



Country report
5.1 Conditionality
Romania
2016

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Acronyms

AH1N1 – influenza A virus subtype H1N1 (commonly known as "swine flu")

ARI - Acute respiratory infections

ATU – Administrative Territorial Units (in Romanian: UAT - *Unități Administrativ Teritoriale*)

BLEVE - Boiling Liquid Expanding Vapour Explosion

CBRN – Chemical, Biological, Radiological and Nuclear events (in Romanian: *Evenimente Chimice, Biologice, Radiologice și Nucleare*);

ECCS – Emergency Con Cooling System;

FRMP – Flood Risk Management Plans;

GIES – General Inspectorate for Emergency Situations (in Romanian: IGSU - *Inspectoratul General pentru Situații de Urgență*)

GD – Government decision

GEO – Government Emergency Ordinance

GO – Government Ordinance

H5N1 – Influenza A virus subtype H5N1 (commonly known as avian influenza or "bird flu")

H7N9 - Influenza A virus subtype H7N9 (commonly known as avian influenza or "bird flu")

HAEI - human - animal - ecosystem interface

ILI - Influenza-like illness

INHGA - The National Institute of Hydrology and Water Management (in Romanian: INHGA - *Institutul Național de Hidrologie și Gospodărire a Apelor*)

IPPC – Integrated Pollution Prevention Control;

IPCC – Intergovernmental Panel on Climate Change;

LOCA – Loose of Coolant Accidents;

MESREE – Mobile Emergency Service for the Resuscitation and Extrication in Emergency (in Romanian: SMURD - *Serviciul Mobil de Urgență, Reanimare și Descarcerare*)

MERS-CoV - Middle East respiratory syndrome coronavirus

NARW – National Administration "Romanian Waters" (in Romanian: ANAR - *Administrația Națională „Apele Române”*)

NaTECH - Natural Hazard Triggering Technological Disasters

NCSES - National Committee for Special Emergency Situations (in Romanian: CNSSU - *Comitetul Național pentru Situații Speciale de Urgență*)

NTCIQMES - National Training Center for Increasing the Quality of the Management of Emergency Situations (in Romanian: CNPPMSU - *Centrul Național pentru Perfecționarea Pregătirii Managementului Situațiilor de Urgență*);

NCWC - National Committee for Weatherproof and Calamity (in Romanian: CNIC - *Comitetul Național pentru Intemperii și Calamități*)

NIPE - National Institute of Physics of the Earth (in Romanian: INFP - *Institutul Național pentru Fizica Pământului*)

NMA - National Meteorological Administration (in Romanian: ANM - *Administrația Națională de Meteorologie*)

NPDRR - National Platform for Disaster Risk Reduction (in Romanian: PNRDD - *Platforma Națională pentru Reducerea Riscului de Dezastre*)

NPP – Nuclear Power Plan;

NRAWG– National Risk Assessment Working Group (in Romanian: GLERN - *Grupul de Lucru pentru Evaluarea Riscurilor la Nivel Național*)

NSESM – National System of Emergency Situations Management (in Romanian: SNMSU - *Sistemul Național de Management al Situațiilor de Urgență*)

NSVFSA - National Sanitary Veterinary and Food Safety Authority (in Romanian: ANSVSA - *Autoritatea Națională Sanitar Veterinara și pentru Siguranța Alimentelor*)

NIRDH – National Institute for Research and Development in Health (In Romanian: INCDS - *Institutul National de Cercetare Dezvoltare Sanatate*);

OIL – Operational Intervention Level;

RBA – River Basin Authorities;

SPA - Special Protected Areas;

SCI - Sites of Community Importance.

TMF - Tailings Management Facility

WMO - World Meteorological Organization (in Romanian: OMM - Organizația Meteorologică Mondială)

Acknowledgements

This report was developed in the project "National Risk Assessment – RO RISK" – (SIPOCA code: 30, co-financed under EFS through the Operational Program Administrative Capacity 2014 – 2020) under coordination of the General Inspectorate for Emergency Situations by a team of external experts (Agora Est Consulting). The data used in this report was provided by the institutions involved in the sectoral risk assessment (see **Annex 2**). In the elaboration of the report, the team of experts benefited from the assistance provided by advisors from the Joint Assistance to Support Projects in European Regions (JASPERS).

Foreword

An overall national review of all the risks in Romania is one of the most important concerns of the Romanian central authorities involved in risk prevention, response and management. Very professional and well documented analysis of various hazards were developed over the past years, but a general common perspective on these hazards was never explored at national level. This approach may contribute to the increase of effectiveness of risk related emergency situations services, but also to a broader cooperation among different European states in facing the consequences of various hazards.

A national risk assessment in Romania is of special importance for the level of interoperability among different domestic institutions, but also abroad. Communicating the risks to population and an increased level of performance of responsible institutions are key factors in this context. The European Commission considered this topic as highly important and development of a risk assessment at national level became one of the conditionality for accessing European funds for 2014-2020.

The aim of this report is to present the main actions which were undertaken in order to comply with this conditionality and to develop a solid risk assessment process in Romania.

As the reader will further discover in this report, one of the key features of the national risk assessment process in Romania is the wide coverage of the consultation process which was undertaken in order to reach a general agreement on the way risks are assessed. Relevant central and local administration institutions, research institutes, as well as common citizens were involved in different stages of the consultation process.

Another feature is the involvement of specialized institutions in developing sectoral risk assessment. Using a common methodology, the risks were assessed and results were used in order to place the risks on a common matrix.

This report is the first one of a series of reports which will be periodically updated in order to insure a proper communication of risks to population and relevant institutions.

I. Introduction

I.1. Current situation

In Romania, the risk management organizational system¹ comprises of a series of institutions from the central, the territorial (decentralized) and local public administration. Their institutional capacity and resources are important due to the imminence of certain types of emergencies which have a repetitive pattern in Romania and an important impact on the people, the environment and the socio-political stability. The system has been created to ensure an effective management of any type of emergency situation and, also, to cover the obligations Romania has as part of international treaties and agreements, especially as a Member State of the European Union, which includes a European risk prevention system, considering the cross-border nature of contemporary risks.

The focal point of the entire reform process is the Ministry of Internal Affairs and its subordinated structure, the **General Inspectorate for Emergency Situations** (GIES – In Romanian: IGSU - *Inspectoratul General pentru Situații de Urgență*) under the Department for Emergency Situation. The Ministry of Internal Affairs develops the main public policies on emergency situations, as well as the assessment centralization and risk management generated in legislation under the responsibility of other line ministries. A number of these line ministries fulfill support functions in emergency situations management: Ministry of Regional Development and Public Administration, Ministry of Environment and Climate Change, Ministry of Agriculture and Rural Development, Ministry of Health, Ministry of Economy.

The main piece of legislation regulating the emergency situations domain is the Government Emergency Ordinance no. 21/ 2004 on the **National Emergency Situations Management System** (NESMS, in Romanian: SNMSU - *Sistemul Național de Management al Situațiilor de Urgență*), amended and supplemented by the Government Emergency Ordinance (GEO) no. 1/2014 on certain measures in the area of emergency situation management. In completion of the legal framework, the Government Decision (GD) no 557/2016 on risk type management was adopted. According to these normative acts, the institutions have defined the obligation to draw up sectoral plans to provide specific emergency situations management. The coordination of the whole process is ensured by the National Committee for Special Emergency Situations (NCSES).

The National Emergency Situations Management System represents a permanent communication network between public administration authorities and the organizations qualified for emergency management, established by levels and fields of competence, and which have the infrastructure and resources necessary for reducing casualties and response in case of different types of emergency situations.

The *National System* is composed of:

- Emergency situations committees (at national, ministerial, Bucharest Municipality, county and local level);
- The General Inspectorate for Emergency Situations (as integrator – ensures the transmission of the decisions taken by the Government or by the National Committee towards the local and central public administration authorities);

¹ Accordance with the legislative provisions: **GD no. 762/2008** on the approval of National Strategy of prevention of emergency situations; **GD no. 557/2016** on the approval of risk type management; **GEO no. 1/2014** on certain measures in the area of emergency management and amending and supplementing **GEO no. 21/2004** on the National Management System for Emergency Situations.

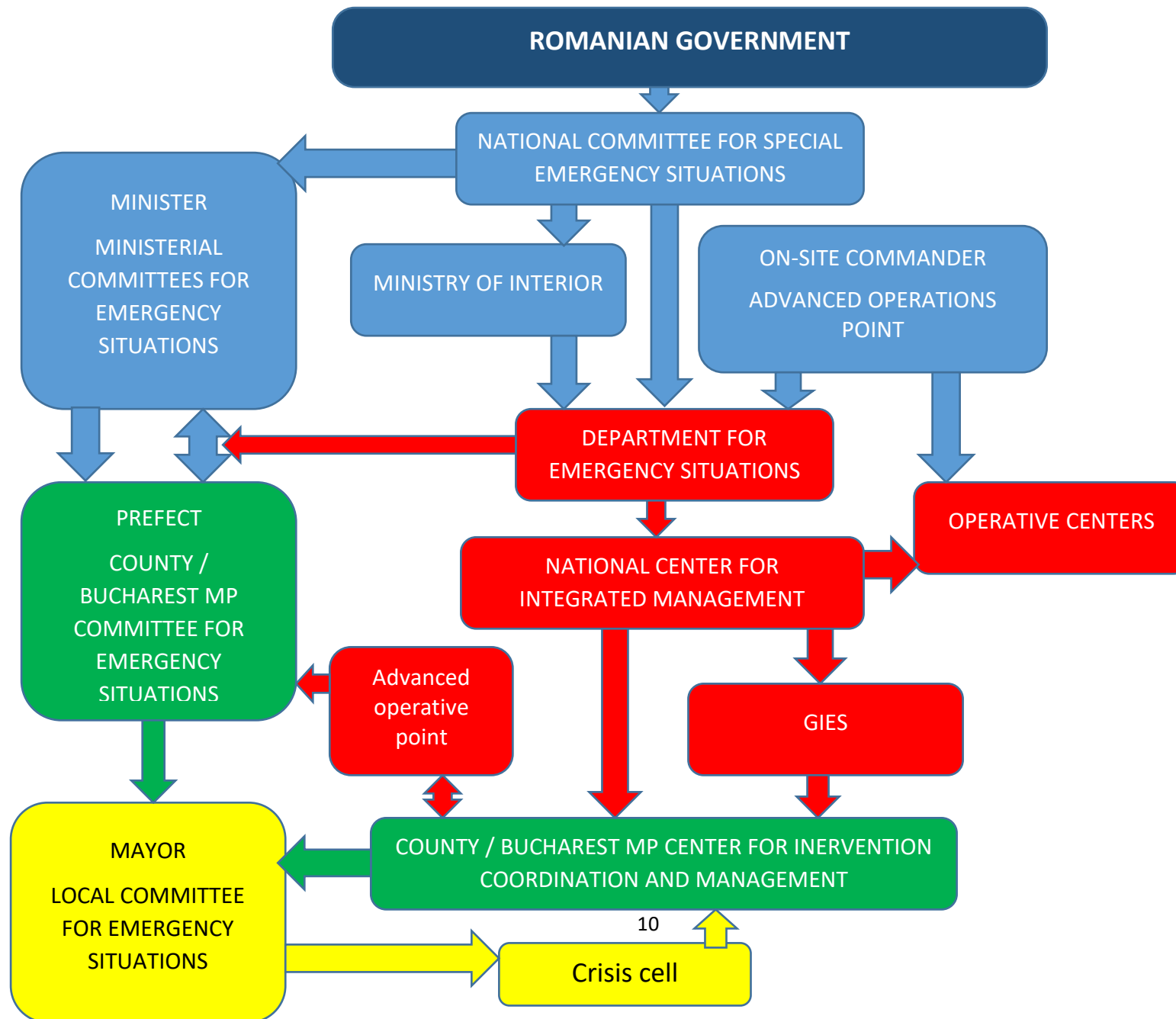
- Professional community public services for emergency situations (County Inspectorates for Emergency Situations) and Volunteer emergency services according with GEO no. 21/2004;
- Operational centers for emergency situations (permanent or temporary - are established within ministries and other institutions within the system, in order to ensure the flow of information before or at the time of an emergency);
- On-site commander (ensures the unitary coordination at the place where the exceptional event has occurred);
- In order to manage emergency situations, GIES and the county structures fulfill the mission of: monitoring, evaluation and response to emergency situations;
- Information and preventive education and warning of the population, notification to government authorities about the possibility/imminence of emergency situations; search and rescue, extrication of persons; evacuation of endangered people, population and property by ensuring evacuation measures, installing victim camps, participation in public transportation and of certain categories of goods.

