	16.0	16.7
Absolute annual maximum value	**36,6**	**34,0**	**33,5**	**35,3**	**33.3**	**39,5**	**37,5**	**36,3**	**36,6**	**33.6**	**39,4**	**37,9**	**37,9**	**36,8**	**34.8**

Table 17.The monthly average for air temperature during 2007-2010 years

AIR TEMPERATURE (monthly and annual average)												*Celsius degrees*
	Meteorological station and observation years											
	Briceni (North)				Chişinău (Center)				Cahul (South)			
	2007	2008	2009	2010	2007	2008	2009	2010	2007	2008	2009	2010
Monthly average												
January	2,5	-2,4	-2,8	-7,4	3,9	-1,5	-0,1	-5,2	3,7	-1,3	-0,1	-4,2
February	-1,2	1,2	-0,2	-2,9	0,5	2,3	1,5	-0,9	1,9	2,7	2,0	0,1
March	6,4	5,0	2,4	3,1	7,1	7,2	3,9	4.0	7,2	8,1	4,8	4,8
April	9,3	9,9	11,1	10,3	10,6	11,0	12,2	11.0	10,9	11,7	11,8	11,6
May	17,5	14,4	15,1	16,2	18,9	15,5	16,6	16,8	18,7	15,8	16,8	17,2
June	20,2	19,0	19,1	19,4	23,2	20,9	21,7	21.0	23,2	20,9	21,6	20,7
July	21,9	19,8	21,4	21,8	25,8	22,2	24,0	23,3	26,0	22,2	24,4	23,2
August	20,8	20,5	19,7	22,4	23,9	23,8	22,3	24,9	23,8	24,2	22,7	24,9
September	14,5	13,6	16,7	13,9	16,7	15,5	18,7	16,1	16,4	16,2	18,4	17,1
October	9,3	10,5	9,2	5,9	11,3	12,4	11,5	7,5	11,9	12,7	12,3	8,6
November	1,1	4,0	5,4	8,2	3,0	5,1	6,5	10,3	3,7	6,0	7,1	11,1
December	-1,7	0,5	-2,1	-4,3	-0,4	1,3	-0,1	-2,1	-0,3	2,6	0,0	-0,7

Annual average	**10,1**	**9,7**	**9,6**	**8,9**	**12,1**	**11,3**	**11,4**	**10,6**	**12,3**	**11,8**	**11,8**	**11,2**

3.2.1.2 Floods

Moldova's large transboundary rivers, Prut and Dniester, make it easier to forecast floods since it may be caused by heavy storm rainfall or snowmelt events upstream of Moldova in the Carpathian upper watersheds. Moreover, the Prut, Dniester and Bic rivers have been effectively controlled by infrastructure works undertaken in the 1960s and 1970s. However, flooding of the larger rivers have potentially catastrophic impacts as it was shown by the 2008 and 2010 events, and especially should flood control infrastructure fail. The Government should invest in flood control works; however, until such strengthening has occurred, systems aimed to provide dam-break alerts should be a high priority for installation. In 2007 the World Bank has estimated the cost of dam-break alert systems for Moldova's four major dams as of US$3 million.[43]

Priorities for flood risk mitigation include improving hydrological forecasting and ensuring the safety of selected small dams. The 2007 World Bank study considers that most damaging floods in Moldova are those of its small internal rivers, which are caused by local storms. These rivers are not well controlled by infrastructure or natural watershed vegetation. The propensity of small dams to fail during major storms is such that flood risk may be increased by the dams' presence.[44] Also the presence of illegal dams and artificial lakes should be taken into account as these increase the risk of flooding. The later events in 2008 and 2010 have demonstrated that improvement is needed even in the case of bigger rivers. Flood mitigation would also require the capacity to relay information immediately to the authorities who would need to act on it. As the above mentioned 2007 WB study describes, radars currently in use with the anti-hail service could be configured to support nowcasting capacity, and also contribute to European radar mosaics.

Moldova does not have enough financial resources to implement the primary technological adaptation measures needed to address the expected water variability, such as dams and dykes. Considerable external funding would be needed for these measures to be successful. Comprehensive and efficient implementation of Moldova's "Strategy on the modernization and development of communal water supply and disposal systems in the settlements of the Republic of Moldova" and the "Concept of national water resources policy" would be an important first step towards addressing Moldova's water situation.

The "Framework regulation on using communal water supply and disposal systems" needs to be improved in many ways, including establishing rules for up-stream and down-stream users and for force majeure situations. Given Moldova's limited financial resources, introducing new crops and agricultural practices, together with reduced use of flood plains in crop production, would provide some relief from expected climate-related water stress.[45]

The precipitation picture is quite complex (Table 18). There is a change in the direction of some trends: from a decrease to an increase in spring, and from an increase (about 6 mm per decade) to a decrease in last thirty years (above 13 mm per decade) – in summer. For autumn-winter and annual precipitation the previous slight increase is continuing.[46]

Table 18.The monthly and annual quantity of precipitations during 2007-2010 years

ATMOSPHERIC PRECIPITATIONS (monthly and annual quantity)	
	Meteorological station and observation years

[43] UN National Human Development Report 2009/2010

[44] Rural Productivity in Moldova – Managing Natural Vulnerability, WB, 2007

[45] UN National Human Development Report 2009/2010

[46] UN National Human Development Report 2009/2010

	Briceni (North)				Chişinău (Center)				Cahul (South)			
	2007	2008	2009	2010	2007	2008	2009	2010	2007	2008	2009	2010
January	29	27	32	62	44	26	25	86	41	14	32	35
February	41	19	32	40	62	6	26	62	27	2	21	43
March	21	27	40	23	34	36	63	29	44	33	48	29
April	18	127	9	34	37	48	3	45	21	47	18	23
May	62	54	24	109	19	43	33	69	25	49	49	82
June	88	37	95	205	27	63	39	85	37	95	20	121
July	121	212	41	196	4	51	68	67	0	43	34	146
August	91	71	34	38	34	31	33	53	105	20	20	25
September	42	89	4	76	26	75	22	46	39	46	41	31
October	46	46	67	45	71	16	30	69	49	22	35	80
November	38	29	23	56	60	16	9	40	63	13	13	20
December	21	35	44	76	62	55	95	83	66	60	74	64
Annual quantity of precipitations, mm	**618**	**773**	**445**	**960**	**480**	**466**	**446**	**734**	**517**	**444**	**405**	**699**
Number of days with 0,1 mm and over of precipitations	**131**	**146**	**132**	**159**	**114**	**107**	**122**	**134**	**95**	**114**	**101**	**140**
Relative air humidity, %	**73**	**76**	**71**	**76**	**64**	**70**	**68**	**74**	**67**	**71**	**68**	**73**

3.2.1.3 Droughts

Drought risks affect especially the agricultural activity, which is the main activity in Republic of Moldova and it can be mitigated through adoption of appropriate agricultural practice and crop varieties, through improved weather forecasting and response, and through irrigation in specific limited areas. Insurance schemes may provide options for spreading risk in future. It should be taken into account the fact that based on a long term analysis, as well as on several scenarios of climate change the drought element will be more persistent.

Usually, separate consideration of temperature and precipitation change is insufficient to represent new humidity conditions and the two should be incorporated into certain complex indices. Indicators of new humidity conditions – *Potential Evaporation (PE)* and *Aridity Index (AI)* – were calculated and expressed, using statistical and graphical approaches. According to both scenarios, Moldova faces a change for the worse in its territory's humidity conditions. Annual decrease of precipitation, against a temperature increase, stimulates a strong humidity deficit. *Potential Evaporation* is likely to increase by 15-20 per cent over the first time horizon and practically twice – by the end of this century, with the harder climate change expected.[47]

The study performed in the UN NHDR 2009/2010 shows that it is evident that Moldova is moving towards a dryer climate, from insufficiently wet and wet subhumid zones to dry subhumid and semiarid zones.

The precipitation picture is more complex. There is a change in the direction of some trends: from a decrease to an increase in spring, and from an increase (about 6 mm per decade) to a decrease in last thirty years (above 13 mm per decade) – in summer. For autumn-winter and annual precipitation the previous slight increase is continuing.[48]

[47] UN National Human Development Report 2009/2010

[48] UN National Human Development Report 2009/2010

3.2.2 **Geological hazard**

3.2.2.1 Earthquake

Moldova has a high risk of earthquakes, which could cause catastrophic damage to infrastructure at any time in the next few decades. Historically, most earthquake events that had impacts on Moldova originated from the Vrancea region of Romania, as shown in Table 19. Moldova is hit by an intense earthquake once every a few decades. It has been predicted that there is a stress accumulating in the Vrancea region and a strong earthquake may occur in the near future.[49]

Table 19.The list of most intense registered earthquakes in the Republic of Moldova during 1940-2008 years

Date (day, month, year)	*Time by Greenwich, hour/min*	*Coordinates of the epicenter*		*Depth of the hearth, km*	*Magnitude on Richter scale, degrees*
		Northern latitude	*Eastern longitude*		
24.06.1940	09:57	45^{0}90’	26^{0}60’	115	5,9
22.10.1940	06:37	45^{0}90’	26^{0}50’	140	6,2
10.11.1940	01:39	45^{0}80’	26^{0}80’	140	7,4
07.09.1945	15:48	45^{0}90’	26^{0}50’	80	6,8
09.12.1945	6:08	45^{0}70’	26^{0}80’	80	6,5
04.03.1977	19:21	45^{0}77’	26^{0}76’	94	7,4
30.08.1986	21:28	45^{0}52’	26^{0}49’	130	7,1
30.05.1990	10:40	45^{0}83’	26^{0}89’	90	6,9
06.04.2000	0:10	45^{0}75’	26^{0}64’	132	5,0
03.05.2002	18:31	45^{0}58’	26^{0}33’	162	4,6
05.10.2003	21:38	45^{0}64’	26^{0}44’	150	4,8
27.09.2004	9:16	45^{0}07’	26^{0}05’	150	5,2
27.10.2004	20:34	45^{0}78’	26^{0}55’	90	5,8
14.05.2005	1:53	45^{0}60’	26^{0}51’	140	5,3
18.06.2005	15:16	45^{0}68’	26^{0}71’	130	5,4
16.02.2006	2:49	45^{0}59’	26^{0}72’	100	4,4
06.03.2007	10:40	45^{0}44’	26^{0}63’	100	4,4
14.02.2007	6:56	45^{0}38’	26^{0}34’	150	4,3
15.02.2007	2:32	45^{0}72’	26^{0}81’	100	4,2

[49] Harmonization of seismic hazard in Vrancea zone, Anton Zaicenco, Iolanda Craifaleanu, Ivanka Paskaleva, NATO Science for Peace Project SfP-980468, 2009

21.03.2008	16:18	$45^0 80'$	$27^0 17'$	30	4,0
07.05.2008	8:00	$45^0 29'$	$30^0 90'$	20	5,5
06.09.2008	19:48	$45^0 77'$	$26^0 56'$	20	4,1
25.04.2009	17:18	$45^0 70'$	$26^0 66'$	100	5,1
05.08.2009	7:49	$43^0 85'$	$28^0 39'$	30	5,2
08.06.2010	15:16	$45^0 62'$	$26^0 38'$	110	4,5
30.09.2010	**5:31**	**$45^0 60'$**	**$26^0 35'$**	**140**	**4,7**

3.2.2.2 Landslides and soil erosion

Landslides can occur as shallow slumps (1-2 meters), where reforestation could be used as an effective means of containment, and on deeper slumps (up to 25 meters), where hydro-technical an engineering measures may be more appropriate. Landslides in Moldova do not take the form of mudflows, and move at speeds not exceeding 2-3 meters/day. Their size can be anywhere in the range 50 m^2 – 10 km^2. The danger they pose concerns local displacement, which may do damage to buildings and other assets. The Frequency of Landslide Distribution of the Ecological State Map shows the most severely affected area: the area between Nisporeni, Calarasi and Balti, western Rezina District, and the area north of Cahul (Tigheci hills). About 30,000 hectares are severely affected by landslides. This most-affected area is expanding by about 1000 hectares/year.[50]

Table 20. Status of Land Degradation, Including soil erosion, ravens and landslides

A. Ranges given for landslides	**Number**	**13,000-17,000**
Affected area	acc. to Literature	20,000-50,000 ha
	acc. to Ecological	Map24,500-30,000 ha
	Average from Map	10-30 per 100km2
	PCF Baseline Study	1 per 200 ha agric. land
	"Destroyed" area	8,423 ha
B. Ranges given for ravines	Number	75,000
Affected area	acc. to Ecological Map	8,000-12,500 ha
	Average from map	10-20 per 10km2
	State Ecol. Inspectorate.	800 km2
	State of Environment	20046200 'active
C. Ranges given for erosion		
Affected area	acc. to Literature	8,000-14,000 km2
	ISA, PRSP	26 million tons/yr

Table 21. Loss of soil and associated carbon loss by region for 1995[51]

[50] Rural Productivity in Moldova – Managing Natural Vulnerability, WB, 2007

[51] Bulletin of ecopedological monitoring. 1996. 3rd Edition, Chisinau

REGION	Eroded area	Soil loss	Humus loss	Soil loss	Humus loss	Carbon loss
	000 ha/ yr	000 tons/yr	000 tons/yr	tons/ha,yr	tons/ha,yr	kg/ha,yr
North	652.4	3880.6	115.0	5.9	0.176	102
Central	289.9	9828.0	255.5	33.9	0.881	511
South- East	103.6	740.8	21.2	7.2	0.205	119
South	384.9	7694.9	214.8	20.0	0.558	324
TOTAL	1430.8	22144.3	606.5	15.5	0.424	246

Table 22. Land Degradation Trends in Recent Decades

A. Growth rates from literature		
Landslides	500-2300 ha/yr	
Ravines	1000 ha/yr	
Erosion	0.86%/ yr	
Erosion- PCF Moldova Baseline	1.5%/yr	10,000 ha

B.Erosion trends[52]	1975	1995	2005	1995-2005
		000 ha		Ha change/yr
Non-eroded	1457	1288	1211	-7700
Slightly eroded	342	485	511	2600
Moderately eroded	213	245	255	100
Strongly eroded	100	94	135	4100
TOTAL	2112	2112	2112	

C.Activation of landslides[53]	1970	1980	1990	1995	1996	1997	1998	1999	2000	2001
Number of activation cases	n/a	n/a	n/a	13	57	121	126	268	98	65
Administrative regions	n/a	n/a	n/a	8	10	14	14	14	12	5
Area affected (000 ha)	21.2	48.6	79.3	n/a	n/a	n/a	n/a	n/a	84.0	n/a

[52] Cerbari and Leab (ISA), undated. The process of soil degradation in Moldova

[53] PCF Moldova Baseline Study, 2003

Economic costs due to landslides are hard to evaluate but quite limited. There are an estimated 15,000 to 16,000 sites in the country subject to slow landslides, i.e. top soil progressively sliding along the slopes over the years (Table 22). Being slow, the process does not put human lives at risk. Forestry or pasture land is mostly affected: estimates vary from 30,000 ha (according to the Institute of Geology and Seismology of the Academy of Sciences) to 83,000 ha according to the Geological Agency. Between 1970 and 2004 there was a steady growth in the number of (active) landslides by an estimated 1,000 ha per year. The central portion of the country is especially threatened by landslides, with density of 30-50 per 100 km^2 in most areas and over 50 in many. [54] (Table 20)

It is established that the damages produced by landslides: a. affected productivity of the land itself, and b. affected property, which economically is much greater than the before mentioned point a.

It should be noted that though the SCPESS has a list of places susceptible for landslides (at least for Chisinau municipality) and verifies the installations responsible for preventing landslides, they are not responsible for the maintenance and repair works of these installations, nor they have financial or human resources to do this. In this case, without having the necessary care, the respective equipment is used and out of date and it time will be destroyed completely. The destruction of this equipment will trigger landslides to start and the potential consequences are unknown. [55]

Erosion, at the same time affects greatly the whole territory of the Republic, from the physical point of view, as well as from the economical one, as it actually reduces the natural capacity of the land and the loss of the fertile surface level of soil – humus that is practically impossible to recover. It should be taken into account that it is scientifically proved that 1 mm of this complex organic substance resulting from the breakdown of plant material needs about 100 years to be formed (Table 21). Thus, it is imperative for Moldovan Government to adopt specific measures that would stop or at least reduce the erosion.

3.3 Future scenarios

The climate projections for Moldova in this Report are based on the models used for the UN National Human Development Report 2009/2010 that represent a range of coupled atmosphere-ocean General Circulation Models (GCMs).[56] The results of six GCM experiments based on the A2and B2 marker scenarios of the Special Report on Emission Scenarios (SRES) for three time-slices (2010-2039; 2040-2069; 2070-2099) served as a basis for downscaling.

These models (Table 23) suggest that annual mean air temperature in Moldova will increase under both emission scenarios. By the end of this century the increase may amount, on average, to 4.1-5.4 °C. Depending on the GCM experiment, these values vary from 1 °C to 6 °C. Along with warming, a continuous annual fall in summary precipitations is expected, especially for the A2 emissions scenario.[57]

Table 23.Projections of annual mean air temperature (T) and precipitation (P) changes in Moldova in comparison with baseline values (the first line) and averaged by six GCM, for three time horizons and two SRES emission scenarios[58]

Time horizon	T, °C		P, mm	
	A2	B2	A2	B2
1961-1990	9,2		555	

[54] Rural Productivity in Moldova – Managing Natural Vulnerability, WB, 2007

[55] Informative note of the SCPESS of Chisinau municipality from May5, 2012 with regard to the activity of the Department for Emergency Situations of Chisinau Municipality during the period of time June 1, 2011 – June 1, 2012. No. 509 from May 5, 2012

[56] Such models are used as a research tool for studying and simulating the climate, and for operational purposes, including monthly, seasonal and inter-annual climate projections.

[57] NHDR 2009/2010

[58] NHDR 2009/2010

2010-2039	1,7	2,0	-9	-17
2040-2069	3,4	3,2	-38	-11
2070-2099	5,4	3,2	-64	-23

An interesting overview and projections are presented by Table 24 and Table 25, as it actually shows current state and expected changes, by SRES scenarios, which thus can be compared and .

Table 24.Ensemble-averaged projections of seasonal air temperatures and precipitation relative changes (%) in comparison with baseline climate[59]

3.4 Season	3.5 Emission scenarios	3.6 Mean air temperature, °C				3.7 Precipitation sum, mm			
		Time horizons							
		1961-1990	**2010-2039**	**2040-2069**	**2070-2099**	**1961-1990**	**2010-2039**	**2040-2069**	**2070-2099**
Winter	SRES A2	-2,1	1,9	4,0	5,7	107	7,5	11,4	10,4
	SRES B2		2,2	3,5	4,4		8,5	13,6	15,5
Spring	SRES A2	9,5	13,2	26,8	43,2	130	4,4	6,0	5,5
	SRES B2		18,6	25,3	32,7		6,4	12,3	11,6
Summer	SRES A2	19,8	9,3	19,7	32,9	207	-7,8	-19,3	-30,2
	SRES B2		11,8	18,3	23,8		-13,2	-16,7	-22,6
Autumn	SRES A2	9,8	17,8	34,3	55,4	110	-6,07	-16,0	-17,6
	SRES B2		19,3	34,0	42,3		-6,2	-6,1	-6,8

Table 25. Projections of absolute (Abs) and relative (%) changes in humidity conditions[60]

Parameter		Time horizon and emission scenario						
		1961-1990	2010-2039		2040-2069		2070-2099	
			A2	B2	A2	B2	A2	B2
		Annual						
Potential evaporation	Abs, mm	787	126	158	258	238	420	307
	%		16,0	20,1	32,6	30,2	53,1	38,9
Aridity Index	Abs, mm	0,71	-0,11	-0,14	-0,22	-0,18	-0,30	-0,22
	%		-15,5	-19,7	-31,0	-25,3	-42,2	-31,0

[59] NHDR 2009/2010

[60] NHDR 2009/2010

Vegetation Period								
Potential evaporation	Abs, mm	686	105	135	221	205	366	266
	%		15,3	19,7	32,2	29,9	53,3	38,8
Aridity Index	Abs, mm	0,55	-0,10	-0,12	-0,19	-0,16	-0,27	-0,20
	%		-18,2	-21,8	-34,5	-29,1	-49,1	-36,4

A very easy to read projection is presented in Table 26 giving a clear view over the expected increase in maximum temperature.