As an integrator of the National Emergency Situations Management System, GIES coordinates the actions of the institutions involved in the management of emergency situations, ensuring the position of national contact point in the relationship with governmental and nongovernmental international organizations with responsibilities in this area. From an operational point of view, GIES and the county structures have 42 operational centers and 280 operational sub-units, with over 3500 pieces of equipment for intervention. The nearly 30,000 human resources/people, represent 97% of the operational units and 3% are administrative structures: educational and research institutions, facilities, workshops and technical supply warehouses, logistics and repairs.

In this institutional framework, special attention has been given to the appropriate measures to respond to recommendations in order to fulfill the 5.1 ex-ante conditionality mentioned above. The approach involved the following steps:

- Establishing a National Risk Assessment Working Group (NRAWG, in Romanian: *Grupul de Lucru pentru Evaluarea Riscurilor la Nivel National* - GLERN). It was concerned with the national risk assessment, as well as to ensure the continuity of the estimation process and risk mapping. It is a working group consisting of experts on risk assessment from the central public administration (ministries), the academia and research institutions. Also, it is a condition to fulfill the ex-ante conditionalities for accessing EU funds for the period of 2014 – 2020.;
- The development of the individual risk (sectoral) assessment – The development and implementation of the Methodology – at this stage experts from the business sectors, authorities from central and local level, as well as experts from the academia and the ministries with attributions in the management of the types of risks that may generate emergency situations were involved (see **Figure 1**);
- The development of the sectoral risk assessment – at this stage experts in the assessment of the ten types of sectoral risks, ministries with attributions in the management of the types of risks which may generate emergency situations, as well as authorities with attributions in the intervention as stated by the law were involved;
- The development of The National Platform for Disaster Risk Reduction (NPDRR, in Romanian: PNRDD - *Platforma Națională pentru Reducerea Riscului de Dezastre*) was part of the implementation of the measures under the Hyogo Framework for Action and Sendai Framework. It is organized and operates as a national multi-sectoral and interdisciplinary mechanism, consisting of National Committee for Special Emergency Situations (NCSES, in Romanian: CNSSU - *Comitetul Național pentru Situații Speciale de Urgență*) members, the technical and scientific support groups and NGO representatives, the associative structures of local authorities, professional associations, trade unions, higher education institutions and research institutes, cultural institutions of religious denominations and associations recognized by law and mass – media.

Figure 1. Information flow – Decision making process at NESMS (Source: GIES)



I.2. Types of risks acknowledged by the Romanian legislation

According to the regulation in force, there are a number of hazards acknowledged by the Romanian legislation and considered, on historical basis, as being probable to occur on Romanian territory. A number of 10 types of hazards were selected from this list to be subject to assessment, based upon scientific evaluations. The evaluations were based on historical data regarding the impact of each risk, as well as different assessments developed at the level of relevant institutions. On the left column, **Table 1** shows the initial hazards and, on the right column, the 10 types of hazards that were selected after evaluations.

Table 1. Selection of risks

Natural hazards	Storms and blizzards	Selection process	1. Floods
	Floods		2. Drought
	Massive snowfalls		3. Forest fires
	Tornadoes		4. Landslides
	Drought		5. Earthquakes
	Extreme temperatures		6. Nuclear and radiological accidents
	Forest fires		7. Seveso accidents
	Avalanches		8. The risk of major accidents involving dangerous substances
	Landslides		9. Epidemics
	Earthquakes		10. Animal epidemics and Zoonosis
Technological hazards	Accidents, breakdowns, explosions and fires in industry, including land collapses caused by mining activities or other technological activities	Selection process	6. Nuclear and radiological accidents
	Accidents, breakdowns, explosions and fires associated with the transportation and storage of dangerous products		7. Seveso accidents
	Accidents, breakdowns, explosions and fires in transportation activities		8. The risk of major accidents involving dangerous substances
	Accidents, breakdowns, explosions, fires or other events associated with nuclear or radiological activities		9. Epidemics
	Water pollution		10. Animal epidemics and Zoonosis
	Collapses of buildings, installations and facilities		
	Failure of public utilities		
	Falling objects from the atmosphere and from space		
	Inactivated or unexploded ordnance leftover from military conflicts		
Biological hazards	Epidemics	Selection process	9. Epidemics
	Animal epidemics and Zoonosis		10. Animal epidemics and Zoonosis

The selection of hazards as well as the entire process of risk assessment was developed taking in consideration the provisions of the Decision No 1313/2013/EU of the European Parliament and of the Council, of 17 December 2013 on a Union Civil Protection Mechanism.

I.3. GIES vision and objectives

The organization of emergency situations response activities has a long history in Romania. From the Roman organization of the municipal services, through the Middle Ages to the modern times, services provided in case of emergency situations were considered of major importance. This type of services starts to be reformed and equipped in the 19th century when fire fighters became an organized military corps of the Romanian Army, as subunits of territorial artillery.

The High Royal Decree no. 468 issued on 28 February 1930, approving the Regulation of Passive Defense Against Aerial attacks, is considered the Act of birth of civil protection. Regulation is French-inspired and was implemented with effect from 23 March 1933, when it was published in the Official Gazette no. 69/23.03.1933.

In 1945, the Military Firefighters were transferred, together with their organization, to the Ministry of Interior. As a result, the Command of the Military Firefighters becomes the General Inspectorate of the Firefighters. Therefore, they were not part of the army staff, but were organized as a civil institution of the Ministry of Internal Affairs.

In 1968, as a result of a change in the legislation, fire companies were set in each county residence, 39 counties at the time. Subunits have been established on some industrial sites (after the sinister incident from Pitesti in 1974), the testing and experimentations center from Boldești (in 1974 as well), the School of Firefighters officers from Bucharest (1976), which became the Firefighters Faculty, as well as the school of NCOs Firefighters from Boldești (1986).

It is worth mentioning the fact that more recently, since 1984, firefighter officers had been trained successively in Bucharest, Oradea and Sibiu, while noncommissioned officers were trained in Bucharest (since 1931) and Câmpina. Important reform initiatives (allocation of modern equipment and training) were undertaken after the fire on the petrochemical platform from Pitesti in 1974 that had caused huge material damage and loss of human lives. The period is important in that the use of cars with gasoline engines had been almost entirely stopped. The import has been maximally lowered and high capacity special vehicles have been domestically produced, with multiple working possibilities, such as the ones with four-extinguishing agents. In the 80s, the equipment of the Military Firefighters was completely renewed.

In the post-communist period, the emergency situation services went through major changes, as did the entire Romanian society. In National Defense Act, no. 45 from 01.07.1994, the term civil protection formally appears. Civil protection orientation towards specific missions to disasters will become apparent only after 1990. In October 1996, the law no. 106 of civil protection is adopted, which has been repealed and replaced by a new law, no. 481/2004, integrating civil protection National system of Emergency Management. According with this regulation, the General Inspectorate of Military Firefighters, along with its units, merged with the structures composing the Civil Protection Command, thus generating the General Inspectorate for Emergency Situations, the county inspectorates and that of the Ilfov-Bucharest Municipality. This institutional change was motivated by the exponential growth of non-military risks, against the background of globalization trends, climate change, the diversification of the economic activities and response to disasters. The inspectorate has been active until recently, when its profile was reformed in order to be compatible with the EU requirements.

In the pre- and post-accession period, Romania benefited from the support provided by EU through its funds. Among the projects developed by The General Inspectorate for Emergency Situations worth being mentioned are the following:

- Joint Risk Monitoring during Emergencies in the Danube Area Border, Cross Border Cooperation Programme Romania – Bulgaria 2007 – 2013;
- Improvement of the response of the Mobile Emergency Service for the Resuscitation and Extrication (SMURD) in emergency, preparedness and intervention through a joint integrated system for efficient monitoring and disaster consequences mitigation, according to population in the common boundaries of Romania, Ukraine and The Republic of Moldavia;
- EMERSYS – for an integrated border system for detection and written procedures for fast response in nuclear, radiological, biological, chemical emergency situations – MIS ETC 774. Cross Border Cooperation Programme Romania – Bulgaria 2007 – 2013.

Following the implementation of these projects and the institutional reform initiated in this very important area, the General Inspectorate for Emergency Situation continues to have a major role in the development of a sound national system in order to provide emergency services in a more efficient and accountable manner.

According to its latest strategic plan², the main objective of GIES refers to its institutional consolidation and development, in order to increase the operational and response capacity reduce the impact of emergency situations on communities and improving the quality of missions undertaken in benefit of the population. The reason for introducing GIES vision and objectives as a distinctive chapter in this country report is represented by its central position in the National Emergency Situations Management System in Romania. However, the action roadmap presented in a later chapter comprise initiatives envisaged also by other central public administration institutions, members of the National System of Emergency Situations Management.

Towards achieving its goals, GIES undertakes various activities correlated with different types of risks, active on Romanian territory. The actions are fire prevention and intervention, extrication and first aid (SMURD), search and rescue missions and limiting the damage caused by floods, landslides, seismic activity, epidemics, epizootic diseases, snow, drought, the assistance of people in critical situations, interventions in case of technological, radiological or biological accidents, or other types of natural and anthropogenic calamities.

The priorities of GIES for the upcoming period (by 2020) are the following:

- Assuring the essential capabilities on prevention, protection, reducing/limiting the impact, response, recovery to cope with new challenges;
- Improvement of the quality of the Human Resource;
- Developing procedures, standards, regulations and innovative tools to optimize the resources and anticipate emergency situations, in order to ensure the management of complex or unprecedented situations;
- A dynamic partnership with the society in order to respond to the new requirements and to integrate new skills and capabilities;
- Improvement of the ability to command and control;
- Improvement of the ability to promote new technologies in prevention, preparedness and response.
- Increased effectiveness of the legal framework due to the laws which were passed on the organization and functioning of institutions as well as the military firefighters and volunteer statutes;
- High operational and response capability;
- Strengthened preparedness and prevention system;
- High resilience of NESMS structures and communities;
- Trained human resource and employment security assured;

² http://www.igsu.ro/documente/informare_publica/Programe-strategii/PSI_2014-2016_anexa_OMAI_159din2014.pdf

- New integrated technologies in the prevention, preparedness and response (telemedicine system, drone units, emergency communications system for missions in tunnels / subway and in areas without telecommunication coverage);
- Centralized alarm notification-national system achieved by ensuring 100% coverage of the county residence city, 70% of the remaining municipalities, and 50% of the cities and communes nationwide – to be achieved by 2020;
- High degree of confidence in GIES;
- Reduced impact of the assessed and treated risks.

The quantitative and qualitative indicators related to the corresponding activities for fulfilling the directions of action, are detailed in the Strategy Action Plan.

I.4. The process of risk assessment in Romania

The main results of the process of risk assessment in Romania are represented by the Methodology for National Risk Assessment and, based on this methodology, individual assessments of sectoral risks³. Identification of the position on the risk matrix of the risks identified represents the final outcome corresponding to these results. This report contains descriptions of the activities developed in order to obtain these main results.

These activities, summarized in the following pages, were of two types: *research* activities, represented by various studies and analyses and *consultation* activities with various stakeholders involved in risk management and assessment.

I.4.1. Methodology

The support activities for developing the Methodology⁴ (**research** and **consultation** activities) were undertaken during the entire process of elaboration of its first draft, according with the provisions of the *Commission Staff Working Paper - Risk Assessment and Mapping Guidelines for Disaster Management*.

The *Research* activities consisted in conducting sociological research, comparative studies and legislation analysis aiming at gathering data on the existing situation regarding the institutional framework and possible means of improving it, identification of various thresholds for impact indicators, identification of methodological similarities for various already existing regulations and methodologies in force for different types of risks.

The studies developed in the research phase also included analysis and identification of the best practice cases across European countries. The methodologies from various countries were analyzed in a comparative manner and recommendations regarding the best approach to be adopted in the case of Romania were formulated. Another useful output of the research phase consisted in an overview of the existing domestic regulation related to evaluation and risk management. Among the results of this study, one is the identification of overlapping and redundancies in the Romanian legislation. This information was further used in formulating the main elements of the methodological framework to be applied in the case of assessment of all types of risks. Some of the definitions or other elements of the Methodology were considered and proposed for adoption in the first draft.

³ As required by the Risk prevention and management criteria (p. 77).

⁴ The Methodology can be consulted at the following web address <https://www.igsu.ro/documente/RO-RISK/Metodologia%20de%20evaluare%20unitara%20a%20riscurilor%20-%20versiune%20finala.pdf>

During the *Consultation* activities⁵ various instruments were used, such as:

- Surveys: among citizens and representatives of various institutions regarding risk acceptability – thresholds of impact indicators for various risks;
- Interviews with relevant representatives of the institutions involved in risk assessment and management – identification of the best approach in the development of various components of the methodology;
- Workshops – the first draft of the methodology was subject to discussions during several workshops organized in order to reach a relative consensus among specialists regarding the thresholds and main components of the methodology. The main topics of the discussions covered subject as the description of the main types of impact with corresponding thresholds, scenario development and selection, the technical solution for the calculation of possible impact, cross border issues, techniques for calculation of the global impact and a proposal for presentation of a common matrix with all types of risks in Romania, based on values of their estimated impact and likelihood. The participants to the workshops were mainly from specialized departments within ministries and governmental agencies;
- Input from the partner institutions of GIES involved in the development of sectoral risk assessments (assessments developed for each type of risk consisting in the description and analysis of risk scenarios) – a final set of recommendations were formulated after the dissemination of the first draft of the methodology, towards those institutions which were later involved in the application of the assessment of each type of risk.

During the entire process, as it is presented in **Figure 2**, two versions (one intermediary-first draft and one final) of the Methodology were developed. The sectoral risk assessments were developed using the provisions of the final version (draft II) of the Methodology.

I.4.2. Risk assessment

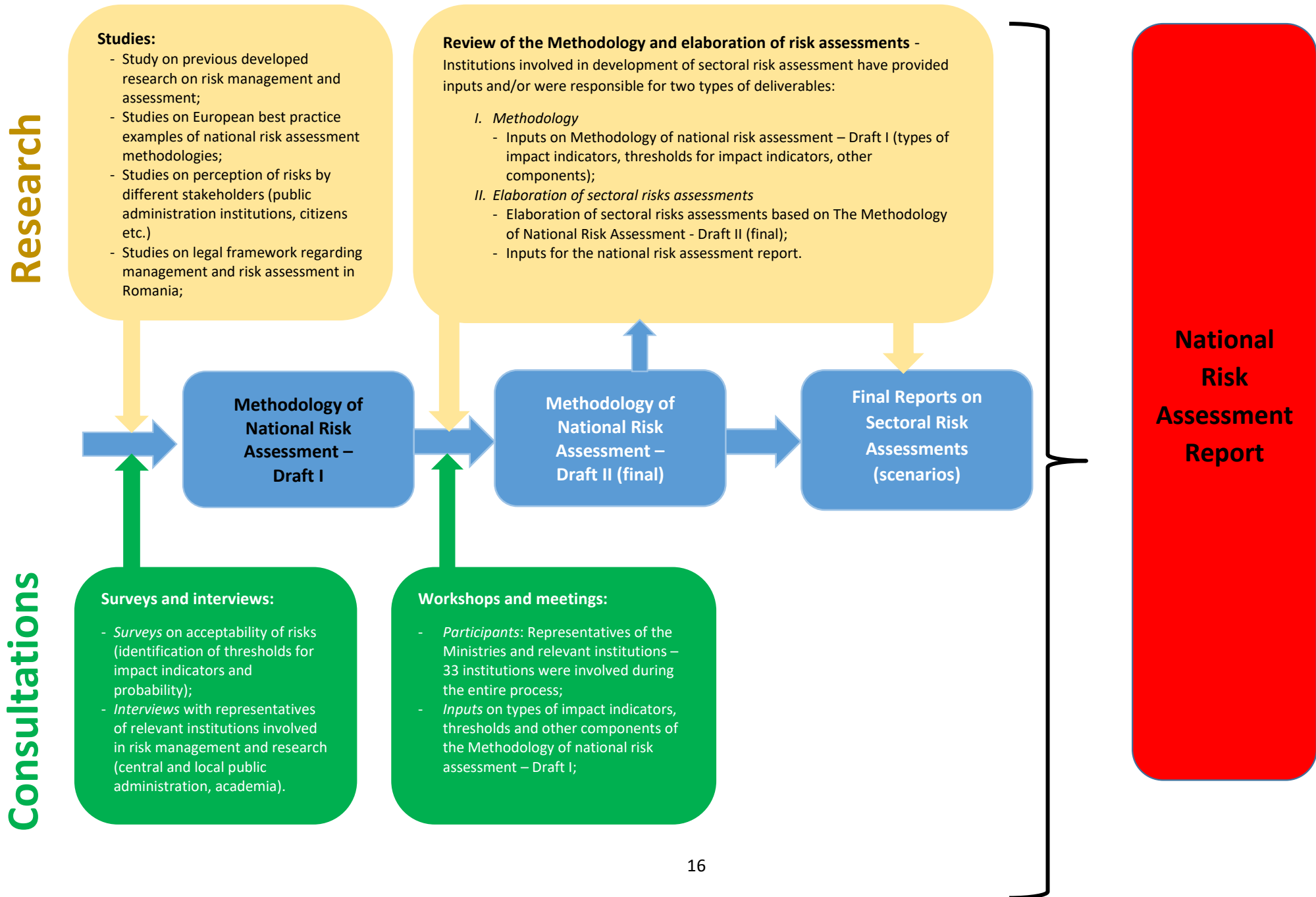
After reaching agreement on the content of the Methodology, specialized institutions (see **Annex 2**) start developing individual assessments for each type of risk (sectoral risk assessments), based on the provisions of the Methodology. During this phase, an in-depth analysis of each risk was developed, using relevant scenarios and the values of specific impact indicators, such as those referring to physical impact (human impact included), economic and socio-psychological impact, but also the likelihood scale and the selection criteria for scenarios.

Detailed economic and sociological methodologies were developed in order to support the sectoral risk assessments. During this phase, the content of the Methodology was once more submitted to a consultation process, a number of modifications being operated, in accordance with the recommendations of the institutions involved in the sectoral risk assessment⁶. Being as detailed as it was, the consultation process made possible the elimination of inconsistencies or possible causes of failure in its application on different types of risks. Another result of this process was the identification of some of its elements as being inconsistent or impossible to apply. In these cases, proper modifications of the initial version were undertaken.

⁵ Following the Criteria for fulfilment which states that "the process of producing a national or regional risk assessment has involved a wide range of actors and stakeholders (e.g. one coordinating authority has been designated; working groups involving public authorities from different levels, research and business, non-governmental organisations have been planned).

⁶ As required by the Criteria for fulfilment stating that "Stakeholders and interested parties have been widely consulted on the draft risk assessments and information has been disseminated towards the general public on the process and the outcomes of risk assessment;"

Figure 2. The support activities for developing the Methodology and sectoral risk assessment.



I.5. Structure of the report

The objectives of the report are the following:

- Presentation of the main stages of the national risk assessment process in Romania;
- Presentation of the main components of the Methodology for National Risk Assessment (henceforth called the "Methodology");
- Presentation of the main results of the Sectoral Risk Assessments and of a comparison framework (risk matrix) for different types of risks - the national adaptation strategies to climate change were taken into consideration in this process;
- Identification of the most important needs of the administrative system in order to improve the capability level of Romanian institutions involved in risk management related activities;
- Identification of the indicative measures to be implemented.

The report contains the main activities that were undertaken in order to comply with the recommendations provisioned in the thematic ex-ante conditionalities for accessing European funds in 2014-2020, as proposed by the General Regulation 2014-2020. The objectives of these conditionalities are the following:

- 5.1. To promote climate change adaptation and risk prevention and management (Climate change target). This objective envisages promotion of investment addressed to specific risks, ensuring mobility for disasters and disaster management systems development;*
- 5.2. Risk prevention and risk management. In order to comply with this objective, a national or regional risk assessment for disaster management has to be developed, taking into account the climate change adaptation objectives.*

For this latest objective, a set of criteria has to be met - Conduct a national or regional risk assessment which are comprised of:

- A description of the process, methodology, methods and data used to assess national risk;
- A description of single and multiple risk scenarios;
- Takes into account, where appropriate, the national adaptation strategies to climate change.