Table 26.Mean values and different probabilities of observed and projected summer (June-July-August) maximum temperatures at Chisinau weather station[61]

Period	Mean maximum						Absolute maximum					
		Range		Percentile, %				Range		Percentile, %		
	Mean	Max	Min	90	95	99	Mean	Max	Min	90	95	99
1961-1990	25,6	28,1	23,6	27,1	27,6	28,4	32,0	29,0	34,1	33,9	34,4	35,5
1981-2008	26,4	30,2	23,6	28,2	28,6	29,6	32,9	29,2	38,0	35,3	36,0	37,2
2010-2039	28,0			29,8	30,3	31,2	34,7			37,0	37,7	40,0
2040-2079	29,9			31,7	32,2	33,1	36,8			39,2	39,8	41,1
2070-2100	32,0			33,8	34,3	35,2	39,1			41,5	42,2	43,4

Possible Climatic Scenarios for the RM for the period till 2100 are provided in the Second National Communication of Moldova as it follows:

"Air Temperature.

According to the climatic models, chosen to identify the climatic scenarios for the RM during 2010-2100 time series, the development patterns of the monthly temperature averages have shown some clearly pronounced changes under all three applied models. The negative temperature averages for the winter months may become a thing of the past already in the late 60s of the 21st century. In a similar way, all the climatic models used have yielded the results showing a more significant growth of the monthly temperature averages for the winter months as compared to that for the summer months.

[61] NHDR 2009/2010

The projected heat resource development patterns have demonstrated that the annual air temperature averages will register an increase of 1.7-1.9º temperatures averages to the year 2039. During 2070-2099 the air temperature averages will grow considerably in spring and summer, as well as in winter.

Annual air temperature in Moldova will increase in any case, as it is shown by both emission scenarios applied. Thus, by the end of this century the increase may amount, on average, to 4.1tury th. The days typical for winter period will disappear in the Central and Southern zone by 2100. In the North the number of days typical for winter period will decrease at least by half and reach 50-52 as compared to the 105 days registered for the climate during the reference period (1961-1990). The resultant effect will be a higher number of the days typical of autumn, spring and summer. Thus, summer will be 25-40days longer in the Central and Southern zone and at least35-53 days longer in the Northern zone.

Precipitations.

The projected precipitation levels have fluctuated depending on the season as well as the particular climatic model applied to make the forecast. The analyzed scenarios have shown that the annual precipitations will grow by 107.71 mm under the HadCM2 model and by 51.81 mm under the CSIRO-Mk2 model, but decreasing by 48.61 mm under the ECHAM4 model by the year of 2100. The development pattern of the precipitation levels has yielded considerable differences throughout the year. Thus, the growth will be more pronounced during the winter months (December-February) and in spring (March-May) under the scenarios, which have yielded the growing pattern of the annual precipitation averages. All the applied climatic models have yielded the reduced monthly precipitation averages for summer (August) and autumn (September-November) already by 2040.

Heat Insurance.

The indicator characterizing the level of insurance with heat was assumed to mean the length of the periods with the average daily air temperatures above 0oC, 5oC, 10oC and 15oC and their cumulated temperature.

The respective values were modeled for the RM's 3 zones (North, Centre and South) for the next 100 years, using this approach as well as the actual data registered in the RM during the reference period (1961-1990) and CSIRO-Mk2, Had-CM2 and ECHAM4 models. The assessment performed for RM's Central zone show that the length of the period with the average daily temperatures above 5ºC varied within the range of 220 days in the North and 235 days in the South for the reference period (1961-1990).

The results yielded under the climatic models show that such periods would be longer in the future on the total territory of the RM. By the year 2099 such periods will be by 29-67 days longer in the Centre zone. The length of the period with such temperatures determines the duration of the vegetation period for the majority of the cultivated crops and wild species in the RM.

An increased length of such period will result in longer vegetation periods for such species. It has been demonstrated that the periods with the average daily temperatures above 5ºC, 10ºC and 15ºC would also become significantly longer. To be noted, that the cumulated temperatures determine the specific spreading areas for diverse species of plants, animals and insects, which may impact on the Republic of Moldova' s economic, social and environmental situation.

The obtained results show that a pronounced pattern of the significant cumulated air temperatures growth will persist during the next 100 years for the days with the temperatures above 0ºC, 5ºC, 10ºC and 15ºC. Already by 2039 the sum of biologically active temperatures will grow by 429ºC and 479ºC and make 3174ºC and 3224ºC in the North of the RM for the days with the averages above 10ºC under CSIRO-Mk2and HadCM2 models; the respective values will constitute 431ºC and 3226ºC under the ECHAM4 model. By the year of 2099 the sum of biologically active temperatures for the days with the averages above 10ºC will be within the range of 3763-4175ºC in the North of the Republic of Moldova and as high as 4379-4715ºC and 4472-4861ºC respectively in the Central and in the Southern zone.

Humidity.

According to the used model, most of the RM's territory is characterized currently with dry or sub-humid climate (0.50≥K≤0.65). Certain areas in the South-East have semi-arid climate (K≥0.48), and the Northern zone and the areas with altitudes above 350-400 meters above sea level have sub-humid and humid climate (K≥0.65). The conclusions made after the analysis of the obtained results have shown that the climate aridization process may accelerate considerably on the territory of RM in the future. Thus, already in the early 2040s that process would intensify noticeably as compared to the period of 1961-1990. That phenomenon will be more pronounced during June to October. By 2100 the climate aridization will be felt during the total plant vegetation period (April to October); it will be much more pronounced and may result in the values characteristic of the semi-arid climate (K= 0.21-0.50). All the climatic models applied for the assessment purposes have demonstrated that the aridity would be higher as compared to 1961-1990, and in August those levels can achieve even the values characteristic of the arid climate(K = 0.05-0.20).

In Moldova the characteristic of the arid climate is determined by the hydro-thermal coefficient (HTC[62]) that ranges from 1.2 in the North to 0.7 in the South-East of the country, i.e. registers the values characteristic of the moderately dry climate in the former case and of the dry climate in the latter case. The assessment of that index has shown that the insufficiency of moisture would become more pronounced in the future as compared to the climate of the reference period. Thus, by 2100 the growing evaporation rates caused by higher temperatures will result in an increase.

During 2010-39 precipitation is expected to rise in winter (10-20%) and spring (3-4%) and decrease in summer (4-6%) and fall (5%). Precipitation events are expected to become more sporadic and intense, leading to more severe and frequent droughts and floods (even on major river systems). Potential evaporation is projected to rise by 15-20%, thereby reducing soil moisture. Aridity will increase significantly, transforming much of the country into dry sub-humid, semi-arid, and (in the south) arid zones. Reduced soil moisture in turn may lead to more destructive landslides and amplify the secondary impacts of earthquakes.[63]

4 Country Situation

4.1 Institutional framework

The table below provides the list of organizations involved in the DRR and DRM procedures and the risk category for which the respective organization is responsible for.

Table 27. Risk category and the organization/institution/agency responsible for it

№	Risk categories	Organizations/institutions responsible
1	**Earthquakes**	Institute of Geology and Seismology of the ASM
2	**Landslides, erosion**	Institute of Ecology and Geography Agency for Land Relations and Cadastre (INGEOCAD) State hydro-geological expedition Agency for Geology and Mineral Resources Agency "MoldSilva"
3	**Climate change, meteorological**	Eco-TIRAS International Environmental Association of River Keepers Institute of Ecology and Geography Ministry of Agriculture and Food Industry State Hydro-meteorological Service

[62] when the value of that index is 1.0 it means that the amount of the precipitations is equal to the amount of the evaporated moisture

[63] Republic of Moldova, Ministry of Environment and Territorial Development, 2000, First National Communication of the Republic of Moldova under the United Nations Framework Convention on Climate Change, pp. 42-46; UNDP, 2009, Climate Change in Moldova: Socio-Economic Impact and Policy Options for Adaptation. National Human Development Report 2009/2010.

		Climate Change Office
4	**Drought**	Institute of Ecology and Geography Ministry of Agriculture and Food Industry State Hydro-meteorological Service
5	**Irrigation, water management**	Fisheries Service Eco-TIRAS International Environmental Association of River Keepers Aquaproiect, aqueducts systems design Institutes Apele Moldovei Agency
6	**Floods**	Aquaproiect, aqueducts systems design Institutes State hydro-geological expedition State Hydro-meteorological Service Civil Protection and Emergencies Situation Service Apele Moldovei Agency
7	**Ecological and technogenetic hazards**	Fisheries Service Institute of Ecology and Geography State hydro-geological expedition Eco-TIRAS International Environmental Association of River Keepers
8	**Epidemics, viral**	Ministry of Health of Moldova
9	**Complex risks**	Civil Protection and Emergencies Situation Service Red Cross Ministry of Labor and Social Protection Ministry of Finance

Note: Annex 10 provides the full list of state and non-governmental organizations with a description of their responsibilities related to Risk Assessment

The World Bank report on Rural Productivity in Moldova – Managing Natural Vulnerability, issued in May 2007, provides a description of the institutional framework valid till today. It is as follows:

"The ***Ministry of Agriculture and Food*** (MAFI) collects data concerning damages to agriculture by natural disasters. Data is sent in from districts and is compiled and analyzed by the Department of Crops for. MAFI is also promoting crop insurance against natural hazards (frost, hail, and drought), matching compensation by the insurance company MOLDASIG (in 2006 from a Government budget line of approximately 12 million Lei). The anti-hail services also fall under the jurisdiction of MAFI.

The Republican Water Management Agency ***Apele Moldovei*** (AM) is responsible for planning of water distribution, mitigation of flooding and waterlogging, the provision of irrigation and drainage services, and evaluation of water use and water rights, and developing national water policy. Since 1996 AM has undergone divestiture of sections such as construction trusts, which reduced its staff from 18,000 in 1991 to 5,000 in 1997 to 1,549 at present. Outside of the central departments, irrigation operations and maintenance is carried out by 14 directorates, while others deal with flood and drainage control and other aspects.

Together with Apele Moldovei, several agencies are involved in ***hazard mitigation***. These include:

• The ***Agency Regional Development,*** which is responsible for developing legislative and regulatory acts, and building code enforcement to mitigate flooding, landslides, earthquakes, and subsurface flooding, countrywide planning and zoning, construction and safety standards development to mitigate emergency consequences for the population;

• The ***Institute of Pedology, Agro-chemistry and Soil protection "N. Dimo"*** of MAFI, which establishes the Government strategy towards erosion control;

• *The* ***Forestry Agency Moldsilva***, which reports to the Government of Moldova, carries out afforestation works to stabilize landslides and prevent erosion, as well as overall management of the national forest estate;

• ***IPROCOM*** design institute subordinated to Apele Moldovei Agency is a self-financing agency that designs and constructs rural and urban infrastructure projects, including slope stabilization and other measures to mitigate landslides;

• The ***Agency of Land Relations and Cadastre,*** which reports to the Government of Moldova, implements erosion control and land stabilization measures.

Three agencies provide most of the observation, prognosis, and early warning services for natural hazard management in Moldova. These are:

• The **State Hydrometeorological Service** of the Ministry of Ecology and Natural Resources, which monitors, forecasts and issues warnings related to meteorological, hydrological, and agrometeorological hazards. The meteorological department operates and maintains the system of posts and stations and issues public forecasts, including hazardous meteorological and hydrological phenomena.[64]

• The **State Geological Agency** (AGeoM) also of MENR, is responsible for exploration, monitoring, and mapping of mineral wealth, landslides, and groundwater level.

• The **Institute of Ecology and Geography**, Institute of Geology and Seismology of Moldovan Academy of Science undertakes monitoring of earthquakes, mapping of areas susceptible to geological and other natural hazards (including development of methodologies for microclimatic mapping), assesses risks, and proposes scientific measures to mitigate impacts.

• **Climate Change Office,** was established under the Ministry of Ecology, Constructions and Territory Development of the RM through Order No. 21 as of February 11, 2004. The basic objective of the Climate Change Office is to implement the Republic of Moldova's commitments under the UNFCCC.

Disaster relief and recovery operations are the mandate of the ***State Service for Civil Protection and Exceptional Situations*** (SCPESS), which has been part of the Ministry of Internal Affairs since 2004. SCPESS is a civilian organization organized along military lines – as are most emergency services worldwide. The central departments of SCPESS are: operations, civil defense, fire and rescue services, finance, and judicial affairs. SCPESS has around 2600 staff including 640 dealing with civil defense. These are deployed in 54 SCPESS sub-units in all rayons and also individual municipalities. For extreme disasters, the SCPESS has two army brigades at its disposal, and each administrative district is required to maintain an accident-rescue team, usually comprising 10 to 12 persons with basic emergency response training. Training is conducted in Ukraine, Belarus, Russia, and Moldova. Cooperation with NATO is significant.

SCPESS works closely with the ***Red Cross Society of Moldova***, with which it has an agreement to exchange operative information and coordinate disaster interventions. The two agencies have cooperated in producing a brief assessment of vulnerability to various hazards and are working together to harmonize the legal framework with EU requirements, create a national crisis center, and develop a GIS system for emergency management.

Local Governments are involved in coordination with SCPESS and other local departments, as well as mobilizing local funds and other resources for relief and recovery operations. In addition, they are charged with emergency planning with SCPESS, as well as planning and zoning and construction codes for mitigation of floods, landslides, earthquakes, and subsurface flooding.

The National Commission for Emergency Situations is the main coordinating body created to take specific measures meant to reduce the risk of emergency situations, and in case of their happening – to organize the liquidation of their consequences and ensuring the protection of the population and the territory.

The table below presents the current nominal composition of the commission.

[64] The vital role of hydrometeorological services to prevent and mitigate natural hazards was discussed broadly at the international conference "Mitigation of Hazards and Risks Impact on the Environment and Society" that was initiated by the MENR through the SHS and hold in 2005 in Chisinau with support of the WMO. Next international conference "Role of the National Hydrological and Meteorological Services in prevention and mitigation of natural hazards impact" will be conveyed in Chisinau in 2007.

Table 28.The nominal composition of the Commission for Emergency Situations[65]

Nr.	Name	Position occupied, agency/organization/institution
1	FILAT Vladimir	Prime Minister of Republic of Moldova, President of the Commission
2	LAZAR Valeriu	Deputy Prime Minister, Minister of Economy, Vice President of the Commission
3	LEANCĂ Iurie	Deputy Prime Minister ,Minister of the Foreign Affairs, Vice-President of the Commission
4	RECEAN Dorin	Minister of Internal Affairs, Vice-President of the Commission
5	HARABAGIU Mihail	Head of the State Civil Protection and Emergency Situations Service of the Ministry of Internal Affairs, Vice-President of the Commission
6	BODIU Victor	General Secretary of the Government
7	NEGRUTA Veaceslav	Minister of Finances
8	BUMACOV Vasile	Minister of Agriculture and Food Industry
9	RADUCAN Marcel	Minister of Regional Development and Constructions
10	SALARU Gheorge	Minister of Environment
11	SANDU Maia	Minister of Education
12	USATII Andrei	Minister of Health
13	BULIGA Valentina	Minister of Labor, Social Protection and Family
14	FOCSA Boris	Minister of Culture
15	EFRIM Oleg	Minister of Justice
16	MARINUTA Vitalie	Minister of Defense
17	CEBANU Ion	Minister of Youth and Sport
18	FILIP Pavel	Minister of Informational Technology and Communication
19	SALARU Anatolie	Minister of transport and road infrastructure
20	GHILAS Anatolie	General director of the Cadastre and Land Relations Agency
21	ROIBU Alexei	General director of the Border Police of the Ministry of Internal Affairs of RM
22	LUPU Ion	General director of the Moldsilva Agency
23	PINTEA Vasile	General director of the Material Reserves Agency
24	CHETRARU Viorel	General director of the Center for Combating Economic Crimes and Corruption
25	FORMUZAL Mihail	Governor of UTA Gagauzia Gagauz-Yeri(Gagauz territorial unit)
26	ZUBCO Valeriu	General Prosecutor
27	BALAN Mihai	Information and Security Service
28	DUCA Gheorghe	Chairman of the Academy of Sciences
29	GIRBU Oleg	Head of the Unit of Special Problems of the State Chancellery
30	RUDICO Vitalie	Head of the Operative Unit of the State Civil Protection and Emergency Situation Service of the Ministry of Internal Affairs

The Commission is responsible for preventive and reactive actions in emergency situations in order to avoid or reduce the danger of such situations.

The main tasks of the Commission for Emergency Situations are[66]:

[65] Government Decision No. 1340 from 14 December 2001, modified by GD 149 from 14 March 2010. http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=295793

[66] Government Decision No. 1340 from 14 December 2001, modified by GD 149 from 14 March 2010. http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=295793

- achieve long-term programs and measures to prevent emergency situations and liquidation of their consequences, increasing population and territory protection, safety and stable functioning of the economy and potentially dangerous objects;
- creating state system of prevention and liquidation of consequences of emergencies, maintaining the state of readiness of its forces and means;
- analyze the causes and consequences of emergency situations and the effectiveness of protective measures applied, generalization and popularization of experience liquidating the consequences

In case of danger and emergency situations, the Commission:

- coordinates state system of prevention and liquidation of emergency situations;
- analyzes the data received on the situation, studies nature, causes and extent of the outbreak exceptional situation, adopts decisions about the application of emergency measures and further measures to protect the population, territory and property, location and liquidation of consequences of emergency situations. Central and local public administration authorities shall inform the Commission about the situation through the Civil Protection and Emergency Situations Service of the Ministry of Internal Affairs;
- monitors and reviews the progress of rescue work and emergency response, take appropriate measures to ensure their receive necessary forces and means;
- if necessary, decides evacuation of people from affected areas;
- hears the reports of the decision-makers with regard to the rescue-release works and offering the necessary aid to victims;
- provides information to the public, through the media, about the causes and extent of emergency situations, the measures taken by the Government for prevention and liquidation of their consequences, protecting people and territory, familiarizes the public with the rules of conduct in emergency situations;
- notifies the leaders of neighboring countries about the exceptional situation of transboundary character on the territory of Republic of Moldova, the character of the existing danger for the environment and the population of these countries and the measures taken by the Government of Republic of Moldova for its liquidation, and in case of large-scale outbreak of an exceptional situation launches international appeal for aid with rescue forces, material and financial resources, if necessary coordinates actions of liquidating the consequences of the exceptional situation created with mentioned countries.

The Commission for Emergency Situations of the Ministry of Health is created in order to prevent and action in emergency situations, generated by natural and ecological calamities, accidents of big proportions, catastrophes, fires, epidemics and other dangerous phenomena, as well as in the case of public health emergencies.[67]

Chairman is the Minister of Health. The composition of the Commission consists from Vice-Presidents, Secretary and Members. Membership of the Commission is approved by the Minister of Health.

Commission activity is regulated by legislation of the Republic of Moldova, Presidential decrees, Government decisions, and decisions of the Commission for Emergency Situations of the Republic of Moldova, decisions emitted by the Extraordinary National Public Health Centre, this Regulation orders, the Minister of Health guidelines.

Reserve Fund. In addition to agency budgets, there exists a reserve fund managed by the Ministry of Finance on behalf of the Government, used for emergency interventions by all concerned agencies (though not to cover investment costs). The reserve fund is contains up to 2% of the national budget. It is non-accumulating and

[67] Order nr. 102 from February 2, 2010, of the Minister of Health.

replenished by annual appropriations. The reserve fund allocation for 2006 is Lei 30 million. The allocation can be augmented by transfers from other budget lines in case of a widespread disaster. SCPESS reports that about 30% of the damages in rural areas (related to dwellings and property, but not agricultural activity) due to natural hazards are compensated by the fund. Overall, some 70% of the reserve fund goes to compensate losses emanating from natural hazards.

The State Hydrometeorological Service issues warnings on weather-related hazards. SCPESS assists with dissemination of these, as they may entail mobilization for possible intervention and relief effort where needed. However, the warning system for floods does not appear to be working well. Additionally, although Moldovan agencies have the capacity to initiate design and operation of an early warning system for droughts, as yet there is no such system in operation; in general, slow-onset hazard events are not addressed by the warning process and, although mandated to do so, SCPESS has never reported on hazards related to land degradation and erosion. Warnings for low-onset hazard categories require extensive data analysis and prediction capability for which national capacity must be reinforced and operational systems put in place. Warning systems are under consideration for dams, chemical plants, etc., although implementation is constrained by lack of resources. Large dams in particular are in need of dedicated local warning systems. Such systems have been designed, but have not yet been implemented due lack of funds.

The above information can be summarized in the following table.