This report provides information about the manner in which these criteria have been met. It refers to results and activities developed, as well as the actors involved in the process. This document represents a starting point, as it shall undergo periodical revisions, and strategies and further policies shall be added in the future, as recommended by the European Decision No 1313/2013 on a Union Civil Protection Mechanism, article 6 (c) stating that "*Member States shall: (c) make available to the Commission the assessment of their risk management capability at national or appropriate sub-national level every three years following the finalization of the relevant guidelines as referred to in point (f) of Article 5(1) and whenever there are important changes;*".

The main coordinator of the process of risk assessment in Romania and responsible for complying with the conditionality criteria is GIES. This institution is part of the Emergency Situation Department from the Ministry of Interior.

The report is structured as follows:

Chapter II – This chapter has two components: the first consists of a presentation of the main components of the Methodology for National Risk Assessment. The description refers to concepts such as: scenario building, types of impact, likelihood, and risk matrix. The second represents a summarized description of each risk, which was previously subjected to an assessment based on the

developed methodology. Relevant details about impact and likelihood are provided for each type of risk. The risk matrix containing all the risks is also presented at the end of this chapter.

Chapter III – This chapter explores the possible vulnerabilities and needs the risk management system (GIES included) might have by analyzing the existing data, correlated with aspects such as: the institutional framework, infrastructure and logistics and human resources. The results will provide input for the road map for action to be presented in the following chapter.

Chapter IV – The final chapter consists in a presentation of the main objectives and corresponding indicative measures based on the needs identified in the previous chapter.

II. Risk assessment instruments and results

This chapter addresses two main aspects: a description of the main components of the Methodology and the results of the sectoral risk assessments, as well as the risk matrix.

II.1. Main components of the Methodology

The risk assessment process, its instruments and results have been developed according to the guidelines⁷ and the Commission Staff Working Paper on "*Risk assessment and Mapping Guidelines for Disaster Management*" from 21st December 2010⁸. It also took into account the national climate change adaptation strategies, which address the impact of climate change⁹ on health, agriculture and forest, biodiversity and ecosystems, water, coastal and marine areas and infrastructure and constructions. The main elements of the Methodology were:

A. Scenario building

a) Scenario development (single and multi-risk scenario)

Single risk scenarios

Scenarios are a way of creating a descriptive base of analysis for future decisions regarding risk management. A scenario "*provides a means of communication about a common image regarding future uncertainties and factors which may influence decisions to be taken in the present*"¹⁰.

The single risk scenarios represent scenarios that identify and describe a single risk and the implications that could be generated by a risk event. It was the primary concern of risk assessment, in order to obtain high consistency for the means and response level. Baseline analysis was the starting point in identifying and building scenarios. These elements were important because they enable, during the scenarios building process, differentiation between:

⁷ Fulfilling the criteria stating that "A description of single-risk and multi-risk scenarios have to be presented".

⁸ Risk Assessment and Mapping Guidelines for Disaster Management SEC (2010) 1626 final.

http://ec.europa.eu/echo/files/about/COMM_PDF_SEC_2010_1626_F_staff_working_document_en.pdf

⁹ http://www.mmediu.ro/beta/wp-content/uploads/2012/10/2012-10-05-Strategia_NR-SC.pdf

¹⁰ 2009, National Safety and Security Strategy of the Netherlands, *Working with scenarios, risk assessment and, capabilities, Scenarios*, pp 17.

- Scenarios that were based on historical events that had a major likelihood to occur (floods, dangerous transportation accidents, etc.);
- Scenarios which may include indirect risks and longer-term development (global warming).

Experts from various fields were involved in order to identify different scenarios. In addition to sectoral risk experts (experts in physics, epidemiologists, etc.), experts with other specializations were involved (experts in public administration, construction, agriculture, sociologists, economists, etc.). The team's multidisciplinary nature enabled the identification and informational scenario building in a more accurate manner.

The methodology presented a series of features that should be followed in this first stage, which aimed at the identification of an extensive number of possible risk scenarios (approximately 40 for each type of risk).

All scenarios were identified based on the hazard's *likelihood*. Subsequently, the scenario's *impact* was checked, in order to establish whether it is affecting Romania's national or sectoral strategic interests. These two elements further enable *the selection* of a number of plausible scenarios (5 for each type of risk). A general checklist was pursued during the scenarios building phase, according to the criteria mentioned in the Commission Staff Working Paper on "*Risk assessment and Mapping Guidelines for Disaster Management*".

Multi – risk scenarios

Multi-risk scenarios refer to the occurrence of several different risk events, but interconnected, such as NaTECH events (Natural Hazard Triggering Technological Disasters), or events generating a domino effect. These represented the object of a multi–risk assessment for situations where an event triggers multiple events with different risks (e.g., an earthquake followed by several fires).

A multi-risk assessment consists in determining the events overall risk which:

- Occur at the same time;
- Follow each other, being initiated by the same trigger or hazard;
- Do not follow chronologically, but the events' occurrence influences the same exposed/vulnerable elements¹¹.

Multi-risk scenarios have been classified, therefore, in any of the aforesaid three types of events. Events that may occur in a multi-risk scenario belong to several types of hazards. In the scenarios identification and description stage, possible events amplifications determined by the interaction of several types of hazards have been considered. The vulnerability was addressed taking into account the possibility that all the events may occur.

The development of multi-risk scenarios in the process of risk assessment was recommended by the European Commission, particularly to Member States where the national risk assessment is in a later stage. The following steps were recommended:

1. Identification of possible multi-hazards scenarios, starting from a first – event and assessing the trigger for other possible hazards or events leading to hazards;
2. Exposure and vulnerability analysis for each hazards and risk separately in each part of the scenario;
3. The estimated risks for each hazards, adverse event and multi-risk scenario.

¹¹ Risk Assessment and Mapping Guidelines for Disaster Management SEC (2010) 1626 final.

Multi – risk scenario development and assessment represented a complex process in practice, which is why this Methodology for National Risk Assessment recommended that multi – risk scenarios should be identified, as a first stage, following the steps which were further detailed, and that the multi-risk scenarios assessment, which was a complex synthesis process, should be performed in a later stage of the national risk assessment.

B. Types of impact

The types of impact were specifically defined by the Impact of the Criteria (C) (See **Annex no. 4**). The Impact of the Criteria were assessed and measured through the representative indicators. The scores of these indicators allowed a quantitative – value assessment of these criteria and the calculation of the impact for each scenario¹². All these indicators were measured through quantitative scales.

For some scenarios corresponding to certain types of risks it was not necessary to estimate the indicators corresponding to each criterion (e.g. the criterion “number of affected buildings” was not estimated in case of the scenario corresponding to the drought risk). In these cases, only the indicators that, according to the analysis conducted, were found to have been affected, have been taken into consideration.

In order to calculate the impact for all the criteria, the scale for the Impact of the Criteria (C) had 5 intervals, from *very high impact* to *very small impact* and is common to all the indicators. The scale included a series of indicators which were selected and defined as a result of the consultations with experts and public authorities, taking into account the European Commission recommendations, the methodologies of the Member States and the commonly accepted thresholds as representative of the impact.

T1. Physical Impact

This type of impact referred to the physical, negative effects of a risk event of the exposed elements. The analysis of the Impact of the criteria was performed for each of the selected scenario for each type of risk. The focus of this type of impact is represented by people, 4 out of 10 criteria referring to them. The indicators composing this type of impact were: the number of deceased people, injured people, evacuated people, people with no access to basic services. The rest of them are represented by civil and industrial constructions affected and destroyed, kilometers of affected transport infrastructure, kilometers of affected utilities infrastructure, number of machinery and equipment, sq. km. of affected area and environment - the protected area affected.

T2. Economic Impact

The economic impact referred to the costs associated with human loss, the costs associated with direct material loss, costs associated with environmental loss, costs for the intervention of the task forces and indirect costs.

T3. Social and psychological impact

The analysis for the social and psychological impact generated due to the occurrence of a risk event was a substantial element of the impact analysis. It had a key role in the selection of the most important national risk scenarios. It consisted of disruptions of everyday life and the psychological impact.

¹² The mentioned types of indicators are part of the European Commission recommendations and are found in various forms and names in most of the methodologies developed by the Member States. This was done according to the Criteria of fulfilment stating that the risk assessment has considered all three categories of impacts (human, economic and environmental, and political and social impacts).

C. Likelihood

The likelihood calculation resulted in the identification of the likelihood of a risk event to occur within a predetermined timeframe, taking into account the available information.

The information included in the scenarios constructed in the previous step was used to frame their likelihood on the proposed scale below. The likelihood of an event described by the relevant scenarios prioritized has been based primarily on data identified during construction of the scenario, and then, if the data was not available, on the expertise of specialists who have identified usable and comparable data.

The likelihood of the events described in the scenario was measured on a scale of 1 to 5 steps (1 - low, 5 - high).

D. Risk matrix

The risk matrix was the recommended tool for *representing, comparing* and, subsequently, *ranking* the scenarios. The matrix is a graphical representation of the aggregated impact and likelihood scores. The European Commission recommended this tool to ensure comparing results of the risk assessment in the Member States.

According to the matrix, the impact was placed on a vertical axis and the likelihood on a horizontal axis. The aggregate impact scores, the likelihood of a particular scenario and the manner in which the scores determine a scenario's position in the matrix were represented in the risk matrix.

Positioning the scenarios on the risk matrix has ranked a risk depending on risks value by placing them on the three areas of the matrix: acceptable – “green”, necessary measures need to be implemented – “yellow”, not acceptable – “red”. Representation of the scenarios on the risk matrix provided a final list of the national main risks, according to their occurrence likelihood and their impact.

II.2. Results of sectoral risk assessments based on the Methodology

Risk management represents the systematic approach and practice of managing uncertainty to minimize potential harm and loss¹³. It encompasses risk assessment and analysis, and the implementation of strategies and specific actions to control, *reduce* and transfer risks.

However, prevention is the outright avoidance of adverse impacts of hazards and related disasters¹⁴. Prevention (i.e. disaster or risk prevention) expresses the concept and intention to completely avoid potential adverse impacts through action taken in advance. Very often the complete avoidance of losses is not feasible and the task becomes one of mitigation. Partly for this reason, the terms prevention and mitigation are sometimes used interchangeably in casual use.

As one can see, risk prevention or mitigation is a part of a wider process of risk management. The following descriptions of types of hazards and their risk assessments are aimed at providing valuable information not only for risk response activities but for risk prevention as well. However, the results of the assessments are further used in this report for identification of possible capacity needs in order to increase the overall performance of emergency services provision.

¹³ Source: <https://www.unisdr.org/we/inform/terminology#letter-r>

¹⁴ Source: <https://www.unisdr.org/we/inform/terminology#letter-p>

For each type of hazard the description will follow aspects such as: specific context (details on the specific physical context of disaster occurrence in Romania), estimated impact based on risk assessment developed according with the provision of the Methodology, likelihood/frequency in accordance with available historical data and comments on the position of the risk on the risk matrix. This information constitutes one of the sources for identification of objectives in organizing the emergency situations services related activities.