Table 29. The institutional framework for DRM in Moldova

Organization	Data providers	Disaster Risk Assessment capacity	Disaster Risk Assessment technical capabilities	User of Risk Assessment Information	Requirements for the information
Agency for Geology and Mineral Resources	+	+	-	+	Most of information or data about disasters and risk assessment information is received by an institution or organization paying for this and only a few organizations can receive this information with a requirement letter.
Apele Moldovei Agency	+	+	-	+	The informational exchange is made with the interested institutions with which there is an confidentiality agreement or by means of an official letter from this institution.
Aqua-project, aqueducts systems design Institutes	+	+	+	+	Most of the information is used by those who order and pay for it. But the institution offers information to the mayors of settlements in the republic, which is transmitted under arrangements between the parties.
State hydro-geological expedition	+	+	-	+	The information is offered to interested parties that present an official letter and could be for free or paid. Between relevant state organizations (involved in common projects or activities) the information is made available under an agreement.
Agency for Land Relations and	+	+	+	+	Offers information at the request of the central government authorities (for

Cadastre					free) If information is requested by other organizations or private institutions information is offered for a fee or by confidentiality agreement
Institute of Ecology and Geography	+	+	-	+	Transmit/send information to other organizations, depending on their demand.
Institute of Geology and Seismology of the ASM	+	+	-	+	Information exchange is performed between the Institute and the Academy of Science, Ministry of Environment, the Agency of Geology and Mineral Resources, Ministry of Regional Development and Constructions, and SCPESS. The information can be received with an official letter from the interested institution, but the request will have to be demonstrated.
Ministry of Finance	-	-	-	-	-
Ministry of Labor and Social Protection	-	-	-	+	Receives and shares information with the Civil Protection and Emergency Situations only with SCPESS. If necessary cooperates with other organizations
Ministry of Agriculture and Food Industry	+	+	-	+	Information sharing is quite bureaucrats. Takes place through letters, official requests (from the Ministry of Agriculture and to other ministries), regular reports are only available on the ministry site, if you need other information when it is obtained only through formal approach
Ministry of Health of Moldova	+	+	+	+	It works through joint programs, can offer direct informational contribution only if necessary.
Agency "MoldSilva"	+	+	+	+	Transmit/send information to other organizations, depending on their demand.
Red Cross	+	+	+	+	Information is exchanged with various ministries, eg Ministry of Environment, Ministry of Labour, Ministry of Agriculture and Food Industry. All collaboration is done through the Civil Protection and Emergency Situations. The information is for free.
State Hydro-meteorological Service	+	+	-	+	Information is divided by agreement or official request, or for a fee
Civil Protection and Emergencies Situation Service	+	+	+	+	According to the law, the service is primarily dealing with collecting information about risks. Sharing information is based on intergovernmental agreements with Russia, Ukraine, Belarus, Romania. It works directly with the Commission of the Republic of Exceptional

					Circumstances. It works with national ministries and institutions.
Fisheries Service	-	-	-	-	-
Climate Change Office	+	+	+	+	Offers information at the request of the central government authorities, publishes information in annual/other reports.

4.2 Risk assessment studies and projects

According to the list of documents and publications related to risk assessment, one can say there have been extensive studies on hazards, risks, and vulnerabilities done in Moldova for the past about 50 years.

4.2.1 Statistics on Publications

The following statistics were made based on the review of more than 273 documents including 229 scientific and informative articles and about 20 books, 15 projects and 9 reports covering earthquakes, landslides and erosion, climate change, droughts, floods and irrigation. Please note that project reports are placed separately from other reports prepared by organizations based on specific scientific or other types of studies.

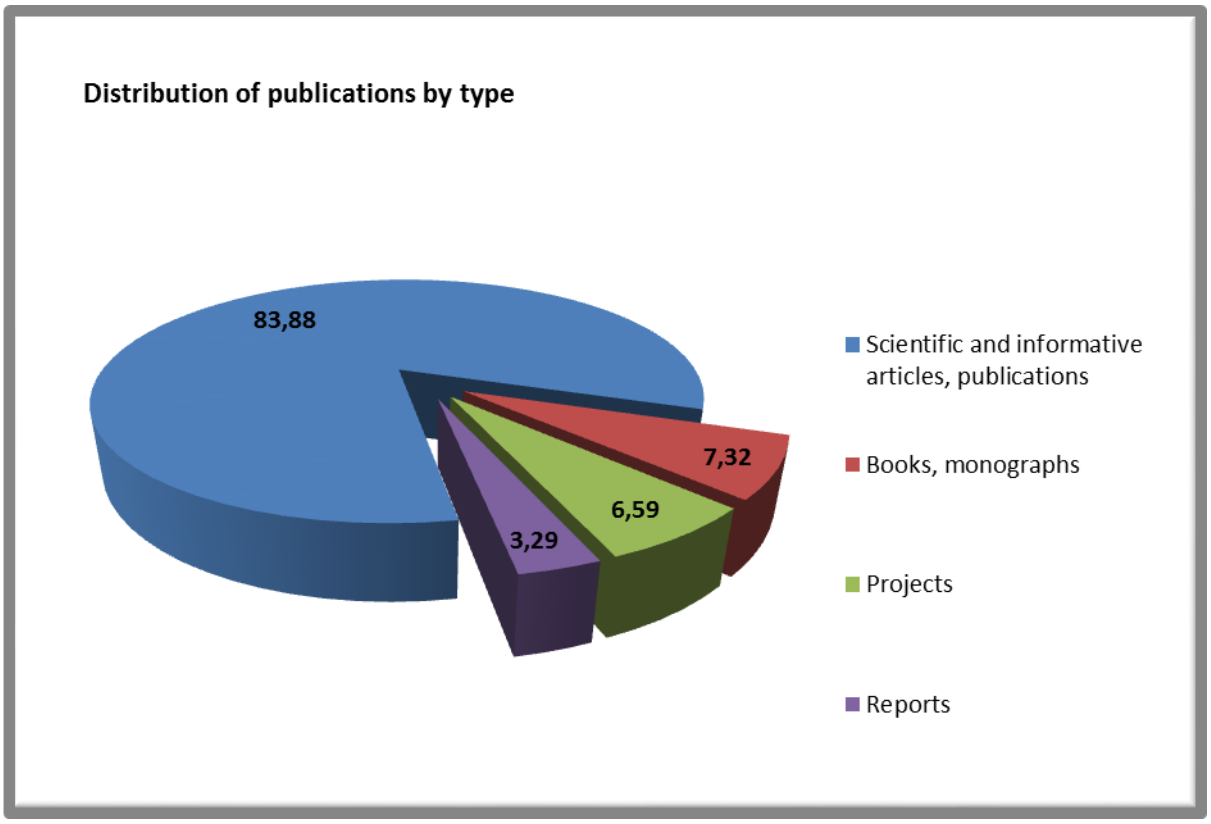


Figure 4.Distribution of publications by type

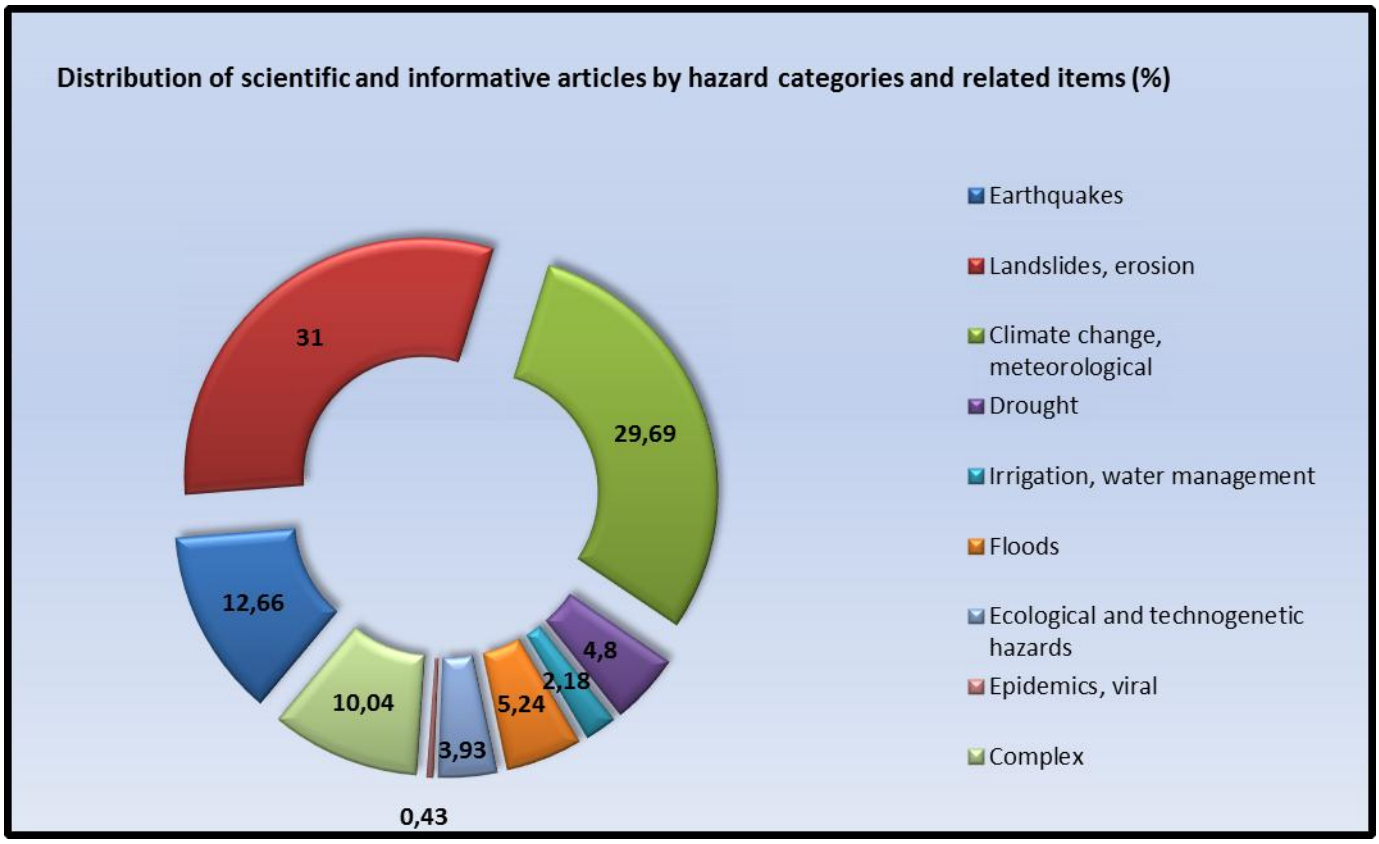
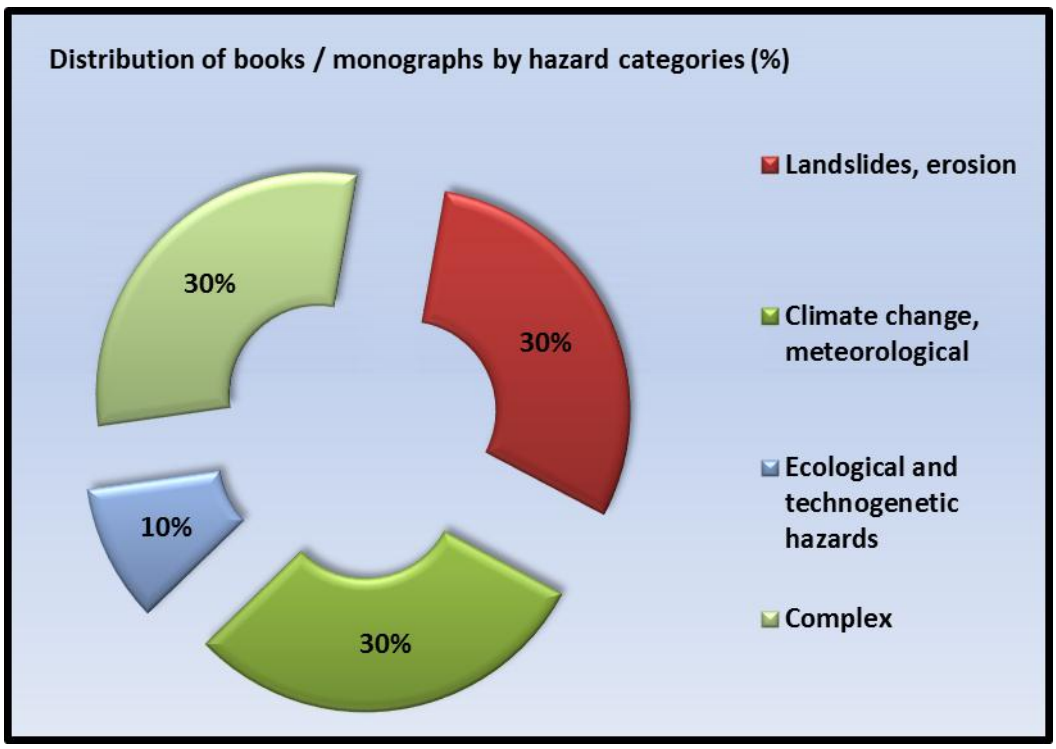


Figure 5. Distribution of research papers by hazard category and related items

Among the studies over the past 50 years, most are focused on landslide and erosion and conducted with a scientific purpose. Little is known to or used by decision makers.

Figure 6. Distribution of books / monographs by hazard categories



In addition, most studies are on natural hazards that are prevailing in the territory of Republic of Moldova or its neighboring countries. Just a few latest publications have dealt with Disaster Risk Management.

The number of reports and publications assessed is 273 in total. Segregated by hazard:

Earthquake: 29

Landslides, soil erosion: 81.

Climate change: 83.

Drought: 13.

Irrigation, water management: 5.

Flood: 15.

Ecological and techno-genetic risks: 12

Epidemics, viruses: 1

Complex risks: 34

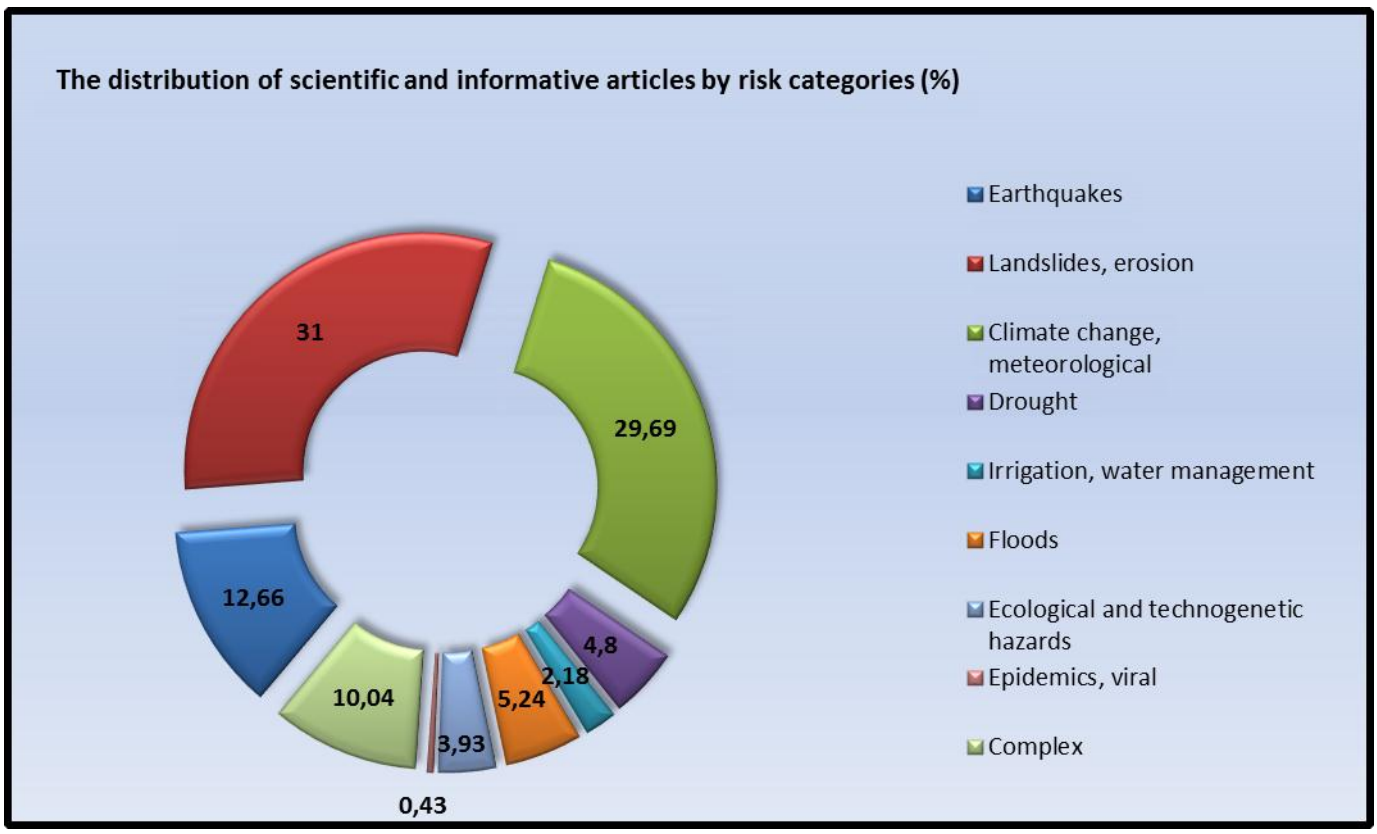


Figure 7. Distribution of scientific and informative articles by risk categories

As it may be seen in the figure above, most of the studies and publications are focused on landslides and soil erosion, this being the main field of study since the soviet times and remain of high importance, but almost replaced starting 2002 by climate change documents. The earthquake materials have a steady evolution throughout the whole period. Also an evolution of the volume of publications can be seen in the chart 3 below.

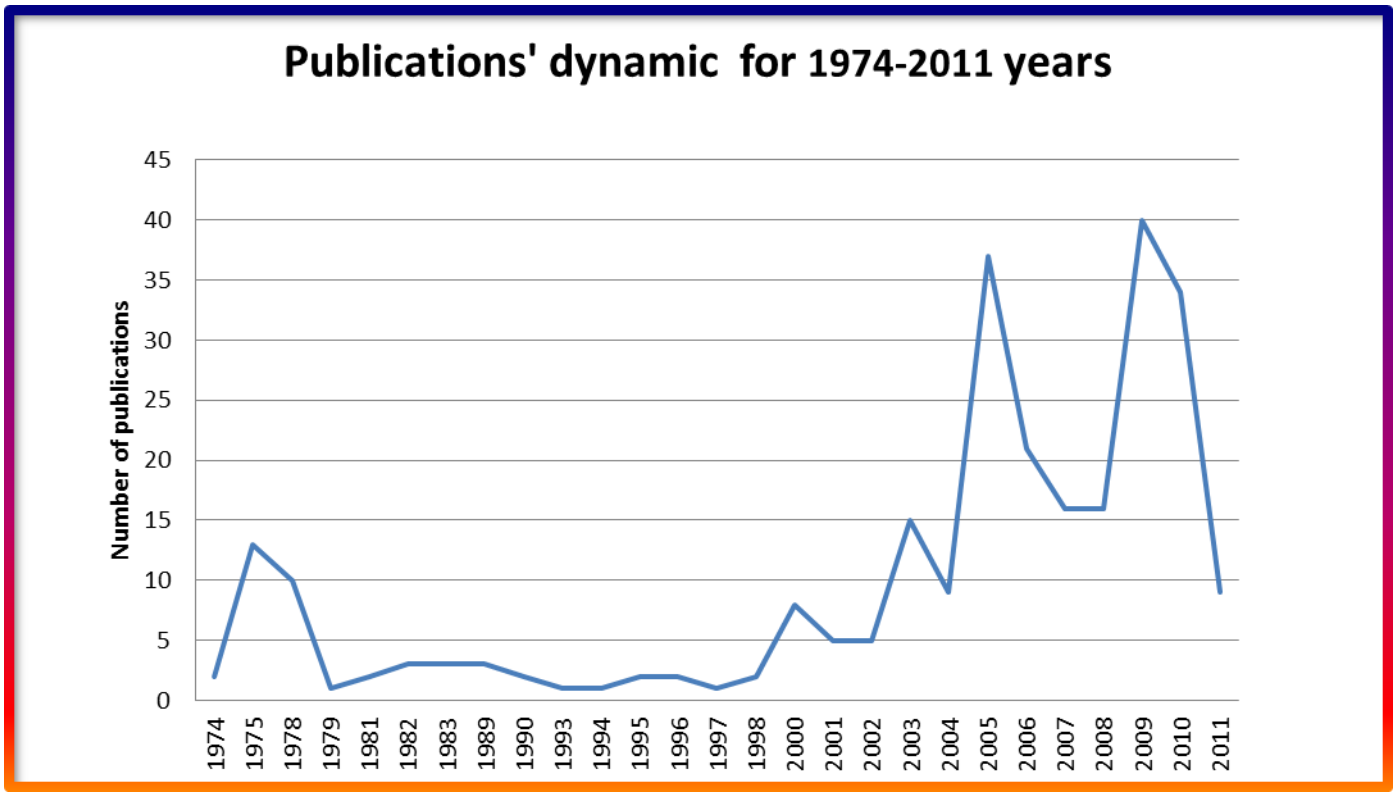


Chart 3.Publications' dynamic for 1974-2011 years

Extensive flood hazards, windstorms as well as long and severe droughts mobilize national and international attention. Floods are rapid onset hazards and perhaps the most difficult of all hazards to assess in terms of impact. The recent alternation of floods and droughts have brought a lot of attention due to their frequency and impact on people and on the country's economic development.