II.2.1. Natural risks

A. Earthquakes

Specific context

Romania is situated at the contact of three continental tectonic plates: Eastern European plate (its Southwestern corner, with the Western boundary beneath the Eastern Carpathians) in the North-Eastern Romania, the Intra-Alpine sub-plate (a component of the Western European plate) beneath Transylvania, and the Moesian sub-plate in southern Romania.

Several tectonic models, covering a large range of geodynamic scenarios, attempted to explain the characteristics of the strong intermediate-depth seismicity from the bend of the South-eastern Carpathians (Vrancea region); nevertheless, the nature and mechanisms for earthquake generation are still subjects of debate.

Likelihood and Impact

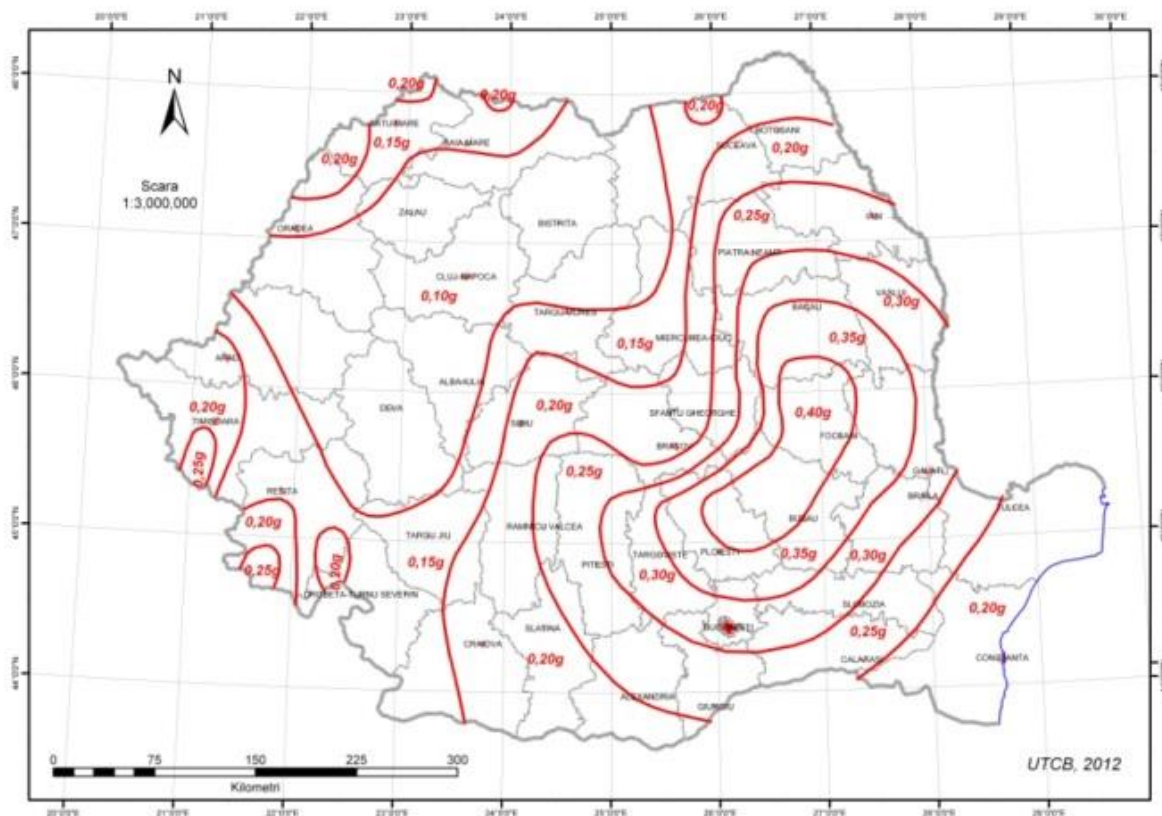
The Romanian level of seismicity is determined by several sources: Vrancea area and other 13 seismic sources situated on Romanian territory but also on Bugaria's and Serbia's and Hungary's territories. From these 14 sources, the Vrancea area is the most active one, influencing two thirds of the Romanian territory, but also parts of Moldova and Bulgaria. During the last century this sources determined seismic events with over 6 degree magnitude. 5 events were with a above 6,5 magnitude¹⁵.

In this area, situated at the Carpathians Arc-Bend, 2 separate/decoupled seismogenic zones are identified: the zone crustal seismicity (VRC), with earthquakes mainly down to 40 km depth, and the zone of intermediate-depth seismicity (VRI), in the depth range 60 to about 200 km, where major earthquakes with moment magnitude $M_w > 7$ may occur. The intermediate-depth earthquakes are felt over wide areas in Europe. The occurrence rate of the Vrancea intermediate depth earthquakes with magnitude greater than 5 is about 1,82 earthquakes/year. The maximum magnitude instrumentally determined for VRI is $M_w = 7,7$ - the earthquake of 10th November 1940 In the Vrancea crustal zone (VRC), the most recently recorded significant event occurred on 22nd November 2016 with 5,2 magnitude. The presence of the Vrancea intermediate-depth seismic source results in a high seismic hazard in the Extra-Carpathian area of Romania, while the Intra-Carpathian zone (the central, Northwestern and Western regions of the country) is less exposed.

75% of the population and 45% of the vital networks are exposed to moderate and high earthquake risk, and the possibility and likelihood of occurrence of a major earthquake in 30-40 years is a statistical reality. Romania's capital, Bucharest, is highly exposed to earthquakes. As seen in **Map 1**, the entire eastern part, some areas in the center, the southern and south-western parts of Romania are exposed to a high level of seismic hazard.

¹⁵ The most severe earthquakes occurred in Romania at 10 November 1940 ($M_w=7,7$, $h=150$ km), 4 March 1977 ($M_w=7,4$, $h=94$ km), 6 October 1908 ($M_w=7,1$, $h=125$ km), 30 August 1986 ($M_w=7,1$, $h=131$ km) and 30 May 1990 ($M_w=6,9$, $h=91$ km) – see also **Table 2**.

Map 1. The design ground acceleration with mean recurrence interval, $MRI = 225$ years (20% likelihood of exceedance in 50 years) Official Gazette of Romania no.558 bis/2013. P 100-1/2013



In the **Table 2**, an overview of the most important earthquakes is presented. Data on their impact, casualties and degree are provided.

Table 2: Major earthquakes on Romanian territory in the XXth century

	Date	Time	M_w	Casualties	Building affected, economical losses
1	November 10 th 1940	03:39	7,7	593 deaths (140 in Bucharest) 1,271 injured (300 in Bucharest)	Low rise buildings seriously damaged The tallest reinforced concrete building in Bucharest collapsed.
2	March 4 th 1977	21:21	7,4	1578 deaths (1,424 in Bucharest) 11,321 injured (7,598 in Bucharest)	- 156,000 apartments in urban zones and 21,500 rural houses destroyed or very seriously damaged; - 366,000 apartments in urban zones and 117,000 rural houses to be repaired; -destroyed 374 kindergartens, nurseries, primary and secondary schools and badly damaged 1,992 others. -destroyed six university buildings and damaged 60 others - destroyed 11 hospitals and damaged 228 others hospitals and 220 polyclinics (health care centers) - destroyed or damaged almost 400 cultural institutions such as theatre's and museums - damaged 763 factories. US\$ 2.048 billion equivalent loss

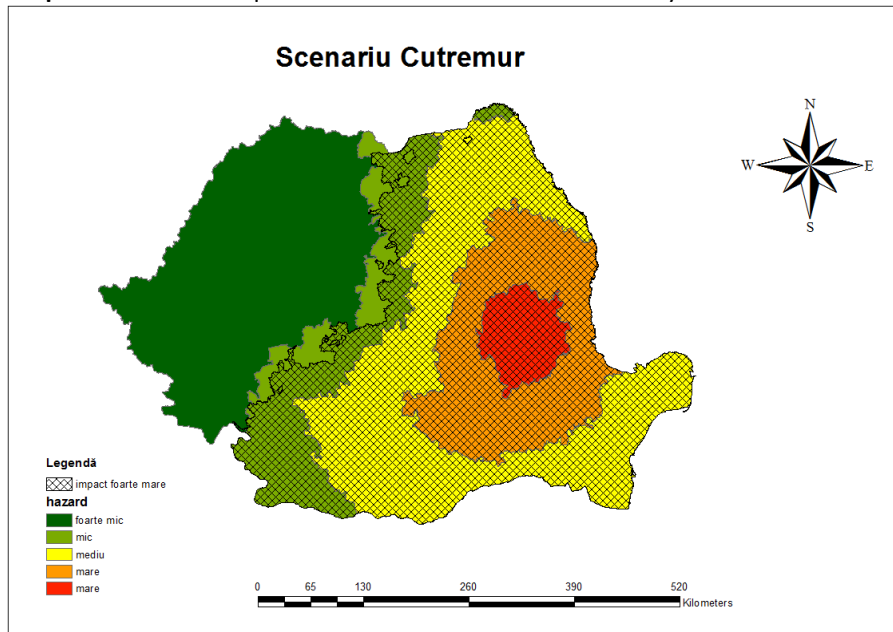
3	August 30 th 1986	23:28	7,1	8 deaths 317 injured	
4	May 30 th 1990	12:40	6,9	9 deaths 296 injured	
5	July 12 th 1991	12:42	5,6	2 deaths 30 injured	5,000 rural houses in Banloc, hundreds to thousands of homeless in Timiș County

According to the scenarios analysed, the impact of a major earthquake will be significant because of the urban areas situated close to the epicentre. Public perception reveals a high level of anxiety regarding the occurrence of an earthquake, especially in Bucharest, were the last major earthquake has caused many casualties and damage. The main concern is related to the situation of building vulnerability.

Position on the risk matrix

The Vrancea earthquake scenario is characterised by a moment magnitude $MW = 8.1$ (which corresponds to a mean return interval of 1000 years) and a focal depth of 90 km. The epicentre is situated in the area in which large magnitude Vrancea seismic events have occurred in the last century, in November 1940 and March 1977. Considering the widespread impact of this earthquake scenario, it can be considered as an event affecting the entire territory of Romania (although not in a direct manner).

Map 2. Vrancea earthquake scenario return interval of 1000 years - hazard



The position of earthquakes on the risk matrix (**Figure 3.**) indicates a high level of impact (4) in case of occurrence (the scenarios were developed for earthquakes of high intensity), but a rather moderate to low likelihood (2). Given the level of impact, preparation for a major earthquake should be considered as a high priority.

Map 3. Vrancea earthquake scenario impact on humans

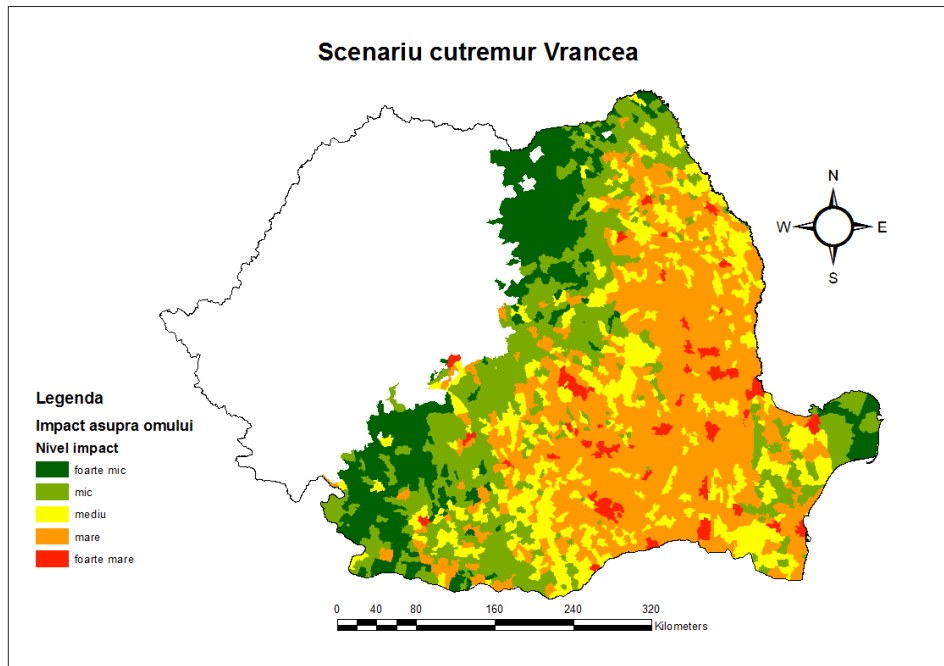
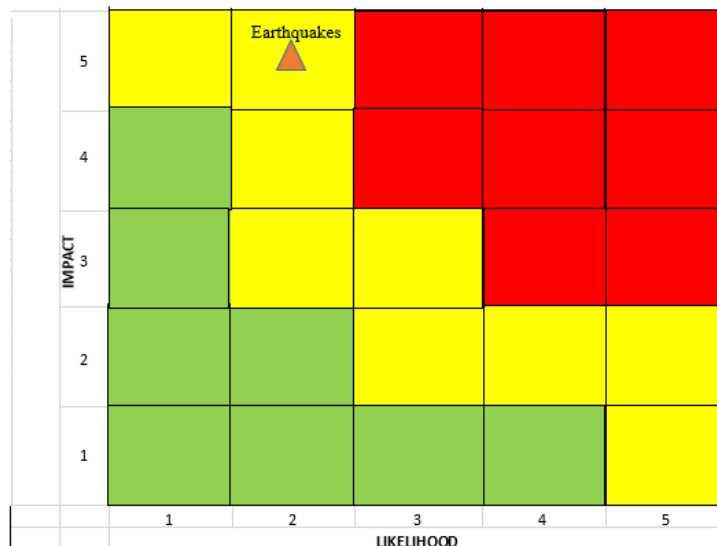


Figure 3. The position of earthquake on the risk matrix.



According to the assessment developed, 75% of the population and 45% of the vital networks are exposed to the risk of an earthquake, and the likelihood of a major earthquake to occur in 30-40 years is a statistical reality. One of the main concerns is that Romania’s capital, Bucharest, is highly exposed to earthquakes. Moreover, the entire eastern part, some areas in the center, and the southern part of Romania are close to the epicenter.

Furthermore, the scenarios analyzed showed that the impact of a major earthquake will be significant because of the urban areas situated close to the epicenter. Public perception reveals a high level of anxiety regarding the occurrence of such an event, especially in Bucharest, where the last major earthquake has caused many casualties and damage. Moreover, earthquakes of lower magnitude have occurred in the Vrancea area in recent years, being felt in Bucharest, as well as other cities around the epicenter.

B. Floods

Specific context

One of the most frequent disasters in Romania are the floods. Flood risk assessment was analyzed during the implementation process of Floods Directive¹⁶ in Romania. Elements exposed to hazard which were taken into consideration are the ones indicated in Article 6 of the Floods Directive, respectively: the approximate number of inhabitants potentially affected; type of economic activity in the area potentially affected; IPPC installations (see Annex I of Directive 96/61/EC on integrated pollution prevention and control) that can cause accidental pollution in case of flooding; potentially affected protected areas etc.

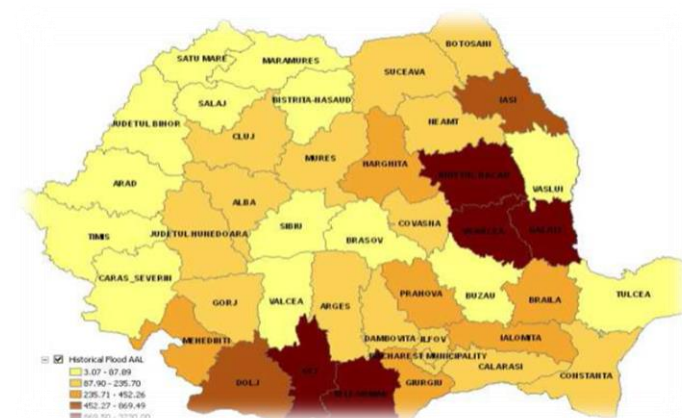
In case of major floods due to overflow of the water courses, in case of 1 in 100 years return period for almost 16400 km of inland water courses and 1074 km for the Danube river, almost 818.000 inhabitants and 3550 localities may be at risk. Related to transport infrastructure, around 6% of the national railways network and about 700 km of major roads (highways, national and European roads), 1300 km of county roads and 1000 km of local roads are potentially affected. Also, 204 points for abstraction of water intended for human consumption, 79 SPA (Special Protected Areas), 86 SCI (Sites of Community Importance), 100 national protected areas, and 32 IPPC (Integrated Prevention and Pollution Control) installations are in danger to be flooded. Regarding cultural objectives, 286 churches, 15 monuments and 13 museums are at risk. The population possibly affected by flooding in case of 1 in 1000 years return period is about 1.817.000 inhabitants.

Likelihood and Impact

During 1960 - 2010, a number of around 400 important floods occurred, among them 39 are considered significant historical floods, based on hydrological criteria and criteria that took into account the magnitude of the floods negative consequences. Thus, there were designated 36 significant historical events for the inland rivers and 3 for the Danube, and 375 areas with potential significant flood risk on the inland rivers and 24 on the Danube. During this period, there have been registered 237 victims (6.6 average victims/event). The Siret river area has generated the highest number of casualties (140) (**Map 4**).

More recent history of floods in Romania shows the great impact of this hazard on people and infrastructure: the 2005 and 2006 floods have affected over 1.5 million people (93 dead), have destroyed an important part of the infrastructure and have caused estimated damages of over 2 billion Euro.

Map 4. Counties most affected by floods. *Source:* GIES.



¹⁶ This Directive requires Member States to assess if all water courses and coast lines are at risk from flooding, to map the flood extent and assets and humans at risk in these areas and to take adequate and coordinated measures to reduce this flood risk. <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32007L0060>

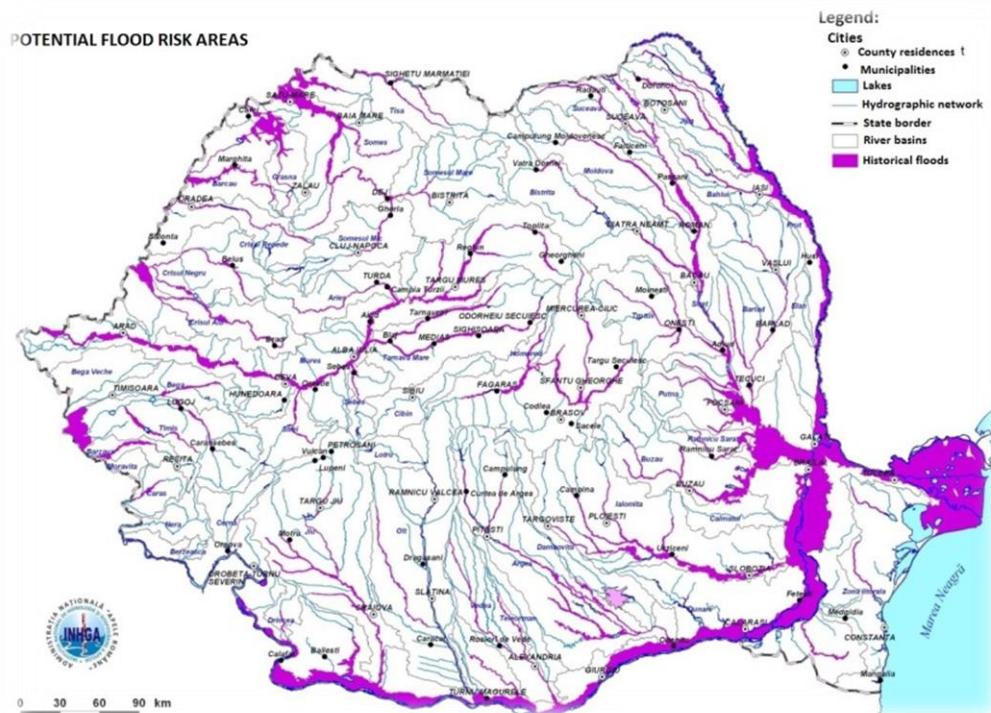
A relevant example are the floods in Galați which affected a number of 39 localities with 73 destroyed dwellings, 2,726 damaged dwellings, 10 casualties (9 adults and 1 child) and 8,583 people were relocated. 227 people and 752 animals were saved. As shown in **Map 4**, Galați County is one of the most exposed area to floods (the eastern part of Romania next to Brăila County). The counties of Bacău, Vrancea, the North – East of Vaslui, Dolj, Teleorman and the South of Gorj in the South are in a similar situation. Analysis of risk from flooding was performed on two major types of floods: flash floods and flash floods slow fast.

Based on flood hazard and flood risk maps elaborated in the third stage of Floods Directive, National Administration “Apele Române”, under the scientific coordination of National Institute of Hydrology and Water Management, had developed Flood Risk Management Plans (FRMPs) for all 11 River Basin Authorities (RBAs) and Danube river. The main chapter of the FRMP consists in proposed measures by the RBAs, that aim to reduce flood risk. The measures are with applicability at national, river basin and areas with significant potential flood risk level.

The scenarios identified for slow floods were based on preliminary flood risk assessment carried out in the first stage of implementation of Directive 2007/60 / EC reported. The purpose of this first stage was to identify significant historic floods and delimitation of areas with significant potential flood risk. Based on the methodology developed in this phase of implementation of the Directive, resulted in 36 events nationwide (excluding the Danube). For the Danube, were selected 3 events (1998, 2006 and 2010).

The selection process of scenarios for rapid floods took into account a number of criteria: likelihood of occurrence, expansion/surface affected, the severity of the damage/impact of the flood genesis spill (determinants and conditioning/predisposing), overlapping with slow floods, event type (single, repeated at short time).