But at the same time, according to further evaluations, we state that the territory of the republic is very vulnerable to time manifestations and droughts. Data analysis shows us, that Moldova is influenced by intense droughts with a frequency of manifestation from 2 till 4 droughts in a decade. According to the evaluation of the UN Development Programme in environment, 280 thousand people suffer from catastrophic droughts in Republic of Moldova. For comparison we can state that the number of the victims of floods and earthquakes is 193 thousand and 19 thousand inhabitants respectively. Vulnerability's relative index is zero, which means that according to this organization data, victims from droughts and famine were not registered.[68] Still the number of reports in the field of draughts is just 9.

It would be recommended to have more reports that would assess not only the hazard and its damages from the social, agricultural points of view, but also combined with an economic assessment of prevention measures in comparison to mitigation, adaptation and of consequences produced by the most frequent hazards.

It should be taken into account that in 2005, according to the data of Emergency Situations Department of Republic of Moldova, from total dangerous natural and technogenic phenomena (150 cases), 38 cases had a natural character, among them spring frosts, hail of big dimension, rain showers often accompanied by big storms are mentioned.

Based on the available data, if natural (climatic) risks manifestation percentage is 25% of total risks manifested on the territory of the republic in 2005, then material losses caused by them represent 95% of the total material damages which is equal to 95 million 605 thousand lei. What is more, approximately 30% of this amount

[68] Evaluation of climatic risks manifested on Republic of Moldova territory. Tatiana Constantinov, Maria Nedealcov, Present Environment and Sustainable Development, Nr. 1, 2007

of money was lost at the end of spring in a quite short interval (23-27 May) because of torrential rains accompanied by hails with a big dimension, causing material damages of approximately 3-4 million lei in some regions.[69]

4.2.2 Statistics on Risk assessment projects

There have been 27 projects or studies related to risk assessment implemented in Moldova since 1974. As it may be seen from the Figure 8below, the majority of implemented projects in the Republic of Moldova have been prepared for the Landslide and erosion field, and the climate change field.

During this period were addressed the bellow mentioned hazards in the provided distribution. It can be seen that landslides and erosion, as well as climate change and meteorological hazards were the ones of more interest. Still, an important overview by years in correspondence with the thematic (performed by the CSA team), shows that the first ones are attributed mostly to the 80-90's and the ones on climate change have entered the picture in the 90's and are still of great focus.

Floods, droughts and complex studies have an even percentage and were under focus constantly during the past about 40 years with higher incidence during the 80's and in the 21 century.

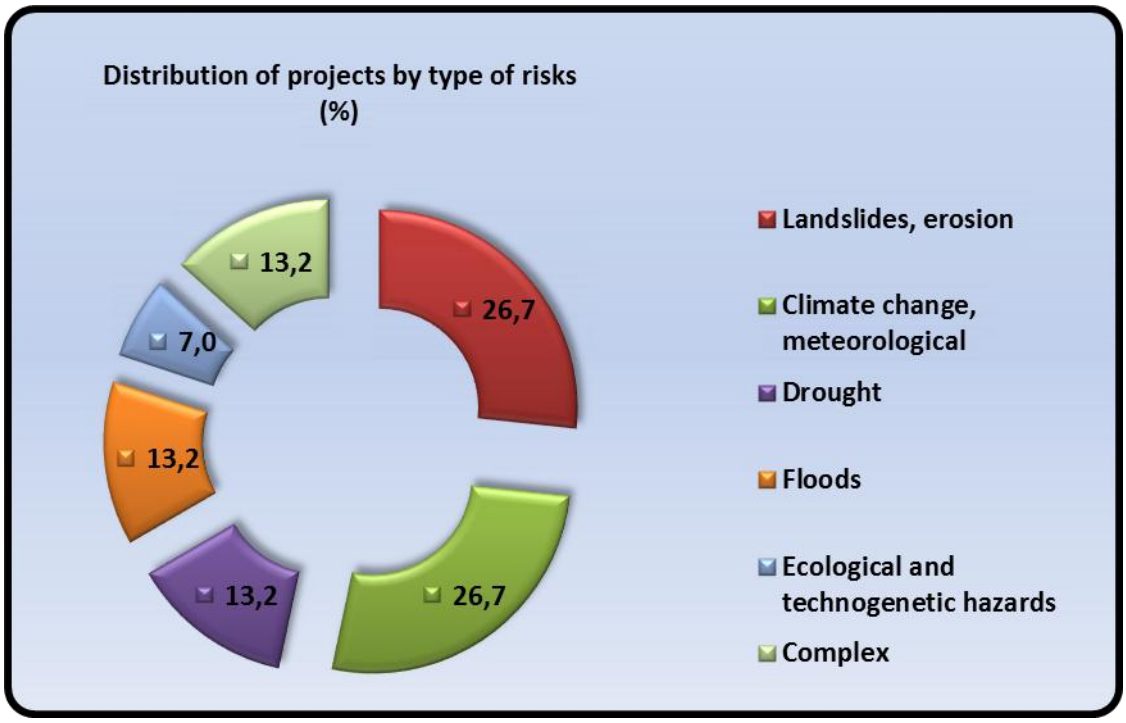


Figure 8. Project distribution by hazard

An important part of the Risk Assessment Projects is the Funding Agency. **Table 30** presents below the funding agencies, the specific areas/themes of the projects, as well as the amount of funds allocated for the respective projects. This table creates a great impression on the areas that have been supported in their development, a well as the years.

Table 30 .Main Funding Agencies

Nr.	Risks/disaster	Project name	Funding Agency	Years	Funds
1	**Earthquakes**	-	-	-	-

[69] Evaluation of climatic risks manifested on Republic of Moldova territory. Tatiana Constantinov, Maria Nedealcov, Present Environment and Sustainable Development, Nr. 1, 2007

2	**Landslides, erosion**	Creating scientific and technical support information (GIS) to develop digital atlas of hazards	State Budget and Co-Finance with special means.	2007-2008	
		Landslide Susceptibility Assessment in the Central Part of Republic of Moldova	NATO	2009-2012	288,000 USD
		Developing ecological criteria for the conservation, protection and improvement of soils with low productivity	Academy of Sciences	2004-2009;	21,000 USD/year
		Erosive processes for soil conservation research in agro-landscapes of the steppe in Eastern Europe in various natural conditions (case studies of Belgorod region in Russian Federation and Republic of Moldova).	Academy of Sciences	2006-2007	21,000 USD/year
3	**Climate change, meteorological**	Analysis and risk assessment of climatic factors and phenomena generated by them.	The State Programme	2004-2006	21,000 USD/year
		Studying the influence of thermo-hydrodynamic regime of the Black Sea on the climate change in Moldova.	Academy of Sciences	2006-2007	21,000 USD/year
		Disaster and Climate Risk Management Project	World Bank	2010-2015	10 mln.USD
		Programme of pilot projects aimed at promoting cooperation on adaptation to climate change under the UNECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes (UNECE Water Convention).	UNECE- The UN Economic Commission for Europe (UNECE)	2010	
4	**Drought**	Relief and Technical Assistance Response to the	European Commission	2007-2008	

		Drought in Moldova	Austrian Development Agency		
			Ministry of Rural Development, Austria		
			UNDP		
			Soros Foundation-Moldova.		
		Analysis and evaluation of the vulnerability of some groups of crops to climate extremes	State program		
5	**Irrigation, water management**	Transition to a modern agriculture	MCA-Moldova Compact	2010 (starting)	101,77mln. USD
	Floods	Emergency Assistance to Flood Affected Rural Farming Households	United Nations for Food and Agriculture	2008	
		Develop kinematic wave model and assess flood risk areas in case of floods on the rivers in Moldova	State program	2009-2010	
6	**Ecological and techno genetic Hazards**	Building platforms for solid waste disposal-solid waste management	FNDR and CR	2011(starting)	430,000 USD
		Study and elaboration of scientific geo-ecological conditions for rational use of landscapes in Republic of Moldova.	Academy of Sciences	2004-2009	21,000 USD/year
		Develop Geographic Information System in order to optimize the spatial organization of the environment.	Academy of Sciences	2004-2009	21,000 USD/year
		The Prut Basin Wide Approach for Nutrient Reduction and Cross Border Co-operation (PBWA)"	Regional Environmental Center for Central and Eastern Europe (REC) UNDP Global Environmental	2004-2006	

			Facility		
		Extension of integrated solid waste management of the city Soldanesti in 7localities in Soldanesti and Rezina district, located in the Ciorna river basin	Other sources of funding	26 July 2011 (2 years)	
7	**Epidemics, viral**	-	-	-	-
8	**Complex**	World Bank Moldova: Adaptation and mitigation of the disasters. Environmental impact assessment and environmental management plan.	World Bank	2007-2001	4,5mln. USD

4.3 Data and information

4.3.1 Basic data and base maps

Institutions with mandate produce basic data and base maps of reference, following established standards and conventions. These institutions and organizations collect raw data in the field, process and validate them, according to specific standards, cooperation agreements and international conventions.

Trained personnel maintain the databases. Data can be acquired in accordance with specific provisions issued by competent authorities (i.e., in agreement with the government) and are offered for free or at request, depending on its status and institution's approved rules.

Basic data and base maps are available in different formats: shape-files, scanned (maps, tables), printed and/or analogue format. Spatial data are geo-referenced. To see what organization/institution is responsible for what risk category and respectively have information related to the specific risk, please see Table 27, from 4.1 on Institutional framework.

4.3.2 Intermediate data

The Table 31. below presents intermediate[70] data type and names of institutions, which have specific data related to Risk Assessment, Disaster Management etc. Not all attribute fields of the data sets include all ideal information required for national risk assessment. The spatial and temporal resolutions of the data vary. Issues of accuracy and precision become more important given the little or lack of communication between institutions. In some cases information with regard to the same issue is produced by two or more institutions, without coordination among them and that differ qualitatively or quantitatively. Having this kind of overlapping induces confusion as well as creates a basis for conflict.

[70] Intermediate data are referred to as those that can be directly used to conduct risk analysis, whereas basic data are those that can be used to produce intermediate data.

Table 31. Institutions that have specific data related to Risk Assessment/ Disaster Management

CATEGORY	DATA SETS	WHO HAS THE DATASETS LISTED
Hazard	Hazard zoning maps Probabilistic seismic hazard maps	"Seismic zoning of Chisinau" map was done by the Institute of Geophysics and Seismology. This map was requested by the Ministry of Construction and Regional Development. A complex map of the hazards was made for the forest-steppe zone, and for the entire territory of Moldova was made the Landslide zoning map and for gullies.- Institute of Ecology and Geography. The probabilistic map of seismic hazard is made for entire territory and this information was developed by Institute of Geophysics and Seismology and some data are evaluated by Agency for Geology and Mineral Resources.
Hazard	Flood inundation maps	Flood inundation maps are made for Dniester and Prut . This map is developed by "Aquaproiect" and are kept in "Moldova's Water" Agency. For some district are developed map for sub inundation.
Exposure	Population, in terms of age, sex, income, ethnicity (e.g. caste, religion, language etc.), occupation, education, and settlement type (rural or urban);	Assessment that emphasizes landslides in populated areas map, was developed by Agency for Geology and Mineral Resources over than 30 years ago.
	Buildings, in terms of residential, commercial, industrial, and public, high-rise building etc.;	
	Livelihoods, i.e. livestock, crops, cattle, industries (the number, location and extent of exposure);	
	Critical facilities, i.e. healthcare (hospitals, clinics, basic health unit, etc.), educational institutions (university, college, school, etc.), warehouses, stockpiles, banks, police stations, fire stations, etc.; and	
	Infrastructures, i.e. roads, bridges, airports, ports, railways, dams, telecommunication network, power supply, etc.	
Vulnerability	Vulnerable communities (food insecurity)	Information about food insecurity and vulnerable communities is analyzed in Ministry of Agriculture and Food Industry
Projections	Future climate change, weather events, extreme temperatures projection maps for any settlement in Republic of	Climate Change Office

4.4 Existing Methodologies for Risk Assessment

Effective DRA is directly dependent upon the understanding of complexities, types and nature of risks faced by a community, determining the susceptible areas, and conceptualizing human vulnerability. Risk is differently understood: some people understand risk purely scientific manner. As such, risk assessment is a process of understanding the problem of risks and disasters, of underlying causes of non-sustainability in development. Behind products of risk assessment (e.g., a map, a report or publication), there are several concepts: hazard, exposure, characteristics of the exposed elements (some authors refer immediately as "vulnerability" which makes up the concept definition and not the way risk is estimated).

The determinants and nature of climate-related risk are important in terms of present day intervention and risk reduction, and also for planning to meet the challenges of future climate change; a society's ability to cope with future climate change may be compromised if its vulnerability is exacerbated by existing climate hazards and their impacts. In the short term, the broad consensus following years of action and research under the UN International Decade for Natural Disaster Reduction (IDNDR) is that strengthening local capacity to cope with natural hazards such as flood and drought is an urgent priority, particularly in the poorest regions in the world (Few, 2003). There have been methodological advances in identifying and classifying underlying vulnerability to hazards, as well as to the multiple dynamics of economic and social change.

Reliable risk assessment products depend partly on clear, precise conceptualizations, but also on the methodology. The country's experience in mapping hazards and the technical capacity in usage of GIS-technologies is an advantage for the NRA Program. Specific data required for DRA are presented in Annex 9.

A more in detail description of currently existing and used methodologies in Republic of Moldova is presented below.

4.4.1 Methodologies for earthquake risk assessment

Research in seismology is made in principle by seismological stations. The National Network of Seismic Stations of the Republic of Moldova is part of the European and worldwide network. In 2004 the Institute of Geology and Seismology of the ASM was admitted as a full member of CSEM and is exchanging data and develops the regional seismic bulletins.

The national network of seismic stations is composed of 6 local stations, which operate continuously and are located in Chisinau, Leova, Cahul, Giurgiulesti, Soroca and the Milestii Mici underground station. The network is equipped with sensors and advanced digital tools of technology, used today worldwide for study in seismic movements, and software, working in the data format accepted by the seismological community.

Modern equipment allows recording earthquakes with epicenters in Vrancea region of Romania and earthquakes around the world. Each station, equipped with GPS, determines the exact arrival times of P- and S-waves, which allows determining, together with data from other stations, the exact location of earthquake epicenters. Applied software provides automatic data about the magnitude, coordinates, outbreaks depth, duration at the station and the center, the first sign of the seismic wave, etc. the local parameters of the recorded acceleration, velocity and displacement of land, which is determined based on the MSK intensity degrees.

The seismic zoning map for Republic of Moldova can be found at http://igs.asm.md/node/124. It was developed by the Institute of Geology and Seismology of the Academy of Sciences of Republic of Moldova. There is no seismic risk assessment mapping for the country. During the meeting with the working group on earthquakes it was stated that there is no need in having seismic risk assessment and mapping for settlement areas smaller than rayon centers, because it would not be a financially acceptable activity, and the need in such maps for a small area is useless. Currently, at the command of the Ministry of Regional Developemtn and Constructions is prepared the map of seismic microzonation for Cahul city, situated in the zone of 8th grade of seismicity.

The central regional seismic station located in Chisinau is planned to receive an Earthquake Monitoring and Warning System (EMWS) in place to provide real-time warning services. The system issues alerts 20-30 seconds before the arrival of the main phase of the earthquake. Time of the seismic warning alarm will be higher and will make up about 36-40 seconds, when will be provided the radio infrastructure for transmitting detection signal of the primary P-wave to Chisinau stations from the Romanian Plostina and Vrancioaia stations, situated in Vrancea epicentral area. Implementing real-time warning system will be used in industrial facilities with a strong impact among the population and taking action to mitigate damage from strong earthquakes.

4.4.2 **Methodologies for landslide risk assessment**

Laboratory method consists of topographic maps analysis and aerospace images. Topographic maps offer the basic idea on the location of relief items in space and their interaction, providing basic information to the qualitative characteristics of the landscape. Information on the intensity of tectonic movements is derived from data rates of absolute altitude. Gradient of altitude in different areas of joint relief items allows analyzing the degree of contrast of tectonic movements. Combinations of the dimensions of major relief allow analyzing the tectonic fragmentation of the landscape and river network analysis gives the information about the prevailing directions of the folded and discontinuous structures of relief.

Topographic maps are available used at the scale of 1:25000,1:10 000and 1: 5000. These maps allow the analysis of morph structures of the different order and creation of their own regional maps and diagrams of the morph structures of different order, which also are useful for detailed mapping.

The materials used the most are from the found of the Agency of Geology and Natural Resources and materials from the Hydro-Geological Expedition that are parts of the Ministry of Environment, but also are used relevant materials from other organizations.

Using GIS technology, which includes developing geographic information systems (based on ARC-GIS package, MapInfo), also is one of the most innovative and efficient methods of data analysis and cartographic representation to obtain a minimum error.

Terrain method. Analysis of the relief under the observation is the initial and main source of field data and has a major importance in confirming the data obtained in laboratory conditions. The main purpose of the work in the terrain is to identify the interdependence of tectonic structures and contemporary relief.

The main terrain method in the analysis of the relief is the initiation of one or some routes created with key observation points in the geographical areas. Also, with the terrain research one can collect factual data about the development and dynamic geo-morphological processes under different forms and relief units.

Maps

In the project “Landslide susceptibility assessment in Central Part of Moldova”, under the coordination of the Murat Ercanoglu, Turkey and Dr. Nicolae Boboc, Institute of Ecology and Geography, Landscape Laboratory, were used three methods for the susceptibility assessment of the central part of Moldova, precisely Nisporeni, Criuleni, Calarasi district. The first method is **Artificial Neural Networks & Logistic Regression** with the following parameters: Aspect, D.E.M, Distance to roads, drainage density, lithology, precipitation, profile curvature, landuse, distance to streams, slope, wetness index, landslides.

The first susceptibility map on the Nisporeni area was made with all 12 parameters: Aspect, Slope, DEM, Distance to roads, Drainage density, Lithology, Land-use, NDVI, Planer curvature, Annual precipitation, Profile curvature, Wetness index nd the second with the 8 main parameters: Aspect, Slope, DEM, Distance to roads, Lithology, Land-use, NDVI, Profile curvature.

The second method is **Logistic Regression,** were used the same parameters; and the third method is **Frequency Ratio Model.**

4.4.3 Methodologies for flood risk Assessment

In hydrological research are used different methods, many of which are used by other natural sciences. Specific hydrological methods are: the stationary observation method, experimental observation method and experimental research method.

Stationary method of observations or observations at hydrometric stations consists of observations and measurements after a certain program at hydrometric stations where are made observations of the variations of water level, flow of water, sediment flow, the temperature, transparency, water color, fixed residue. Data obtained on the basis of regular observations over large periods of time, serve to achieve the synthesis and generalization of the nature of hydrological parameters and allow separation of legitimate expression of various phenomena and hydrological processes such as floods.

Method of expeditionary observations – issued for expeditionary observations in inaccessible regions, where there are no gauging stations installed for the execution of measurements and regular observations (daily, monthly or seasonal). The expeditionary observations are accomplished by a traveling plan that takes into account both performance measurements to obtain quantitative data of hydrological nature, making comparative observations for an applied purpose. With the method of expeditionary observations can be performed an analysis of key hydrological parameters (flows, water velocity, morpho-metric indices, temperature, and salinity) and also to achieve a synthesis of potential hydrologic forecasts.