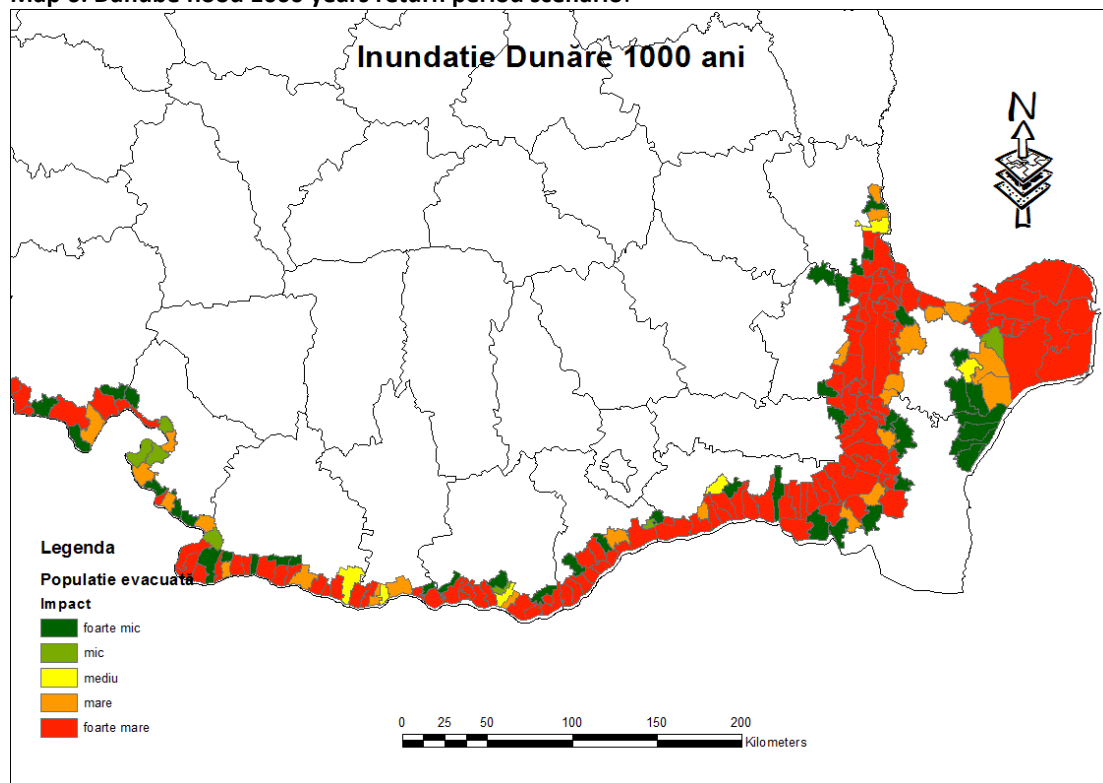
Map 5: Area with potential risk of floods occurrence. *Source:* NIHWM



In the reference timeframe, flow rates higher than 10,000m³/s have been recorded in 24 years. Based upon the NIHWM methodology (The National Institute of Hydrology and Water Management, in Romanian: INHGA - *Institutul Național de Hidrologie și Gospodărire a Apelor*), three major hydrological events have been noticed: January 1998, March – May 2006, June – July 2010. Of these events, the ones from 2006 stood out because of the dimension of their social and economic consequences: 15,834 people were evicted, 154 settlements were affected, 1,774 houses have been flooded, 443 of which were destroyed, 4,700 household annexes, 64,350 ha arable land, 6.8 km of national roads and 593 km of county and village roads.

Risk assessment for floods have been done in accordance with the River Basin Management Plans and Flood Management Plans prepared by ANAR. In Romania there are 11 River Basins for which the documents mentioned above have been prepared. In case of one of the river Basins, because of the specificity of the local geography, (the Dobrogea Coastline), which includes proximity to the Black Sea, an additional risk has been identified, that of coastal erosion¹⁷.

Map 6: Danube flood 1000 years return period scenario.

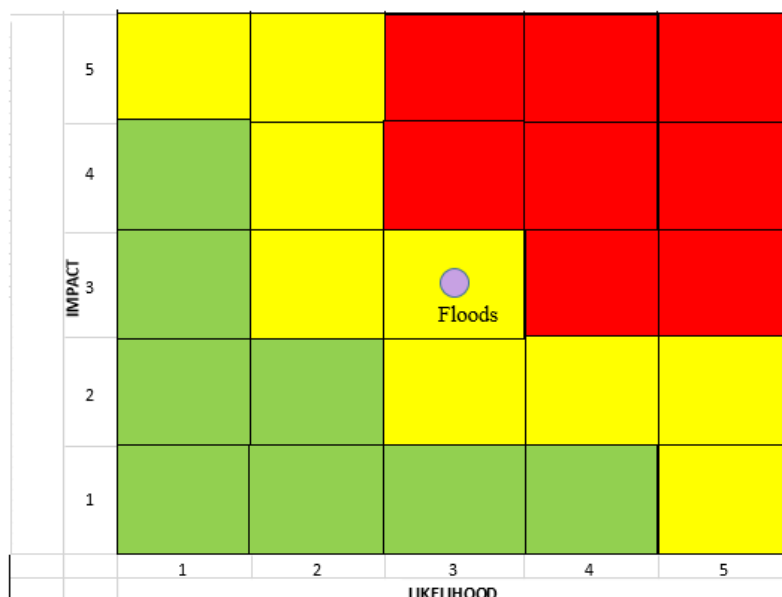


Position on the risk matrix

Floods are one of the most damaging hazards in Romania, having a medium level of impact (physical, economical and socio-psychological). With a medium rate of occurrence, the position of floods on the risk matrix is on a higher position than the earthquakes in terms of likelihood, but with a rather smaller impact (**Figure 4**).

¹⁷ <http://www.rowater.ro/TEST/Planul%20National%20de%20Management%202016-2021%20-%20Sinteza%20Planurilor%20de%20Management%20la%20nivel%20de%20bazine-spatii%20hidrografice/Planul%20National%20de%20Management.pdf>

Figure 4. The position of floods on the risk matrix.



C. Droughts

Drought is a major natural hazard, characterised by water requirements below the optimal values and significantly variation of the supplying functions, depending on the growth and development stage of crops. This phenomenon can be considered as being strictly meteorological, hydrological, pedological and the methods of analysis used allows the assessment of the severity level, function of the intensity, duration, frequency, time and space extent, as well as the consequences on the socio-economic environment.

In Romania, the drought affects 7.1 million ha, which represent 48% from the total agricultural land (RNIS, 2010). The Southern, South-eastern and Eastern parts of the country, as well some areas in the West and Centre (**Map 7.**), are the most affected areas (<600 m³ water /hectare – extreme and severe pedological drought) during the extremely droughty years. In Romania, the mean annual air temperature rose by 0,6°C in the last 100 years. The evolution by decades of the mean multiannual air temperature over the 1901-2015 period shows an obvious increasing trend, especially after 1991, 2015 being the warmest year of the records (+1.96°C deviation of 1961-1990 period). Regarding precipitation, the 1901-2015 period highlighted a general decreasing trend in the annual precipitation amounts especially in the last 30 years in the South, South-East and East of the country where the rainfall patterns are also changing. In this context, these areas become drier, thus even more vulnerable to drought.

The climate data recorded over the last decades have shown a progressive warming of the atmosphere, as well as a higher frequency of extreme events, the rapid alternations of severe heat waves, droughty periods and heavy precipitation being more and more apparent. As it can be seen, the climate change effects in Romania have been clearly mirrored by the modifications in the temperature and precipitation regimes, mainly as far as 1961, with significant influences on the economic sectors. Taking into account the estimations presented in the 4-th Intergovernmental Panel on Climate Change (IPCC) Report, relative to the 1980-1990 intervals, the same annual mean warming in Romania as that projected for the whole Europe is expected, with slight differences between models over the first decades of the 21st century and much greater ones toward the end of the century, (within 0.5°C - 1.5°C for 2020-2029, respectively). As to precipitation, more than 90% of the models which have been projected for Romania, point to pronounced droughts during the summer, mainly in south, south-east and east of Romania, but also West and Centre (**Map 7**), with negative deviations from the

current interval 1980-1990 topping 20%. Due to the complex nature of drought, as well as its large spatial and temporal extent, the drought risk management system should be developed on the cross-sectoral whilst national/regional level. The regions most prone to drought phenomena are regularly the agricultural areas located in the southern and south-eastern parts of the country (e.g. Romanian Plain, Dobrogea Plateau, South of Moldavian Plateau). Besides agriculture, forests and natural vegetation are also sensitive to drought through drying and wilting.

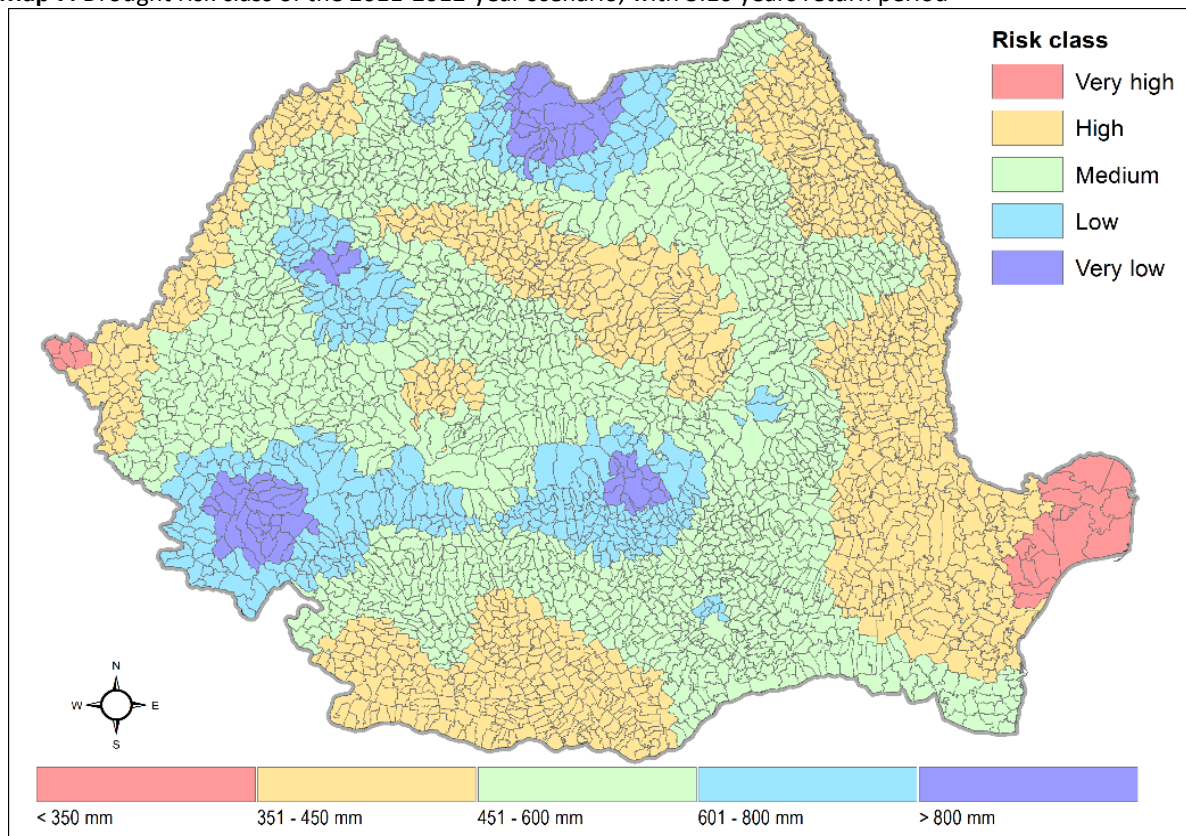
The present-day and foreseeable climatic data highlight the increase in frequency and intensity of the drought phenomenon, its potential effects on the most vulnerable sectors (e.g. agriculture, waters and forests, biodiversity, energy, transport), thus requiring specific adaptation measures to the limiting environmental conditions.