Experimental research method allows to render some phenomenon of nature, to a certain scale, in laboratory conditions in the idea of being able to analyze how they handle various natural processes (for ex. floods) of a water unit, resulting in conclusions and solutions in a much shorter time. Undoubtedly, the basic method is the stationary method that through a long row of stationary observations and measurements made at the same point, can lead to more precise data and conclusions.

4.4.4 Methodologies for droughts and extreme weather events

Dryness and drought can be considered the most complex climate phenomena, because their onset several factors involved, namely rainfall, water supply, humidity and air temperature, evaporation, transpiration, winds peed etc.., this are the main climatic parameters that define the dry weather or drought.

Therefore the data collection, evaluation and analysis are using the same methodology as all hydro-meteorological observations. First, to carry out any study is necessary to use a data base or a fond of meteorological data (climatological archive), in which are quantified meteorological variables (observations of temperature, precipitation, humidity, pressure, wind, etc..) at all representative stations of a given geographical area, starting with the establishment of each weather station, so it is stationary method and the analysis of the data is provided by the laboratory method.

In climatology, investigating climate and climates from past, present or future (diagnosis and climatological forecasts) is made on two main areas: basic research and applied research. The first research direction involves climatic processes at different levels (macroclimate, microclimate and mezoclimate), on the one hand and research climate system and the general circulation, on the other hand, in order to develop scientific approaches to processing and interpretation of data, creating mathematical models required to develop forecasts, issue of theories, assumptions, climate scenarios, which can later be used in applied research (mathematical and statistical method).

This second line of research refers to scientific analysis of climatological data, for use in different practical fields: agriculture, forestry, tourism, etc.

It should be also noted that Republic of Moldova needs to have a NDO in order to collect, organize and offer access to information from one source, and reduce the time and efforts of accessing this type of information. It will also make possible to easier converge four previously separate institutional spheres: development planning, ecosystem management, climate change adaptation and disaster risk management, to establish new working arrangements that facilitate integrated disaster risk management. While there as been improved dialogue and coordination between these various spheres, more effort is needed to achieve greater convergence.[71]

A special importance with regard to the informational needs and requirements is related to the use of disaster risk assessment information within political instruments that set local, regional and national set of strategies like EIA and SEA.

Environmental impact assessments (EIAs) and strategic environmental assessments (SEAs) are the best-known tools for undertaking environmental assessments to inform policy, programme or project development. They allow information on social, economic and environmental impacts to be considered, resulting in a much more integrated assessment process. While practical experience remains very limited, EIAs and SEAs are being adapted to analyze disaster risk-related factors associated with the potential threats to and consequences from proposed projects, programmes, plans or policies.[72]

The following describes a common set of actions required to ensure that disaster risk concerns are adequately addressed and managed during the environmental assessment process[73]:

Data collation: Collect data on natural and human-made (i.e. technological/industrial) hazards and associated risks, including those related to climate change and variability. Simultaneous collection of environmental baseline data, including identification of critical natural resources (e.g. water, wildlife habitats, sources of building materials) and ecosystems that provide important hazard regulating services. Multi-hazard risk maps may be developed and overlaid with environmental baseline information.

Analysis of environmental vulnerabilities as an underlying component of risk: Identify the environmental factors, e.g. degraded ecological resources and functions, geology, soil properties hydrology, climate regime etc. that aggravate vulnerability of people, their assets and environment to natural hazards, which in turn can pose a threat to proposed projects, programmes or plans.

Analysis of the potential consequences of a project, programme or policy in terms of increasing disaster risk as a result of its impact on the environment: Identify the potential environmental impacts that increase vulnerability, based on different hazard and risk scenarios.

Evaluation/Assessment: Identify and assess alternatives based on applying environmental sustainability criteria and different scenarios (e.g. climatic changes, natural hazard events and human-induced hazards); identify and assess the mitigation options to reduce both potential environmental impacts and underlying vulnerabilities; select preferred option; and determine feasibility (i.e. whether financial and human resources are sufficient to implement mitigation measures).

Account for uncertainty: Given the high level of uncertainty associated with assessing environmental impacts, the "precautionary principle" is applied where impacts on ecosystems cannot be predicted with confidence due to limited knowledge of ecosystem resilience thresholds, and/or where there is uncertainty about the effectiveness of mitigation measures.

[71]Global assessment report on disaster risk reduction. United Nations: Geneva, Switzerland. ISDR (2009).

[72]Demonstrating the Role of Ecosystem-based Management for Disaster Risk Reduction.Partnership for Environment and Disaster Risk Reduction.PEDRR (2010).

[73]Demonstrating the Role of Ecosystem-based Management for Disaster Risk Reduction.Partnership for Environment and Disaster Risk Reduction.PEDRR (2010).

Monitoring: Regular monitoring and review of risk and vulnerability data along with environmental sustainability criteria, following approval of projects, plans or programmes. Develop indicators and institutional capacity for carrying out monitoring and evaluation and determine how they will be used and tracked.

5 Issues and Challenges

5.1 Risk Assessment and its use in decision making

Given the diversity of views to risk and the variety of hazards, a NRA requires standard concepts and methodologies of risk assessments. Standardization of risk assessment methodologies is necessary also in order to build a national research capacity to assume duties with requirements on[74]:

- Conduction of risk assessments;
- Development of disaster management plans in effective and efficient manner and
- Setting standard operation procedures timely to effectively deal with emergencies.

The objectives of standardization of DRA methodologies includes establishment of procedures that complies in accordance with the latest best practices for major hazards (drought, floods, windstorms, landslides and earthquakes) in Moldova.

The main problem is caused by the fact of distribution of impacts and vulnerabilities. The sharp differences in the projected regional patterns and regional impacts of climate change are unavoidable. Those in the weakest economic position, including the specific groups such as the poor and elderly, are often the most vulnerable and the most susceptible to climate-related damages, especially when they face multiple stresses. The challenge is therefore to better identify particularly vulnerable systems, sectors and regions.[75]

The Table 32 below emphasizes a range of issues and challenges that were confirmed as existing by the interviews during the general Country Situation Analysis, thus providing an quite objective view on the current status of the risk assessment in Moldova and its use in the decision making process.

Table 32.Issues and challenges confirmed as existing during the general CSA

Activity Category	Country Situation
Understanding the problem of disasters and risks	▪ National risk assessments are partially being conducted (the 1st chapter of Civil Protection National Plan). Sectoral risk assessments are currently being conducted by local institutions (various ministries, agencies etc.) and international experts. ▪ Lack of collaboration mechanism among different institutions. No access to data, a common networking system should be conducted (to collect, organize and monitor the data).

[74]Disaster Risk Assessments in Mozambique: A Comprehensive Analysis of Country Situation. January 2011

[75]UN NHDR 2009/2010

	▪ Each ministry is conducting separate researches on its level. The information is examined, but not entirely gathered at SCPESS. ▪ Capacity risk assessments are being conducted, but none of them is being implemented. ▪ National risk assessment should be updated and implemented according to the National Plan. ▪ Different short-terms projects in the field of natural hazard assessment (floods, landslides, erosion, droughts) are being implemented. ▪ Some flood-prone areas and seismic risk assessments are being conducted. Some seismic maps on hazard-prone areas (Carpathians area), map for landslides (mainly for Chisinau municipality), etc. exist within the Academy of Science. Not all the measures are taken into consideration.
Learning from the past	▪ No nationally acknowledged mechanism is in place to analyze historic disasters and draw lessons learned from these analyses. Various institutions, such as State Hydro-meteorological Service, National Centre of Public Health, Crisis Medical Centre, Ministry of Agriculture and Food Industry, Institute of Ecology and Geography, Institute of Geology and Seismology, SCPESS etc. are collecting data for conducting sectoral analyses in the above mentioned domain. ▪ It should be noted that there are historical information that are kept on paper and need to be studied and systematized to be used. ▪ Individual efforts are not shared nationally. ▪ Geographical information has not been much used. Methods of analysis and geographical schemes that are applied are very old (about 30 years old). Some GIS methods for risk assessments are utilized. Geospatial data should be used. ▪ A reference system based on real data that could allow immediate decision-making is needed.
DRR Planning	▪ No nationally acknowledged disaster risk reduction strategy exists. Sectoral approaches on DRR are conducted. ▪ DRR is mainly reflected in Civil Protection National Plan. ▪ Disaster risks are being systematized according to the Governmental Decree no.347 dated 25 March 2003 ▪ Lack of coordination among different institutions and organizations working in the field of DRR. ▪ Lack of National Master Plan.
DRR implementation	▪ Disaster risk reduction activities are being implemented sectorally. ▪ Disaster risk reduction activities are not being systematically prioritized. ▪ Disasters are dealt with when they come, but not on a long-term basis. ▪ Coordination mechanisms are not systematic. ▪ Early warning codes (in hydrology, meteorology, environment quality) have been introduced and are successfully used. ▪ New European standards (e.g. construction) are being implemented.
Monitoring and Evaluation of the effectiveness of DRR activities	▪ Monitoring and evaluation efforts are undertaken by different stakeholders. The information is gathered at SCPESS level. No data are monitored at national level. ▪ Risk assessments should start by getting data from the area. ▪ The present risks cannot be compared to the risks of last years because of the lack of comparable data; there is no consolidation of national risk assessments. ▪ Monitoring of construction norms compliance is in progress. ▪ One main issue is the inadequate collection of data.

Local risk assessments	▪ The Municipality of Chisinau is carrying out ongoing activities in regard to risk assessments for the main urban areas. Nor results ▪ Development plans based on disaster risk assessments do not exist. ▪ Local risk assessments are being conducted. Sectorially some risk assessments on flood-prone areas, pollution and earthquakes are currently being conducted. Risk assessment on hospitals status was made in order to monitor their security level. ▪ For the Municipality of Chisinau real data on floods, landslides, and earthquakes exist. ▪ The problem with other local mayoralties and municipalities is that they have no training in DRM, and thus the response is late and the efforts are bigger.

5.2 Information and knowledge Management

Conducting risk assessment needs a series of data and information including hazards, inventory of elements at risk, vulnerability, and other base data and maps. However, data and information are not so often existing, rarely available and scattered among different institutions. There were attempts to integrate data by specific theme in respective organizations. Currently, for example the Hydrometeorological Service offers its available information to the public, including warnings for specific weather events marked by color. Still the number of hydrological stations could be improved and their technical equipment could be upgraded. Of course it would imply hiring more people to work, more trainings and a continuous knowledge management, ensuring updating existing information.

One of the main issues is that the technical capacity in this field needs a great improvement. The used methods need special equipment and trained people to operate them, as well as to analyze obtained data.

Due to the lack of technical capacity, much information is kept in written form. Thus it is hard to process even having some software, as it needs to be introduced in electronic form.

Another problem with the existing documents is that these are produced without actually being studied, read or used by decision making authorities. Performed studies are used by students, scientists, reporting, but unfortunately are in most cases ignored when it comes to decision making. Some of the studies are prepared in a very scientific manner and might not be understood by decision makers.

At the same time, different institutions can make studies in the same field and produce documents on the same theme with different results. It happens usually because of lack of communication between organizations, almost no collaboration and interest to do that. A sort of concurrence exists even between departments in the same ministry – this concurrence between state institutions is the main challenge, weakness and gap at the same time in the process of democratic development.

The available information and knowledge need to be shared between institutions. In most cases, produced materials, studies, reports etc. are stored in libraries, rarely published, and even rarer placed on the internet. Still, there are documents that were published by foreign entities and are sold at a specific price over the Internet.

When a scientific institution produces a report that is too complex and is a too in depth study of an issue, it would be logical to produce a short special explanation for those that are not specialists in the field and share it to interested institutions as well as the public, thus making the information accessible and understandable for all, and at the same time – useful.

Continuous training providing knowledge in the field of risk DRA and DRM, as well as strengthening existing capacity to process and use information, is needed in order to improve existing capacity in managing information in the field.

Currently there are two accessible data bases, one on landslides and ravines managed by the Institute on Geology, another one on hydrometeorological parameters managed by the State Hydrometeorological Service (temperature, precipitation, pressure, wind speed and direction, humidity, water levels and discharge, ice

phenomena, phenology etc.). The data is stored in different formats, including in printed form. The Laboratory of Climatology of the Institute of Ecology and Geography has a set of data received from SHS in the framework of an Cooperation Agreement.

There is an official collaboration agreement between the Institute of Ecology and Hydrometeo, based also on a confidentiality note, and the laboratory of climatology has strong communication established also with Hydrometeo.

It would be appropriate to have a common data base (with different levels of access for any case) that would have gathered all information in the field – such a function is actually attributed to the National Observatory that should further be created within this project.

5.3 National capacity for Risk Assessment

To perform a qualitative Risk Assessment, there is a need of well prepared and continuously informed national specialists and experts. In general, a well-functioning risk assessment team requires the following professionals:

- Hazard specialists who can be geologists, hydrologists, meteorologists, climatologists with specific technical skills;
- Structural engineers in building, bridge, road, etc;
- Economists;
- Social/statistic scientists;
- GIS, information management specialists;
- Disaster Risk Management specialists or expert.

In Moldova can be found the mentioned professionals experienced in their own field, mainly in the Institutes of the Academy of Sciences of Republic of Moldova. Their number is actually very small and given the limited access to information, finances, as well as technology in many cases their capacity is also limited. Usually they work separately and are specialized in their own areas being hired by private companies.

There is a number of social scientists, as well as young specialists with local and/or foreign education, but the level of capacity in dealing with DRM issues is limited.

Moldova has a few GIS specialists: at the Hidrometeo, the State University of Moldova, the Institute of Ecology and Geography, and the University of Tiraspol. Still there is the tendency in more organizations to acquire a GIS specialist. There are specialized studies on GIS, but these are expensive and their reputation is of being of a very low quality. Thus more and more interested professionals prefer to take GIS courses in foreign countries. The existing specialists are recognized as being well prepared.

During the institutional interviews performed in the scope of these report, institutions were asked about existing specialists or experts in the field of DRM. None has given a positive answer.

No institution has the expertise of performing a complete analysis from hazard assessment to risk assessment, although the State Hidrometeorological Center does the analysis of collected data and issues warnings with regard to storms, extreme temperatures, hail, draught or flood. But this is still more of a partial capability for risk identification and assessment.

The capacity and needs assessment were completed based on personal interviews that were conducted for key informants who are quite familiar with the situation of risk assessment and its application in the country. Risk assessment is a multi-disciplinary practice that involves many people specialized in different fields.

Financial resources: the transition period as well as the crisis that Republic of Moldova is passing through for the past 20 years, have created a huge gap in the budgets of state institutions that has reduced significantly their

capacity for development, by not having the possibility to acquire technical means, as well as perform specific needed activities.

The financial problems have also influenced the *development of human capacity* within the institutions, reducing the possibility of being trained, experience exchange and grow the number of personnel. Instead, the number of personnel in many cases was reduced drastically, as well as the salaries. Thus, human capacity is at the same time one of the greatest weaknesses.

While performing the interviews, one noticed that almost all stakeholders mentioned the existence of cooperation issues among institutions. It was also noted that there were institutions that produce similar data, based on collected information, but not sharing it with each other or/and not working together in order to obtain an objective result.

Information and experience sharing is limited or non-existent, leading to unnecessary overlap, repeating efforts and little progress. The need to improve these domains is imperative.

Still, it should be noted that there is the last several generations of graduates, who make their studies abroad, are coming back home and work as consultants for different local or international companies. These young professionals need to be introduced in the system of national capacity and be given incentives to actually make the Risk Assessment at international standards. It is a great opportunity that public authorities should look forward to using it.

Another strong point is the fact that due to several projects, some institutions/organizations have received advanced equipment and programs that could also be useful for Risk Assessment. The need is to develop human capacities to use it properly and extract as much benefits as possible. A cooperation strategy, as well as a sharing method (of equipment, as well as of personnel) would be a great asset in this case.

5.4 Governance and Coordination

Although an adequate legal and regulatory framework is in place, there is room for improving coordination.

Moldova has a coherent framework of law and regulation addressing disaster preparedness and response. The Law on Civil Protection establishes SCPESS as the designated national authority and provides clear roles and responsibilities for the office of the President, Parliament, and key Ministries. Responsibilities for initial emergency response to all major hazards lie with SCPESS. Protocols exist for issuance of water–related hazard warnings from MENR and MAFI agencies, following which the SCPESS communicates and coordinates with their own and other central, regional and local civil defense agencies as appropriate for prevention, mitigation, rescue and relief operations. There are no express provisions related to risk assessment.

Other laws include provisions for safe settlement planning, urban design and building construction, as well as provisions for flood risk assessment and management. Moldova has signed a number of agreements with countries in the region and is a member of several organizations responsible for cross-border emergencies and the prevention of industrial accidents.[76]

Current legal provisions that coordinate pieces of the process of DRA and DRM in Republic of Moldova are presented in Annex 11.

Disaster management functions are split among several ministries and state departments, local public authorities, and economic entities. Although overall direction is provided by the Emergency Commissions, and vertical lines of authority within the system in most instances work adequately, there is little feedback back up the chain of command, and horizontal linkages among many institutions appear to be inadequate in many instances.

[76] Rural Productivity in Moldova – Managing Natural Vulnerability, WB, 2007

There is a need to clarify roles and responsibilities for strategic oversight, planning, coordination and implementation of mitigation and response measures for all forms of natural hazard.[77]

Almost all agencies involved in disaster management experience lack of financial resources to procure and properly maintain relevant equipment that currently is mostly obsolete and to develop and implement programs and plans toward prevention, mitigation and response to natural hazards.

With regard to data sharing and management it should be taken into account that it is often difficult even for government agencies to acquire data from one another. Datasets are variance with another, as the used methods in many cases differ. Although there is trend toward digitization of data, and many agencies are either constructing or contemplating a GIS-based decision support system, these endeavors are also often incongruent and would produce better overall results with harmonization. [78]

The Emergency Commissions and SCPES create emergency preparedness and response plans for a period of five years, which are discussed, regularly updated, and ratified in its meetings. Emergency planning at the district and local level is updated on a yearly basis, based upon public consultations and data collected by the authorities. There are also a number of sector plans, such as for flood protection. These plans could be improved as follows:

• Include measures for drought management and mitigation that are not confined to rapid-onset disaster response measures;

• Recognize and specify inter-sectoral linkages and coordination mechanisms;

• Conduct cost-benefit analysis to prioritize among plans and operational measures; and

• Involve all agencies, especially front-end ones such as Hydrometeorological Service, in the planning process.

6 Recommendations and suggestions

The identification and inclusion of all the institutions that should be involved in the DRA process is imperative, as well as understanding and promoting a working DRA system, adapted to the needs and current situation of the country (Table 33). Having the hierarchy established, it needs an appropriate legal policy framework that will configure an overall vision for the NRA. Authorities, as well as policy makers need to be trained on NRA in order to be able to cooperate and collaborate among them, in conformity with the legal provisions and established framework. It is very important to exclude any obstacles in data and experience sharing, to have a common methodology that would make easier communication between involved institutions:

Table 33. Aspects of DRA and actions that should be taken in order to integrate DRA into the current system

Aspects	Detailed Description
Entry points **Expertise and skills** **Key issues & challenges**	• Inclusion of all institutions involved in DRA; • Implementation of a legal policy framework; • Building an overall vision on NRA; • Participation in ongoing international projects; • Prioritization of risks; • Agreement on a unified and common methodology in order to harmonize risk assessments; • Capacity building; • Improving communication between different institutions; • Data sharing; • Identification of information resources;

[77] Rural Productivity in Moldova – Managing Natural Vulnerability, WB, 2007

[78] Rural Productivity in Moldova – Managing Natural Vulnerability, WB, 2007

Strategy & plan **Training needs**	• Building an observatory system and Crisis Management Centre • Developing common plans and strategies on NRA; • Building multi-hazard based plan and strategy; • Training of decision and policy makers; • Training of central and local public authorities

Taking into account the projected impact of climate change[79], the reduction of current and future vulnerabilities to climate change risk *should build on and expand existing disaster risk management efforts*.
It is of high importance to *determine, develop and invest in solutions* with as much positive impact as possible or, ideal response -"win-win" options. Regardless of the accuracy in climate change predictions, reduction of current weather-related disaster risk will reduce losses and initiate necessary actions for climate change adaptation. Planning for extreme weather events also supports preparedness for a variety of other emergencies and, therefore, brings additional benefits.

Earthquakes:

Earthquakes cannot be avoided, but vulnerability can be reduced considerably. Currently, fundamental steps toward seismic risk mitigation would be improved by *risk mapping leading to appropriate development planning and regulation, vulnerability assessments, seismic retrofitting*, and strengthening of international partnerships formulated to adopt the lessons learned in other quake-prone regions.

The Institute of Geology and Seismology of the Academy of Sciences (IGS, formerly Institute of Geology and Geophysics, or IGG) is responsible for hazard and risk assessment, as well as monitoring and warning concerning earthquakes in Moldova. However, the existing map of seismic hazard is outdated in terms of information and accuracy, as well as methodology and application. [80] Thus it needs updating and moreover, it has to correspond to European standards.

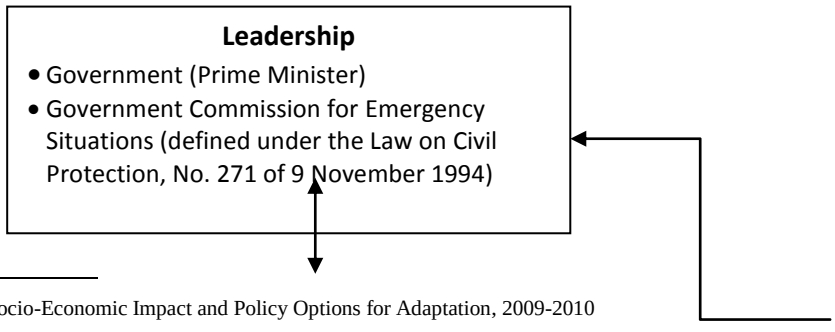
Hail:

Information on hail protection and additional data regarding hail mitigation, anti-hail measures etc. need to be systematized and analyzed thoroughly. A comprehensive conclusion in this respect should be linked closely to the activity of the agricultural domain, starting with the Ministry of Agriculture and continuing with agricultural associations of farmers, NGOs and local farmers/producers.

6.1 National strategy and plan for NRA

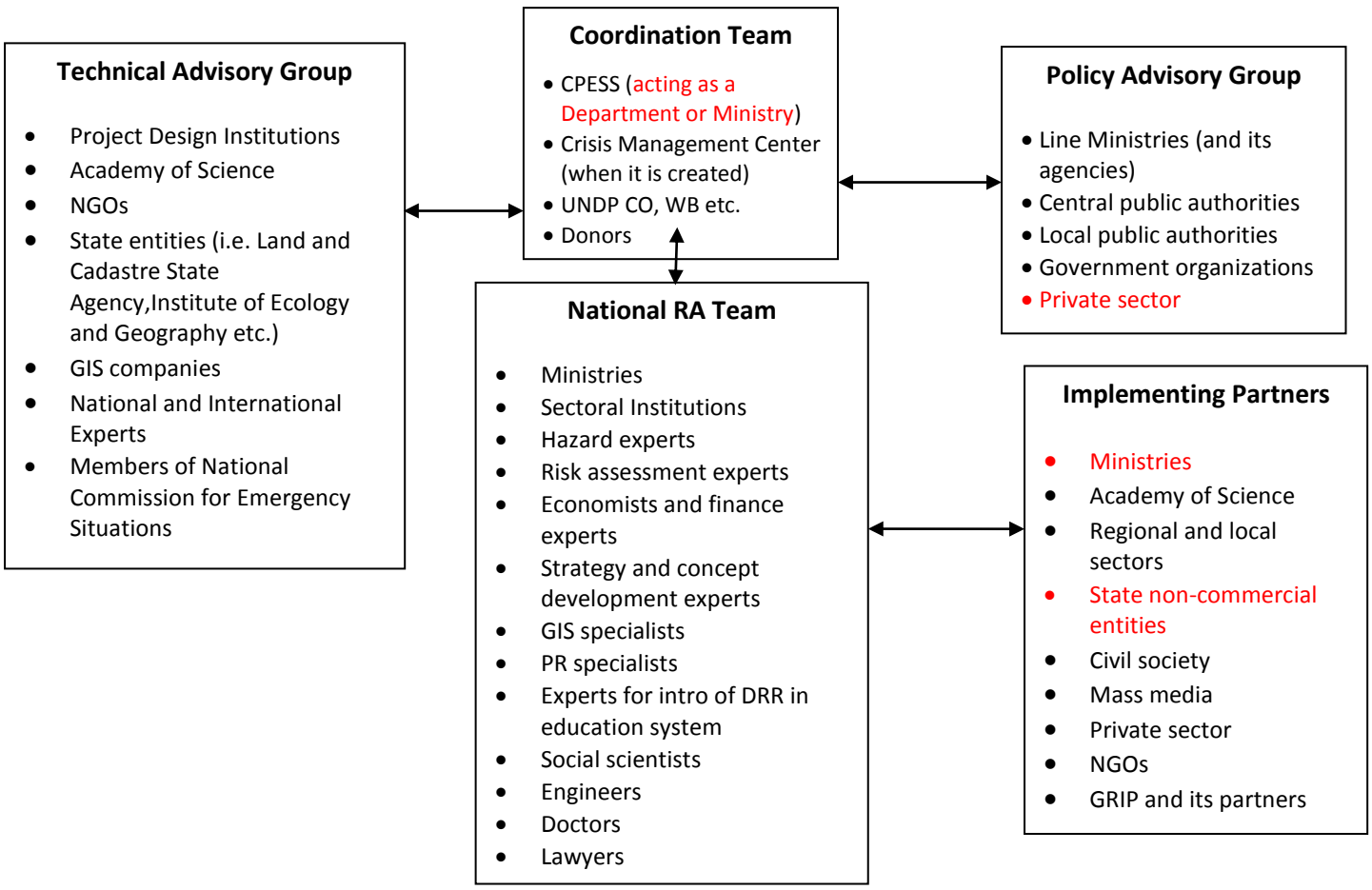
The NRA needs to be appropriated by all the stakeholders (including policy and decision makers). Therefore also mobilizing and sensitizing key institutions related to risk is a flexible approach to raise awareness and may compound the conditions for achieving the best results.

Figure 8. The proposed organigram for the implementation of NRA



[79] Climate Change in Moldova: Socio-Economic Impact and Policy Options for Adaptation, 2009-2010

[80] Rural Productivity in Moldova – Managing Natural Vulnerability, WB, 2007



Four previously separate institutional spheres: development planning, ecosystem management, climate change adaptation and disaster risk management *need to converge to establish new working arrangements that facilitate integrated disaster risk management*. Ecosystem management provides the unifying base for promoting DRR and climate change adaptation, with the overall goals of achieving sustainable development, human well-being and livelihood security. While there has been improved dialogue and coordination between these various spheres, more effort is needed to achieve greater convergence.[81]

Risk assessment is a process of inquiring and therefore of learning as well. The shift of paradigm in dealing with disaster to a position that risk reduction is more important introduces *needs for knowledge and capacity enhancement* about risk to disasters.[82]

The *suggested strategies to achieve this include workshops, trainings and technical support*. But also, a needed aspect is experience exchange. Local specialists do not have a continuous basis for professional development, thus they have to search for resources to get to international conferences and seminars. Given the financial problems that are valid for all state institutions of the country, local specialists are deprived of their possibility to communicate and exchange information and experience with their colleagues from other countries. Having *a national basis for continuous training* would also attract younger specialists in the field and would give them the possibility to develop the DRA field.

It is imperative to have *a national data base with informational and knowledge resources* that could be used for autodidactic and professional purposes.

[81] Global assessment report on disaster risk reduction. United Nations: Geneva, Switzerland. ISDR (2009).

[82] Disaster Risk Assessments in Mozambique: A Comprehensive Analysis of Country Situation. January 2011

There are *specific expertise and skills required* for DRA and these are presented in Annex 10, having included also the respective institutions that are expected to provide this expertise and skills. These institutions' *human capacity needs to be strengthened in the DRA field*.

The principal recommendations made in Moldova's First National Communication to UNFCCC (2000) concerning rural productivity include the need for *reinforcement of the system of reservoirs, rehabilitation of dams in areas with flood danger*, more efficient irrigation, implementation of agrosystems to improve resistance to erosion, soil quality improvement, and identification of plant species adapted to Moldova's trend toward higher temperatures and lower humidity.

Erosion control could be promoted through agro-technical measures, including choice of crop and production techniques, afforestation, and hydro-technical measures such as water harvesting and physical structures to limit run-off. Depending on the effectiveness of the measures undertaken, investment to avert or remedy erosion losses can be well justified. However, benefits may take a long time to materialize and do not accrue only to the communities where measures are undertaken. Therefore, Government intervention is required to achieve potential gains.

Ravine formation can be avoided and stopped through *physical control*. Actions should be controlled and coordinated by the local public authorities with a high level of involvement from the rural population.

With regard to *landslides* should not be ignored the possibility to use *a combination of monitoring, risk management and engineering options.* Local governments, AGeoM, and the Regional Development Agency are charged with drafting and implementing landslide control measures. [83]However, where appropriate, the most cost effective means to prevent and control landslides is *afforestation* of vulnerable areas. The landslide monitoring network should be upgraded, hazard mapping should be developed, and awareness campaigns should also be supported.[84] To be noted that Moldova's main resource is the land, at the same time the country has a small surface and agriculture is an activity offering citizens local products, a source of living in many cases, thus measures need to be taken to preserve the patrimony of the people and the state.

It is imperative *to increase the amount of afforested territories*, including forest lines around and within agricultural land. Forests have the ability to retain humidity and create microclimate, as well as are the best natural mean to stop or reduce erosion. In order to observe and to have as possible more complete data, it is needed to have established a set of indicators and data collectors that would transmit data on a continuous basis from more places to the Hydrometeorological Center to be analyzed and used for the creation of future scenarios, but nevertheless for agricultural predictions, that would increase the capacity of farmers to respond on a timely manner to all or the majority of storms and extreme temperatures, that can affect crops.

In all watersheds, *updated mapping of flood risk areas* and their existing and proposed land use would enable land use planning to avoid or discourage settlements in the floodplains, and a comprehensive survey of the safety conditions of small dams may be justified, as well as a thorough verification of their legality. As about small dams and other DRR important elements would be beneficial some campaigns of sensitizing the population, developing civil responsibility spirit and the idea of volunteers.

Thus, flood forecasting capacity at the State Hydrometeorological Service should be upgraded to improve 0-6 hour forecasting: the Hydrometeorological Service should obtain access to forecasts from ECMWF, satellite data from EUMetsat, and data delivery from a strong measurement network. Operational nowcasting should be enabled and hydrological models linked to precipitation models. MAFI's anti-hail radar network should be reconfigured to serve meteorological use, and should share data with EU and CIS radar data-sharing networks.[85]

Land use and its planning should be updated and thoroughly mapped, flood risk mitigated through appropriate land use planning and enforcement. There should be installed *dam break alert systems* on the four main

[83]Rural Productivity in Moldova – Managing Natural Vulnerability, WB, 2007

[84]Rural Productivity in Moldova – Managing Natural Vulnerability, WB, 2007

[85]Rural Productivity in Moldova – Managing Natural Vulnerability, WB, 2007

dams of Moldova. Special attention should be oriented towards *consolidating land*, as well as *re-arrange natural flooding areas*.

Basic flood protection should be undertaken against events at the 1% level of recurrence probability. *A survey of the safety of small dams* should be undertaken and an action plan developed to mitigate any priority risks identified.[86]

There are three complementary varieties of mitigation measures: (i) *preparedness activities*, including improved forecasting and early warning; (ii) *interventions to address the risks* created by the large number of small and medium dams, among which some are not safe; (iii) flood control systems, consisting of *physical infrastructure*. These components should be coordinated by an overall flood risk reduction strategy. [87]

No hydrological software is used in practice. It would be most helpful to *re-calibrate Moldova's hydrology* in terms of the areas most prone to floods, and among these, to determine in which flooding can be forecast and predicted. The *monitoring network should be expanded* in the river catchments and *modeling improved*.

Opportunities for the use of irrigation to mitigate the risks of drought are limited to less than 100,000 ha. Moldova's once-large irrigated area contracted during the transition. *Irrigation rehabilitation would be economically justified in some areas*.

Individual proposals for irrigation rehabilitation should be supported on a case-by-case, on-demand basis following *feasibility and economic assessments*. Public investment in feasibility assessments, and assistance to small farmers to collectively access the necessary technical and financial support should be warranted.

Forecasting and disseminating the information on weather events enables mitigation of weather damage. *Improved Agricultural Techniques* should be promoted and applied by agricultural workers/land owners/farmers. The utility of *Hydromet Service warnings* will be far greater if they are *supplemented by SCPESS or MAFI guidance on hazard risk mitigation steps* to be taken in light of forecasted events. [88]

6.2 Information and knowledge management

First of all, the country needs an *in depth assessment of all available information* with regard to DRA and DRM, including the one that is still not digitalized. These data should be catalogued and there is need to grant access for scientists and interested persons, natural or legal, thus the information will start being used.

A qualitative cataloguing of all available data will allow reducing overlapping, double efforts (financial as well as institutional capacity) and offering a common base for decision making.

The access to these data should not be limited by the fact that it is detained by one organization. There are procedures of payment for information as well as procedure for requesting the information, but these should be evaluated and the bureaucracy of receiving the information, as well as the deadlines should be adequate to the information requested.

Having the *information stored in one place* and labeled in a catalogue will reduce the effort of search, and increase the control over the used information – offering the state a feedback on what information is needed and which needs improvement of quality, volume, depth of study, etc. Otherwise, the access to different kind of information should be easier, especially for those institutions that need it for their work.

Moldova would need a *hazard prone zone mapping*. In this respect should be used existing technical capacity, as well as available support (including informational, capacity developing and financial) to use GIS-tools including combination of data layers to produce new information that would be updated continuously.

[86] Rural Productivity in Moldova – Managing Natural Vulnerability, WB, 2007

[87] Rural Productivity in Moldova – Managing Natural Vulnerability, WB, 2007

[88] Rural Productivity in Moldova – Managing Natural Vulnerability, WB, 2007

A special attention should be paid to *Data quality*. Using data to create prognosis for short, medium or long term must be done based on verified and approved data, in order to reduce the possibility of internal or other types (between authorities of different or the same level) of conflicts and a truly efficient work of the system.

6.3 National capacity enhancement

It is an imperative need to maintain a continuously updated database on organizations that act in disaster management (disaster prevention, disaster preparedness) and/or in areas of coping with disasters (rescue services, humanitarian aid). The database should comprise also NGOs based in Moldova, working at various sectors (e.g., drought, floods, cyclones, and hunger), and geographic scales (provincial, district and community).

Hazard-specific investments are needed to reduce the risk of hydrometeorological hazards and *increase adaptive capacity*. Early warning systems for various hazards can be developed to monitor heat waves, draughts, floods, etc. Republic of Moldova being an agriculturally oriented country would benefit enormously from having an early warning system for farmers. Flood risk reduction measures are also imperative, that would include developing flood management plans, as well as investments in flood protection schemes. The government and public can take a combination of regulatory, structural, and protective measures to reduce risk, decrease a country's vulnerability to natural hazards, and adapt to climatic changes. But, again, to take such measures there is a great need of transparency and good cooperation.

No change is possible without *strengthening technical capacity of emergency responders*. This includes purchasing activities as for various equipment, tools, and vehicles. A very important point is to keep a *high level communication system* and a continuous exchange of information, thus, it is critical to invest in an interoperable emergency communications and information system. Moreover, this would include the *social training* for the general public, as based on developed countries' experience show that it is an effective and relatively low-cost action, which can be pursued by governments of the region.

In 2007 was established a priority list of activities at an estimated cost of US$0.13 million that would have made some contribution toward seismic risk management.[89] Currently, a new *assessment of available capacity* would be needed in order to objectively evaluate the costs for improvements that could facilitate seismic mapping, vulnerability and risk assessment, monitoring, feeding into the urban planning process and decisions regarding seismic retrofitting and/or reconstruction of key public facilities, such as *structural reinforcement of buildings and lifelines* (hospitals, schools, etc), which would further reduce vulnerability, emergency response facilities, etc.

An additional assessment should be performed on the land use planning and building code provisions, as well as of the permitting process.

6.4 Governance and coordination

There should be developed *local and national strategies* that would provide special tools to respond, monitor and manage weather induced catastrophic events. While developing these strategies, as well as tools, there should be involved all related institutions and thus created a basis for their collaboration and cooperation, as this could ensure a better management of disaster risk, as well as would maximize the use of available resources and reduce the possibility of overlapping efforts, distorted data, etc.

It is highly recommended to develop a National Disaster Risk Assessment Strategy, at least a Risk Assessment Strategy at the level of SCPES that would provide necessary provision for risk assessment activities in the country. A national DRA Strategy should be the base for the collaboration of main responsible institutions and organizations in the DRA process.

During the course of UNFCCC negotiations for a global climate agreement and in particular since the Conference of Parties (COP) in Copenhagen in 2009, ecosystem-based approaches have been recognized as a key climate change adaptation strategy. *Sustainable ecosystems management* is therefore increasingly viewed as an

[89] Rural Productivity in Moldova – Managing Natural Vulnerability, WB, 2007

effective approach for achieving both disaster risk reduction and climate change adaptation priorities. For example, the World Bank recommends that adaptation programmes integrate an ecosystem-based approach into vulnerability and disaster risk reduction strategies.[90]

INCP "Urbanproiect" proposed to include recommendations with regard to the *obligatory development for each settlement separately of a general urban Plan* that would include complex measures for minimization of natural hazards and disasters, for the territory inside the settlement, as well as territory arrangement Plans, that would approach issues related to the territory outside the settlement.

The Ministry of Agriculture recommended establishing and maintaining a team of experts in the DRA field, which would be well trained nationally and internationally and would be up to date with all current information/knowledge available, and with modern instruments and mechanisms of DRA. The best place to keep such a team is considered to be the Ministry of Environment or the Ministry of Agriculture, given the way climate change influences the country and especially the agriculture.

From the Informative note of the SCPESS of Chisinau municipality from May, 2012[91] the authors have retracted a very important alarm signal, that comes here as a recommendation: There is no organization responsible for the maintenance and repair works of equipment and installation related to landslides, or in lakes (for barrages, dykes, dams etc.) at municipal level. Also, people that own reservoirs and lakes do not have enough financial resources to cover works in case of an emergency situation. In this respect, it is recommended to determine the responsible institution for the mentioned above works and to find, in an urgent manner financial resources, as well as human ones to cover expenses and needed effort to assess the state and improve the state of installations (including barrages, dykes, dams etc.) safeguarding the population from landslides and floods. Also, relevant authorities should verify le legality of all reservoirs and lakes that are owned by private persons, their environmental and risk assessment should be performed and afterwards the safety of the population and environment should be ensured.

[90] Convenient solutions to an inconvenient truth: ecosystem-based approaches to climate change. World Bank (2010).

[91] Informative note of the SCPESS of Chisinau municipality from May5, 2012 with regard to the activity of the Department for Emergency Situations of Chisinau Municipality during the period of time June 1, 2011 – June 1, 2012. No. 509 from May 5, 2012

Annexes

Annex 3.Terminology and definitions[92]:

Hazard: potentially damaging physical events, phenomena or human activities, which may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation.

Exposure: the number, types, qualities, and monetary values of various types of property or infrastructure and life that are exposed to the impact of extreme events. Exposure is merely a quantification of what is at risk in the identified hazard zone.

Vulnerability: the susceptibility to injury or damage from hazards, a synonym of "fragility". It is a function of the prevalent hazards and the characteristics and quantity of resources or population exposed (or "at risk") to their effects. It is usually expressed as the damage ratio. Vulnerability can be estimated for individual structures, for specific sectors or for selected geographic areas, e.g., areas with the greatest development potential or already developed areas in hazardous zones. Vulnerability assessments are systematic examinations of building elements, facilities, population groups or components of the economy to identify features that are susceptible to damage from the effects of natural hazards.

Consequences: the damages (full or partial), injuries, and losses of life, property, environment, and business that can be quantified by some unit of measure, often in economic or financial terms. It can be defined by the product of exposure and vulnerability or fragility.

Risk: The potential losses associated with a hazard or extreme event, defined in terms of expected probability or frequency and consequences (damage or losses). Natural risk is a function of natural hazard, exposure and vulnerability or fragility.

[92] Methodology and tools.Systematic Inventory and Evaluation for Risk Assessment (SIERA).Version 2.2.Global Risk Identification Programme (GRIP), BCPR/UNDP. February 2010

Annex 4: Interviewed personnel

	Organization name	Person in charge	Function	Address
1	Apele Moldovei	*Dumitru Proca*	Head of water resources management Department	Str. Gh. Tudor, 5 Tel. +(373)22 28-09-28 Mobil: +(373)685 77 091 e-mail: dima.proca@apele.gov.md
2	Aquaproiect, aqueducts systems design institutes	*Gheorghe Palamarciuc*	Main specialist	Str. Alecu Russo,1 Tel. +(373)22 43-81-22, 44-97-93
3	Eco-TIRAS International Environmental Association of River Keepers	*Ilya Trombitsky*	Executive director	*Str. Teatrala 11A, Chisinau 2012, Moldova* *Ecotiras@mtc.md*
4	Agentia Relatii Funciare si Cadastru	*Alexandru Cebanu*	Head of State Inspectorate geodetic and technical monitoring	Str. Pușkin, 47 Tel. +(373)22 88-12-67 Mobil: +(373)791 17 988 e-mail: cebanu@alex@mail.com
5	Institute of Ecology and geography	*Ghennadi Sirodoev*	Doctor in geology	Academiei street, 3 of.438, Tel/Fax: 73 92 48 e-mail: geomorphology@mail.md
6	Institute of Geology and Seismology of the ASM	*Oleg Bogdevici*	Deputy Director, Head of geochemistry laboratory	Str. Gh. Asachi 60/3 Tel. +(373)22 73-96-63 e-mail: bogdevicholeg@yahoo.com *http://igs.asm.md*
7	Ministry of Finance	*Stela Baghici*	Consultant	Str. Cosmonauților,7 Tel. +(373)22 22-66-87
8	Ministerul Muncii, Protecției Sociale și Familiei	*Vladimir Mariț*	Senior Consultant Department of Policy Analysis and Monitoring	Str. V. Alecsandri, 1 Tel. +(373)22 26-93-61 vladimir.marit@mmpsf.gov.md
9	Ministry of Agriculture and food Industry	*Ivan Guci*	Department's main policy specialist for market products of plant origin	Bd. Ștefan cel Mare și Sfânt, 162 Tel. +(373)22 21-01-06 e-mail: ivan.guci@yahoo.com, ivan.guci@maia.gov.md
10	Ministry of Health of Moldova	*Mihai Pisla*	Head of the Republican Disaster Management Centre CNȘPMU, chief specialist of the	Str. T. Ciorbă, 1 Tel. +(373)22 23-70-73 Mobil: +(373)693 00 064 e-mail: pislamihai@hotmail.com

			Ministry of Health in Disaster Management	
11	Farmers Federation of Moldova	*Gheorhe Barbarosie*	Head of economic development department and rural marketing	Piața Marii Adunări Naționale, 4 Tel. +(373)22 21-01-88, 20-13-55 Mobil: +(373)691 041 50 e-mail: fnfmoldova@gmail.com
12	Red Cross	*Vasile Cernenchii*	Executive Director	Str. Gh. Asachi, 67A Tel. +(373)22 72-96-44, 58 24 e-mail: redcross.md@gmail.com
13	State Hydrometeorological Service	*Elina Plesca*	Prim deputy director al SHS	*Grenoble 134* *022-77-35-11* *069191015* *079557608* *elina.plesca@gmsil.com*
14	Urban Proiect	*Galina Mindru*	Direcție amenajarea teritoriului	Str. Cosmonauților, 9 Tel. +(373)22 24-21-64 Mob: +(373)69645834 urbanproiect@urbanproiect.md mindru.galina@mail.ru
15	Civil Protection and Emergencies Situation Service	*Alexandru Oprea*	Deputy Head of Service, Head of Civil Protection Department	Gheorghe Asachi street, 69 Tel: 73-85-16 Fax: 73-85-01 dse@dse.md
16	Agency for Geology and Mineral Resources	*Tcaci Vasile Nichifor*	Consultant of the Department of Geology of the Agency	MitropolitulDosoftei street, 156, MD-2004, Chisinau, Republic of Moldova Tel: 75-18-10 75-06-56 Fax: 75-08-10 ageom@mtc.md
17	State Hydro-Geological Expedition	*Sudariov Al. Petru*	Chief of Geological Environment Monitoring Department	MitropolitulDosoftei street, 156, MD-2004, Chisinau, Republic of Moldova Tel: 75-14-56 Fax: 75-08-10
18	Agency “MoldSilva”	*Tudor Botnari*	General Deputy Director	Stefan cel Mare street, 124, MD-2001, Chisinau, republic of Moldova Tel: 27-23-06 27-73-49 Fax: 27-73-45 msilva@moldsilva.gov.md

Annex 5. Inventory of Risk Assessment Studies / Projects

State	State which is implementing the RA studies/ projects
Project	
Project Type	National or Transborder
Developing Organization	Organization which is developing the RA studies / project
Coordinating Organizations	Organizations which are coordinating the RA studies / project
Purposes & Objectives	
Scope & Context	Hazards, elements at risk, targeted decision/policy making etc.
Geographical Coverage	The areas covered under the R.A. – which countries are being assessed for hazard risks
Description	A brief summary of the project
Key Activities	The actions taken to do a risk assessment
Methodology Used	Risk assessment methodology used
Expected/Final Outputs	What is the final outcome/output of the RA project/initiative
Stakeholders' contribution	Role, contribution of the stakeholders to RA studies/ project
Duration	The starting year of project implementation
Implementing Organization	Organization which is carrying out the Risk Assessment initiative
Funding Agency	
Project Cost	The cost of the project (project evaluation)
PMP measures	Recommendations to mitigate disasters, increase resilient is given or not in the system report or study
Reports available?	Name of the report(s) or documents
Remarks	
Person in charge, contact information	Name of the person in charge for RA project /initiative, and his / her contact information

Annex 6.Inventory of Publications, Reports, and Risk-related Maps

Author	
Year	
Title	
Category	Document type or category (brochure, book, map, report, bulletin etc.)
Language	
Publisher	
Key Words	Key words for facilitating the search of publication, report and risk-related map
Sources (of information storage), references	

Abstract	
Format	Computer compatible, map or graphical, printed or analog, other
Remarks	

Annex 7. Inventory of Maps

Author	
Year	
Title	
Language	
Publisher	
Sources (of information storage)	
Abstract	
Storage Place	Place where the map is located
Remarks	
Contact Person	

Annex 8. Inventory of Organizations and Institutions

Organization Name				
Contact Information	**Person in Charge**		**Address**	
Mandate				
Expertise & Skills				
Experience				
Resources				
Data & information sharing				
Networking				
Relation to Government				

Annex 9. Data required in Disaster Risk Assessments

Category	Data sets	Remarks
Intermediate Data		
Hazard	• Hazard-prone area or susceptibility maps • Hazard/event intensity maps with difference return periods, such as probabilistic seismic hazard (PSHA) maps, peak ground acceleration (PGA) map, tsunami inundation maps, flood inundation maps, cyclone intensity maps • Hazard zonation maps	**Different mapping scales for different hazards**
Exposure	• Population, in terms of age, sex, income, ethnicity (e.g. caste, religion, language etc.), occupation, education, and settlement type (rural or urban); • Buildings, in terms of residential, commercial, industrial, and public, high-rise building etc.; • Livelihoods, i.e. livestock, crops, industries (the number, location and extent of exposure); • Critical facilities, i.e. healthcare (hospitals, clinics, basic health unit, etc.), educational institutions (university, college, school, etc.), warehouses, stockpiles, banks, police stations, fire stations, etc.; and • Infrastructures, i.e. roads, bridges, airports, ports, railways, dams, telecommunication network, power supply, etc.	**Authoritative data sources include census, year book of economy, engineering department**
Vulnerability	• Expert-based empirical ranking • Vulnerability indicators databases • Vulnerability functions/curves	**Derived from disaster loss databases**
Basic Data		
Historic data	• Historic hazard event catalogues • Historic disaster loss databases	
Geological hazards	• Surface fault rupture/fault lines • Land seismic activity maps • Epicenter distribution by decade, season, month, daytime, night time • Liquefaction maps • Lateral spread • Historical landslide maps	
Hydro-meteorological hazards	• Flood plain maps • Low-lying areas along the main river system • Hydro-geological maps • Location of glaciers & glacial lakes • Vegetative cover mapping • Tropical cyclone path maps	
Other hazards		
Base Maps		
Zonation maps	• Land use and cover map • Coastal zonation map	
Geological maps	• Geological maps • Geomorphology maps • Topography &Bathymetry maps • Land movement speed map (vertical and horizontal) • Bedrock Lithology • Soil typology • Groundwater table depth • Runoff distribution • Temperature distribution • Wind field	
DEMs	• Different resolutions	**90 meter DEM fre**
Aerial photos	• Different time, scanned, geo-referenced maps	
Satellite images	• **Different types and time**	

Annex 10. Expertise and skills required for DRAs

Category	Expertise & Skills	Organizations
Project management & coordination	• planning	***1) SCPESS*** ***2) Crisis Management Center (when it is created)*** ***3) ACSA (the National Agency for Rural Development)***
Disaster risk management	• DRR measures • Policy & regulation • Programming	
Hazard modeling & mapping	• Definition of hazard-prone areas; • Creation of historic hazard events catalogue; • Probability analysis of extreme events; • Probabilistic hazard/event intensity mapping; • Produce disaster risk profile • Modeling and simulation of hazards, i.e. earthquake, landslide, tsunami	***4) Profile organizations*** ***5) Subordinated institutions (State Hydro-meteorological Service, Institute of Geodesy Technical Research and Cadastre "INGEOCAD", etc.)*** ***6) Universities*** ***7) Research institutions***
Structural engineering	• Development of vulnerability functions • Assessment of damage state	***8) Ministry of Construction and Regional Development*** ***9) Ministry of Agriculture and Food Industry*** ***10) Ministry of Environment*** ***11) Ministry of Economy*** ***12) Ministry of Finance etc.***
Economical scientists	• Economic loss modeling and estimation • Macro-economic impacts • Cost-benefit analysis • Cost-effectiveness analysis	***13) Financial and economic institutions, statistics*** ***14) Non-government economical and analytical Centers (expert groups, Business Consulting Institute, "Viitorul")***
Sociological scientists	• Social impacts of disasters	***15) Institute of Philosophy and Sociology of the Academy of Science*** ***16) Social agencies ("AXXA", "CIVIS" etc.)***
Information management	**GIS, remote sensing, database management, digitization, cartography**	***17) Institute of Ecology and Geography*** ***18) "INGEOCAD"*** ***19) Land and Cadastre State Agency***

Annex 11. Current legal provisions that coordinate the process of DRA and DRM in Republic of Moldova

Codes of the Republic of Moldova	
Land Code**, nr. 828-XII 25 december 1991**	Official Monitor of RM nr.3
Subsoil Code**, nr.1511-XII 15june 1993**	Official Monitor of RM nr.11. 1993
Water Code**, nr.1532-XII 22 june 1993**	Official Monitor of RM nr.10. 1993
Forest Code**, nr.887-XIII 21 june 1996**	Official Monitor of RM nr.4-5 16.01.97. art.36
Laws of Moldova	
Law amending and supplementingLaw nr.1347-XIII, 9 October 1997production and household waste**, nr.480-XV 4.12.2003**	Official Monitor of RM 2004 nr.1-5
Law amending Article 16 of Law nr.1540-XIII, 25 February 1998 on payment for environmental pollution**, nr.354-XV, 31.07.2003**	Official Monitor of RM 2003 nr.191-195
Law amending and supplementing the Forest Code **nr.327-XV, 18.07.2003**	Official Monitor of RM 2003 nr.200-203
Law amending the Law nr.1515-XII, 16 June1993 on Environmental Protection, Law nr.851-XIII, 29 may 1996 on ecological expertise and environmental impact assessment and the Code of Administrative Offences**, nr.59-XV, 21.02.2003**	Official Monitor of RM 2003 nr.56-58
Law of Moldova's accession to the Kyoto Protocol to the UN Framework Convention on Climate Change**, nr.29-XV, 13 february 2003**	Official Monitor of RM 2003 nr.48
Law on amending and supplementing Law nr.1540-XIII, 25.02.98 on payment for environmental pollution**, nr. 1566-XV, 20 december 2002**	Official Monitor of RM 2003 nr.20-22
Law on Ratification of Agreement on cooperation in the field of active shares on weather processes and other geophysical processes, **nr.1080-XV, 24 may 2002**	Official Monitor of RM 2002 nr.75
Law on ratification of the hydrometeorological network of communitarian CIS interstate, **nr.1363-XV, 4 october 2002**	Official Monitor of RM 2002 nr.146-148
Law on Ratification of the Protocol on Persistent Organic Pollutants and the Protocol on Heavy Metals to the 1979 Convention on Long-range Transboundary Air Pollution, **nr. 1018-XV, 25 avril 2002**	Official Monitor of RM 2002 nr.66-68
Law on the approval of the trade regime and regulating the use of halogenated hydrocarbons that Deplete the Ozone Layer**, nr.852, 14 february 2002**	Official Monitor of RM 2002 nr.54-55
Law on Access to Information**, nr.982-XIV, 11 may 2000**	Official Monitor of RM 2000 nr.88 - 90
Law on Energy Conservation**, nr.1136-XIV, 13 july 2000**	Official Monitor of RM 2000 nr.157 - 159
Law for afforestation of degraded lands**, nr.1041-XIV, 15 june 2000**	Official Monitor of RM 2000 nr.141-143, art.1015
Law on public property and land delimitation**, nr.981-XIV, 11 may 2000**	Official Monitor of RM 2000 nr.94-97, art.672
Law of Moldova's accession to some international instruments in environmental protection**, nr. 111-XV, 27.04.2001**	Official Monitor of RM 2001 nr.52-54
Law on industrial safety of dangerous industrial objects**, nr.803-XIV, 11 february 2000**	Official Monitor of RM 2000 nr.59 - 62
Law on International Treaties of the Republic of Moldova**, nr. 595-XIV, 24 september 1999**	Official Monitor of RM 2000 nr. 24 - 26
Law on Licensing Certain Types of Activity**, nr.332-XIV, 26 March 1999**	Official Monitor of RM 1999 nr.62 - 64
Law on drinking water**, nr.272-XIV, 10 february 1999**	Official Monitor of RM 1998 nr.24-25, art.154
Law on Payment for Environment Pollution**, nr.1540-XIII, 25 february 1998**	Official Monitor of RM 1998 nr.54-55, art.378
Law amending the Law on Environmental Protection**, nr.1539-XIII, 25 february 1998**	Official Monitor of RM 1998 nr.44-46, art.316
Law on hydrometeorological activity**, nr.1536-XIII, 25 february 1998**	Official Monitor of RM 1998 nr.60-61, art.409
Law on waste production and waste**, nr.1347-XIII, 09 october 1997**	Official Monitor of RM nr.16-17 1998
Law on radiation protection and nuclear safety**, nr.1440-XIII, 24 december 1997**	Official Monitor of RM 1998 nr.24-25, art.154
Law on Air Protection**, nr.1422-XIII, 17 december 1997**	Official Monitor of RM nr.44-46 21.05.1998, art.312

Law on Natural Resources**, nr.1102-XIII, 6 february 1997**	Official Monitor of RM nr.40 din 19 iunie 1997, art.337
Law on Ecological Expertise and Environmental Impact Assessment**, nr.851-XIII, 29 may 1996**	Official Monitor of RM nr.52-53 1996
Law on protection zones and strips of water, rivers and water basins**, nr.440-XIII, 27 avril 1995**	Official Monitor of RM nr.43 1995, art.482
Law on Environmental Protection**, nr.1515-XII, 16 june 1993**	Official Monitor of RM al RM nr.10. 1993
Law on establishing general principles and requirements of the legislation on food safety and establishing the National Agency for Food Safety	Published in the Official Journal of the EuropeanUnionL31/1 of on01/02/2002
Decisions of the Parliament of Moldova	
National Committee on Environmental Policy **nr. 986, 23 july 2002**	Official Monitor of RM 2002 nr.110-112
National Committee on "Ramsar" **nr. 581, 8 may 2002**	Official Monitor of RM 2002 nr.66-68
The results of control law enforcement nr. 851-XIII, 29 may 1996 on Ecological Expertise and Environmental Impact Assessment **nr. 1267-XV, 29 july 2002**	Official Monitor of RM 2002 nr.113-114
On the Concept of Environmental Policy of the Republic of Moldova **nr. 605, 2 november 2001**	Official Monitor of RM 2002 nr.9-10
Sustainable Development Strategy for the approval of the forestry sector in Moldova **nr. 350, 12 july 2001**	Official Monitor of RM 2001 nr.133-135
Decisions of the Government	
Government Decision on amending and supplementing Government Decision no. 666 of 27.05.2002 on transfer of land, **nr.1254, 25.09.2002**	Official Monitor of RM 27.09.2002 nr.134
On some measures regulating the use of water bodies, **nr. 1202, 8 november 2001**	Official Monitor of RM 2001 nr.136-138
On the approval of the mitigation of air pollution by transport, **nr. 1047, 4 october 2001**	Official Monitor of RM 2001 nr.121-123
About some measures on public property land demarcation, **nr. 837, 14 august 2001**	Official Monitor of RM 2001 nr.104-105
Government Decision on the execution. 595 of October 29, 1996 and additional measures to optimize management of farm forestry and forest vegetation protection, **nr. 107, 7 february 2001**	Official Monitor of RM 2001 nr.19-20
About approval of the natural protected areas and built, **nr.1009, 5 october 2000**	Official Monitor of RM 2000 nr.127-129
Regulation regarding cadastre objects and complexes of protected natural areas of state **nr. 414, 2 may 2000**	Official Monitor of RM 2000 nr.54-56
Approving the National Action Programme to Combat Desertification**nr. 367, 13 avril 2000**	Official Monitor of RM, 27 avril 2000 nr.46-49
Approving the national program gradually phased out ozone depleting substances in Moldova **nr. 1064, 11 november 1999**	Official Monitor of RM, 9 december 1999 nr.135-136
Approving the Regulation on the use of hydrometeorological information in economic activity of economic agents **nr. 935, 11 october 1999**	Official Monitor of RM, 15 october 1999 nr.115
The classification of forests into groups and functional categories **nr. 1008, 30 october 1997**	Official Monitor of RM, 11 december 1997 nr.82-83
On measures to ensure the protection of forests, forest belts and forest plantations **nr. 106, 27 february 1996**	Official Monitor of RM, 30may 1996 nr.32-33
To approve the Regulations on the conditions of award and use of water objects **nr. 745, 3 november 1995**	Official Monitor of RM, 22 february 1996 nr.11-12
On the elaboration and approval of schemes for use in complex and water protection **nr. 747, 3 november 1995**	Official Monitor of RM, 7 march 1996 nr.14-15
On the draft concession agreement between the Government and company to exploit "Redeco LTD" (USA) on research and exploitation of oil and gas in Moldova **nr. 621, 7 september 1995**	Official Monitor of RM, 24 november 1995 nr.65-66
On the regulation of underground exploitation **nr. 700, 21 september 1994**	Official Monitor of RM, 10 november 1994 nr.12
On subsoil use license authorization by the Republic of Moldova **nr.726,**	Official Monitor of RM, 13 october 1994 nr.8

27 september 1994	
On approval of the Basic Principles for restoring degraded lands **nr.404, 9 june 1994**	Official Monitor of RM, july 1994 nr.7
About approval of temporary on grass harvesting and animal grazing lands of the Forest Fund of the Republic of Moldova **nr. 294, 25 may 1993**	Official Monitor of RM, may 1993 nr.5
On approval of Regulations on the recovery of damages caused by forest offenses **nr. 854, 28 december 1992**	Official Monitor of RM, december 1992 nr.12
On the approval of the development of water management and hydro-improvement in Moldova for the years 2011-2020 no. 751 of 05.10.2011	Official Monitor of RM, October 2011 no. 170-175
Moldova's cooperation agreements in environmental protection	
Agreement on Cooperation of CIS Member States during the evacuation of citizens in third countries in case of emergencies, signed on April 12, 1996, Moscow, Russian Federation.	R.M Law no. No 1390-XVI. 146-148 of 11.10.2002, Official Monitor of the RM of 31.10.2002
Agreement on exchange of information on emergencies, natural and technogenic character, information on overcoming the consequences of their cooperation and help the affected population, signed on September 18, 2003, Yalta, Russian Federation.	Government Decision no. 340 of 02.04.2004
Agreement between the Government and the United Nations on measures to speed up the import, export and transit of humanitarian personnel and asset said in emergencies and exceptional circumstances, signed on September 17, 1999, Chisinau, Republic Moldova.	R.M Law no. 1085-XIV of 23.06.2000
Memorandum of Understanding on the Institutional Framework of Disaster Preparedness Initiative and their Prevention in South Eastern Europe, signed on September 24, 2007, Zagreb, Croatia.	Government Decision no. 1333 of 08.09.2007
Open Partial Agreement of the Council of Europe / EUR-OPA Major Hazards.	Parliament Decision. 1372-XIII of 19.11.97
Memorandum of Understanding between the Government and the Government of Denmark on cooperation to implement the Kyoto Protocol of the United Nations Convention Base on Climate Change	Copenhagen, October 27, 2003
Agreement between the Ministry of Environment and Territorial Development of Moldova and the Ministry of Environment of the Republic of Poland on cooperation in environmental protection and natural resource	October 22, 2003, Chisinau
Agreement between the Ministry of Environment and Territorial Development of Moldova and the Ministry of Environment and Territorial Protection of the Italian Republic on cooperation in environmental protection	June 27, 2002, Chisinau
Agreement between the Department of Environmental Protection of Republic of Moldova and the Ministry of Natural Resources and Environmental Protection of Belarus, the environmental protection	December 25, 1994, Chisinau
Agreement between the Department of Environmental Protection of Republic of Moldova and the Ministry of Waters, Forests and Environmental Protection of Romania in the field of sustainable use of natural resources	March 18, 1997, Bucharest
Directives	
Directive2007/60/EC on the assessment and management of flood risks.	European Parliament and Council Directive of 23 October 2007 assessment and management of flood risks. (Official Journal L288, 6.11.2007, p27).

Annex 12. List of Institutions related to Risk Assessment

	Institution Name	The responsibility of the Institution related to Risk Assessment
1.	Agency for Geology and Mineral Resources	Agency for Geology and Mineral Resources of the Republic of Moldova "AGRM" is under the Ministry of Environment and is responsible for regulation and coordination of the study, protection and rational use of subsoil of the Republic of Moldova. *The main tasks of the Agency are:* • Coordinating the award of the use of the subsoil as is required; • Keeping the state evidence and state registration of works on geological study of the subsoil; • evidence of the underground sectors distributed for minerals extraction and their use for other purposes than minerals extraction; • creating a single information system of the subsoil use; • organizing the expertise of the useful mineral reserves, their economic characteristics and geological information about subsoil; • developing proposals, together with ministries and departments on the development of mineral raw materials, the national economy and maintaining international relations of the geological study and subsoil use; *The main responsibilities of the Agency*: • realization of state regulation in the study and use of subsoil; • executing the regional geological and geophysical works; • performs research and exploration of mineral water and groundwater; • achieving international collaboration in geology and subsoil use study. http://www.mediu.gov.md/md/asg/
2.	Apele Moldovei Agency	Apele Moldovei Agency is the administrative authority responsible for implementing state policy in water resources management, hydro-amelioration, water supply and sewerage, which operates under the Ministry of Environment.. *The main tasks of the Agency are*: • operation and repair of drainage systems and irrigation systems, water supply and sanitation; • performing repairs of the centralized drainage and irrigation stations, the water supply systems and sewerage; • develop regulations and contribute, through concrete actions to maintain the technical condition of the line storage , construction anti-flood, water supply networks, irrigation and drainage systems, pumping stations and other hydraulic structures; • Organize retraining and improvement of the workers of the Agency. *The main responsibilities of the Agency:* • to contract for carrying out scientific research in this area, and performing design and construction works; • to control the technical condition of hydro-technical construction, distribution and measurement systems, regardless of the ownership; • to create groups within the Agency to implement projects to improve water and sewage systems; • keep records and submit, as required, reports to the state bodies and to bear responsibility for their veracity; • to control the water limit use by the businesses, regardless of their form of ownership; • to control compliance with established norms and legislation in water management and hydro-amelioration; • to coordinate projects related to water management and land improvement.

		http://www.mediu.gov.md/md/apele_moldovei/
3.	Aqua-project, aqueducts systems design Institutes	State Design Institute "Aqua-project" approved by the Government of RM, as a parent Basin project organization, and is the only specialized organization for the design of water facilities in Moldova. *The main tasks of the Institute:* • Organization of groups to defend the population from the river flood; • Protection of the agricultural land in the valley of Prut and Dniester rivers; • Design of the irrigation system and irrigation areas in the Republic of Moldova; • Designing the waterways of the small rivers; • Making flood protection system in Moldova; • Protection of the settlements against floods; *The main responsibilities of the Institute:* • preparing documents and strategies in order to defend the population against flood; • the control of the irrigation systems and irrigation areas in the Republic of Moldova; • ensuring the effective functioning of the flood protection systems in Moldova and all the designed systems by the organization.
4.	State hydro-geological expedition	State Enterprise "EHGeoM" operating on the principles of self-management in accordance with the Constitution, Civil Code of the Republic of Moldova and the Regulation Board and the provisions of this Statute. *The main tasks of the state enterprise*: • Realization of state policy research of the exogenous geological processes; • Realization of state policy research of the earthquakes and their prediction; • Systematic analysis of liquid pollution of groundwater. *The main responsibilities of the state enterprise:* • Monitoring of exogenous geological processes; • Predicting earthquakes(a month before); • Predicting landslides activation; • Forecasting groundwater floods; • Liquidating the consequences of flooding for liquid pollution of groundwater;
5.	Agency for Land Relations and Cadastre	Cadastre Agency of the Republic of Moldova is the central public administration body, carrying out state policy in land relations, cadastre, geodesy, cartography, Geo-informatics and is subject to the Government. *The main tasks of the Agency:* • administering the regulatory regime of land ownership and land protection; • provides, through subordinate enterprises, development of land use schemes at the national level, district, city (municipality), village (municipality) for regulating the ownership of land and ensure the development of concrete programs of improvement and protection of land; • prepare and submit to the Government for approval the annual recovery and improvement programs of degraded lands; *The main responsibilities of the Agency:* • ensure the development of the projects for the recovery and improvement of degraded lands; • examine, coordinate projects and other documentation in the field of soil protection; • coordinates the geological, geo-morphological, geo-botanical soil research; • promote the state policy in the recovery and improvement of the degraded

		land sphere; • make the analysis of the quarterly performance of the work in recovery of degraded lands; http://lex.justice.md/md/334598/
6.	Institute of Ecology and Geography	Institute of Ecology and Geography of the Academy of Sciences was established by Government Decision "On measures to optimize the infrastructure of science and innovation" nr.1326 of December 14, 2005 by merging the National Institute of Ecology of the Ministry of Environment and Institute of Geography of ASM and is under double subordination. *The main tasks of the Institute:* • Elaboration of Geographical Informational System of environment and natural resources; • Integral monitoring of environment and ecological restoration. • Study of spatial distribution and dynamics of exogenous geo-morphological processes; • Assess the role of these processes in the current changing landscape of the country conditions of human life and activity; • Evaluation of the geo-morphological risks. *The main responsibilities of the Institute*: • highlighting trends amending the basic components of the environment (relief, soil, climate, etc.) under the action of natural and anthropogenic factors; • developing scientific bases for rational use of natural heritage; • mapping of the natural , socio-economic processes, mapping of the natural resources in order to evaluate the geo-ecological state of the Republic. http://www.asm.md/?go=detalii_sectii&n=11&struct2=1&sec=11&new_language=0 http://www.ieg.asm.md/lab/lab6.pdf
7.	Institute of Geology and Seismology of the ASM	History of the Institute begins with 1949, the Department of Geology was founded in the Moldovan branch of the Academy of Sciences of the USSR, which was concerned with studying the geological structure and mineral resources of the Republic of Moldova. In 1954 this branch was created by the seismic station "Chisinau", which began investigating the seismic regime of the Carpatian earthquakes. *The tasks of the Institute:* • Study the seismic regime of the Carpatho-Balkan region, seismic zoning of the Moldova, seismic micro-zoning of the settlements, seismo-tectonics and geodynamics; • Regional Geology: lithology, stratigraphy and geological formations of the minerals, tectonics, neo-tectonics, engineering geology; • Dynamics and groundwater regime in Moldova, water resources and quality, hydrological forecasts, processes related to the small river bed; *The main responsibilities of the Institute:* • Seismic zoning of urban territories areas; • Determination of land seismicity under building, located on land with complicated geotechnical conditions; • Recommendations in order to minimize the influence of explosions in the construction of the industry careers; • Seismic activity of the Carpatic earthquakes; • Estimation of the seismic properties of RM territory; • Improving the methods of the seismic zoning; • estimation and evaluation of seismic risk assessment (regional and local); • Monitoring of the seismic regime; • Estimation of the seismic hazard in Moldova and in the Carpathian-Balkan region; http://igs.asm.md/node/80

8.	Ministry of Finance	In Its essence, the Ministry of Finance is the central bodyof public administration, which develops and promotes the unique training and public finance management, financial levers of the application in accordance with the requirements of market economy. In its MF is guided by the Constitution, laws of the Republic of Moldova, RM President decrees, and decisions of Parliament, orders, decisions and orders of the Government. *The main tasks of the Ministry:* • development and promotion of state policy in public finance; • developing the legal framework governing the tax system, budget system and budget process; • preparation of medium-term forecasts on the state's financial resources and make proposals for reform in public finance; • develop regular forecasts of receipts and payments from the state budget and its liquidity provider; *The main responsibilities of the Ministry*: • Based on its work program objectives, develop the necessary set of MF regulations, governing the budget process, governing the system of taxation and accounting, prepare forecasts and long term use of the financial resources, find solutions to reform the public finances, provide receipts and payments from the state budget. • The ministry also develops and promotes the annual budget bill and, if it is necessary, draft law amending and supplementing the annual state budget law. • Ministry of Finance may also be involved in financial aid in case of natural hazards. Initial use of fund money is from Civil Protection and Emergencies, then can be partially or totally returned by the Ministry of Finance.
9.	Ministry of Labor and Social Protection	Ministry of Labour and Social Protection was created under Law No. 21-September 18, 2009 to amend Law No. 64-XII of 31 May 1990 on the Government, which was published in "Official Monitor" no. 149 of 22.09.2009. *The main tasks of theMinistry :* • exercise control over the receipt and distribution of humanitarian assistance provided to Moldova; • analyze and evaluate humanitarian needs, identify beneficiaries who need such assistance in priority; • identify new donors and promote humanitarian cooperation relations with them *The main responsibilities of the Ministry:* • management, under the law, the international programs of financial assistance to support reforms of social protection of population and improve the quality of accorded assistance; • coordination and control of the receipt and distribution of humanitarian assistance provided to Moldova; • identify, together with state institutions and public organizations, donors of the humanitarian aid and promote new cooperation relations with them; • review the prior document necessary for the releasing of the permits for the entry into the country of the humanitarian aid. http://lex.justice.md/md/332740/
10.	Ministry of Agriculture and Food Industry	Ministry is the central body of public administration, subordinated to the Government, the legal person that has a stamp with the State Emblem and its name in the state language and has its treasury accounts. Ministry operates under the Constitution of the Republic of Moldova, laws and decisions of the Parliament, Presidential decrees, orders, decisions and orders of the Government, other laws, international treaties to which Moldova is party and this Regulation. *The main tasks of the Ministry:* • monitoring and contributing to the development of foreign agricultural relations and the maintenance and development of bilateral and

		multilateral relations; • analysis of changes in agricultural structural adjustment and policy; • providing organizational and legal framework for production, control seeds, marketing and use of seeds and planting materials; *The main responsibilities of the Ministry:* • ensuring the compliance of the ecological restrictions in agriculture and agribusiness, including carrying outland improvement works and control of the rational exploitation of land resources of the country; • developing and implementing policy documents in combating the consequences of global climate change in agriculture; • Encourage agricultural insurance against natural disasters; • Support and stimulate soil conservation, including the implementation of Conservative Agriculture(no-till and others), in order to reduce erosion of land; "Action Plan on implementation of the Programme of the Government of the Republic of Moldova" European Integration: Freedom, Democracy, and Welfare "for the period 2011-2014", institution: Ministry of Agriculture and Food Industry http://www.maia.gov.md/pageview.php?l=ro&idc=6
11.	Ministry of Health of Moldova	Ministry of Health is the central body of public administration in health, being subordinated to the Government. Financing of the Ministry is made from the state budget, in accordance with the law. *The main tasks of the Ministry:* • analysis and evaluation of population health indicators, health system activity and performance in public medical institutions and the dissemination of information related to public interest; • Community care policy development (home care, palliative care nursing), provides and promotes cross-sector consolidation in this area; • establish, by law, rules of organization, operation and regulation of the business of public and private health care; *The main responsibilities of the Ministry:* • Participate in limiting the effects arising in disasters and epidemics in the field of it's competence; • Implementation and monitoring of health policies, with paying attention to the needs of the population, especially vulnerable groups; • ensure, through subordinate institutions, identify and assess risks to the health, manages these risks; • forecasting and mitigation of adverse impacts on public health of identified risks; • organize actions against epidemics; http://www.ms.gov.md/ministry/structure/statute/
12.	Agency "MoldSilva"	Agency "Moldsilva" is the central administrative authority in forestry, which shall function in the context of promoting the state policy in forestry: make the extension works, regeneration and conservation, environmental eco-construction, rational use of forest resources, security, protection and development national forest funds. *The main tasks of the Agency:* • Afforestation of the degraded lands; • Funding of the afforestation works and planting of forest belts; • Ensuring forest and forest vegetation outside the forest (Fighting forest fires, Prohibition of cattle grazing on forest lands) *The main responsibilities of the Agency:* • development and promotion of forestry policy documents and legislative and regulatory framework necessary to achieve the objectives in its areas of activity; • ensuring the development, analysis, monitoring and evaluation of sectorial policy documents and help assess the impact of social, economic

		and financial and other policy documents; • organizing and coordinating the implementation of policies in areas of responsibility, ensuring uniform application of national legislation in the areas concerned; http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=311740
13.	Red Cross	Moldova Red Cross Society (founded 1924) is the legal entity of public law, independent, not-governmental and apolitical. It is organized and operates under the law of the Red Cross Society of Moldova no. 139-XV from 10.05.2001. Moldova Red Cross Society acts according to the Fundamental Principles of the International Movement of Red Cross Red Crescent Societies. *The main tasks of the organization:* • to act in the event of armed conflict and in peacetime, to prepare to act as auxiliary organization of public authorities in all areas covered by the Geneva Conventions of 1949 and in favor of those in distress; • to contribute to the amelioration of health estate, prevention of sicknesses and alleviation the human suffering; • to receive, store and distribute the humanitarian aid received from the International Federation of Red Cross Red Crescent Societies, International Committee of Red Cross, other Red Cross Societies (Red Crescent), as well as from other local and foreign donors; *The main responsibilities of the organization*: • to act in case of an armed conflict; to be prepared to act during peace as an auxiliary organization of the public authorities, in all the fields covered by the Geneva Conventions of 1949 and to the benefit of all in suffering; • to organize the service of first aid for the disaster victims regardless of their cause and nature within the national plan of disaster relief; • to receive, store and distribute the humanitarian aid received from the International Federation of Red Cross Red Crescent Societies, International Committee of Red Cross, other Red Cross Societies (Red Crescent), as well as from other local and foreign donors; • to form and keep a stock of aid for emergency situations; • to organize and participate in international actions of victims assistance regardless of their cause and nature; http://redcross.md/en/who-we-are/moldova-red-cross-society/statutes
14.	State Hydro-meteorological Service	State Hydro-meteorological Service (SHS) is a public institution under the Ministry of Environment, which promotes the state policy in hydrometeorology, environmental quality monitoring and achieve state supervision and control of hydro-meteorological observations carried out in Moldova by natural persons and legal entities. *The main tasks of the SHS:* • monitor the status and evolution of the hydro-meteorological and environmental quality to protect the population from branches of national economy against dangerous hydro-meteorological phenomena and the high level of environmental pollution; • development of the agro-meteorological, climate, hydrological weather forecasts, and ambient pollution levels; • developing warnings about the dangerous hydro-meteorological phenomena; • developing warnings about the high levels of environmental pollution; • provide population, local and central public administration, economic and national defense with hydro-meteorological information about environmental quality; *The main responsibilities of the SHS:* • Making permanent observation network of state stations,, stationary and mobile observation points on the conditions and hydro-meteorological phenomena and environmental quality (as chemistry, physics, hydro-

		biological and radioactive); • Processing, analysis and systematic review of data on weather, upper air, agro-meteorological, hydrological, as well as information on environmental quality in the country; • Develop and deliver free construction authorization documents (certificates of climate characterization and background concentrations of air pollutants). http://www.mediu.gov.md/md/shs/
15.	Civil Protection and Emergencies Situation Service	Civil Protection of the Republic of Moldova is a system of measures and actions taken on state-wide peacetime and war, in order to protect people, property and ecological conditions of natural disasters, accidents and disasters, disease outbreaks, fire. *The main tasks of the Civil Protection:* • protecting people and property against the emergency situations; • carrying out of rescue and other urgent works under exceptional situations and liquidation of their effects; • Prior preparation and multilateral organization of the population, national economy objects, the Civil Protection forces to conduct the event of emergencies hazard and their conditions; • Prepare early evacuation, and in case of occurrence of immediate danger, evacuate people and property from the hazardous areas; • Notify the governing bodies and population of the appearance and the danger of the emergencies, brings the full state of readiness of Civil Protection forces and means, and lead their actions to the execution of rescue and other urgent works; • Accord multilateral assistance to the victims. *The main responsibilities of the Civil Protection:* • adoption of legislation in civil protection; • organization, research and examination of issues related to civil protection; • declare a state of emergency in case of exceptional situations; • determine the amount of budgetary allocations for civil protection http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=311639
16.	Fisheries Service	Fisheries Service at present is the specialized body of the Ministry of Environment, pursuant to Law 149 of 06/08/2006 on fish stock, fishing and fish breeding, exercise state supervision over compliance with this law and other legislation, protects fish resources, fish and carry out measures to improve the reproduction of fish, fighting fish poaching in natural aquatic objectives of Moldova. *The main tasks of the Service:* • Ensure in the natural aquatic objectives the protection of aquatic biological resources, regulation of fishing, implementation of measures to improve fish and fish breeding; • prevent and detect violations of existing legislation; • Determine, together with specialized scientific institutions, state of the aquatic biological resources and propose rates for approval; • Calculate injury to the aquatic biological resources through various activities (pollution, destruction of wintering holes, water abstraction, extraction of sand, installation of pipelines and cables, making explosions, illegal fishing, etc.). *The main responsibilities of the Service:* • to issue permits and amateur sport fishing and fishing permit to holders employed by commercial fishing / industrial organization; • to control individuals and legal documentation authorizing the industry / trade fishing and use of aquatic biological resources and identity documents too; • to control work in the natural fishery objectives, such as abstraction,

		deepening and straightening beds, laying cables and pipes, making explosions and the like. http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=316974
17	Climate Change Office (CCO)	CCO was established under the Ministry of Ecology, Constructions and Territory Development of the RM through Order No. 21 as of February 11, 2004. The basic objective of the Climate Change Office is to implement the Republic of Moldova's commitments under the UNFCCC, ratified through the Law No. 404-XIII from 16.03.1995 and Kyoto Protocol, ratified through the Law 29-XV from 13.02.2003. **The main tasks of the Climate Change Office include:** - logistical support to the Government, central and local public administrations, NGO's and educational establishments in the activities implemented and promoted by the RM under UNFCCC and Kyoto Protocol; - implementation of the Climate Change projects and programs, focused on the assessment of greenhouse gases by source and sink categories and producing the National Inventory Reports; - evaluation of the climate change impacts on the country's biological and social-economic components; - development and implementation of mitigation projects; - development and implementation of the climate change adaptation projects; - ensuring cooperation, promotion and implementation of the activities and projects under Clean Development Mechanism (CDM) of the Kyoto Protocol; and - implementation and facilitation of the awareness raising and information activities aimed at civil society, professionals and decision-makers on climate change issues, etc.
18	Eco-TIRAS International Environmental Association of River Keepers	Considering that it is an association of rivers of Moldova protectors, they are required to: • to help and advice authorities and population to manage the river in sustainable way, using Integrated River Basin Management Approach • achieving sustainable river basin management; • Participation in decision-making. Local empowerment and public and stakeholder participation in decision-making; • Develop monitoring and assessment of commitments under river basin agreements or arrangements. http://eco-tiras.org/index.php?option=com_frontpage&Itemid=1