Drought risk associated to the climate change is greatly impacting:

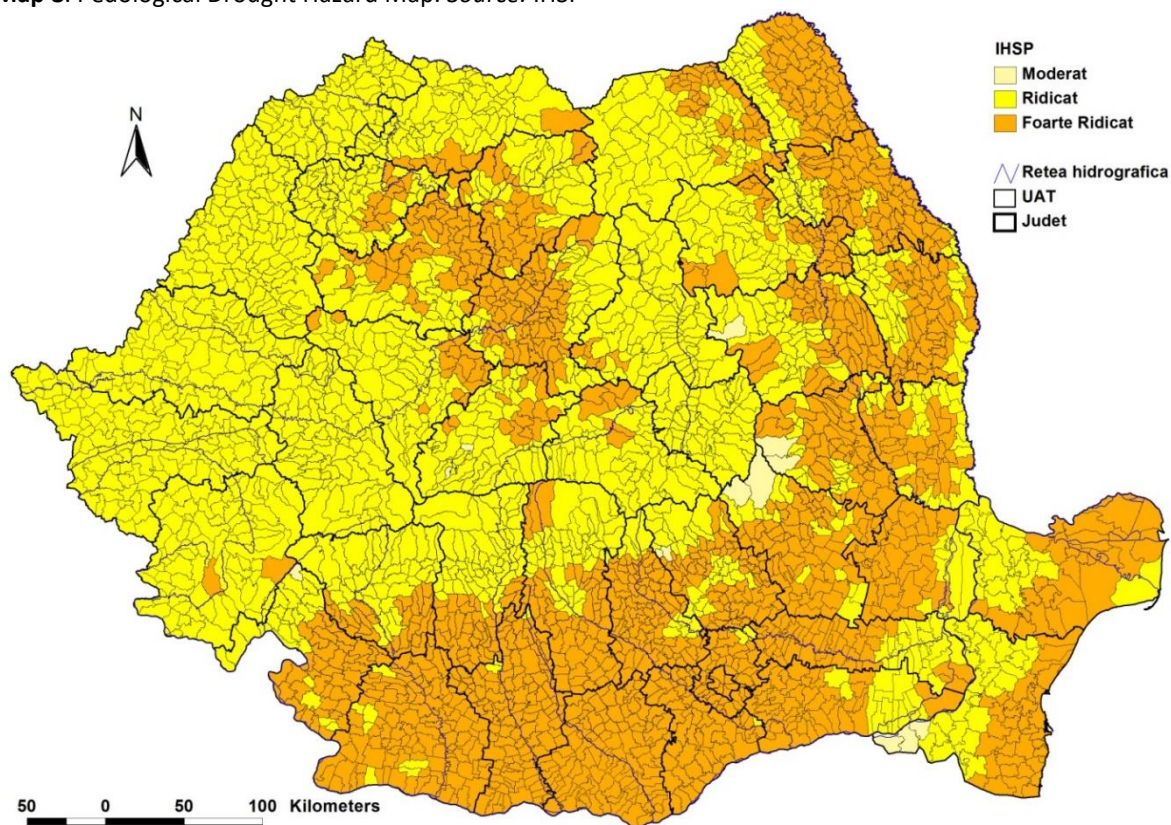
- (1) Food safety (troubles in agriculture, caused by drought and by a non-sustainable approach as regards the land cultivation at subsistence level);
- (2) Biodiversity (forest fires, discontinuation of the ecosystems' dynamics because of high temperatures and the modification of precipitation distribution patterns);
- (3) Energetic safety (drought influences both over the hydroelectric power plants and the nuclear power plant from Cernavodă, as their regular activity relies on the befitted level of the Danube River. This is all the more relevant whereby at country level almost 36% out of the electricity produced comes from hydro sources and 19% from nuclear sources).

Pedological drought (also called agricultural drought) refers to deficits in soil moisture. This type of drought is directly linked to the water availability of plants and has consequently direct impact on many ecosystem functions, as well as on agricultural production. Although droughts are not directly causing deaths in Romania, the phenomenon is one of the most severe natural hazards with major socio-economic and environmental impacts. The assessment of agricultural drought hazard using PHDI (**Map 8.**) highlighted that in Romania, areas with very high drought hazard covers the South part (The Romanian Plain, Getic Plateau), Southeast

Map 7. Drought risk class of the 2011-2012-year scenario, with 3:10 years return period



Map 8. Pedological Drought Hazard Map. *Source:* IHSP



(Dobrogea), East (Moldavian Plateau) and partially the Centre (Transylvania Plain). High hazard is specific for the western part of the country (Western Plain and Western Hills) and also for the Southern part of Transylvania Plateau.

Position on the risk matrix

Large areas of national territory are facing a rather medium risk of drought. There are significant economic losses associated to drought-related impacts, mainly in water-dependent sectors such as agriculture and energy. Under the current climate change predictions for Romania, further mitigation and adaptation measures in agriculture are required in order to enhance the response capacity of communities and economy to draught phenomenon.

The risk of drought is important on the Romanian territory, not just because of the level of direct impact, but also because of the further risks which are triggered by this specific disaster: epidemics and other specific accidents. Based on the assessments and the scenarios developed, the risk of drought is placed on the risk matrix in "the yellow" area, which indicates a rather medium level of impact and a low to medium rate of occurrence.

In Romania, droughts are caused by the fact that the country is situated in an excessive temperate climate zone, with very large deviations from the normal values of the climatic, agro-climatic, hydrological and soil parameters. They have a cyclical occurrence, especially in the Southern and Eastern parts of the country. Chronic drought in the south has the effect of onset of aridity in the Oltenia Plain. The aridity phenomenon is more accentuated in terms of the hydrological aspect, excessive water flow decreased in most rivers of the country.

Map 9. Meteorological drought scenario for Oltenia region 100 years return period

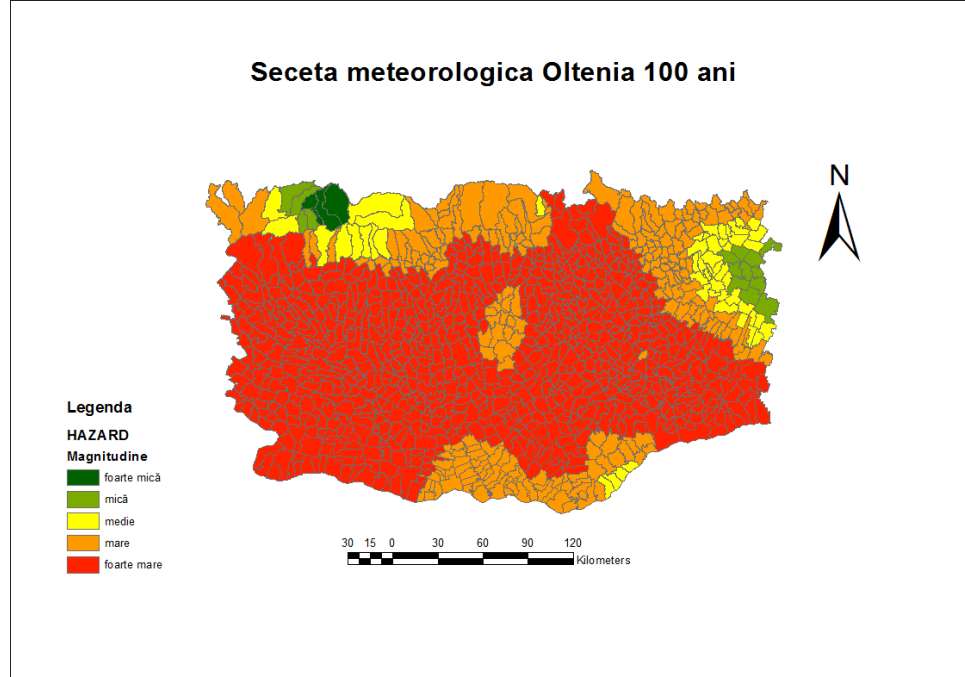
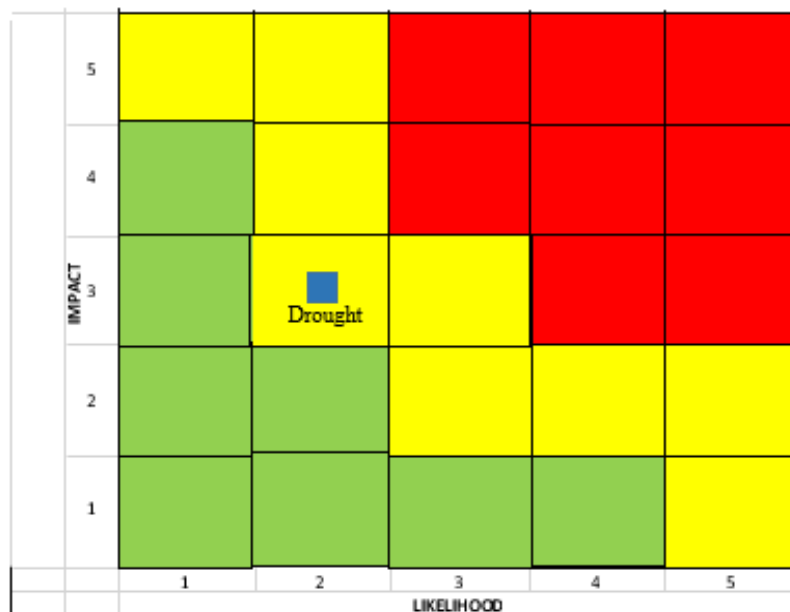


Figure 5. The Position of drought on risk matrix.



Furthermore, the livestock sector is affected by the drought, especially because of the side effects over animals: loss of fertility due to excessive temperatures during summer, decalcification, weight loss and hence, increased propensity to disease (leukemia and septicemia).

D. Forest Fires

Specific context

In Romania, the forests are generally located in the most steep and inaccessible areas and worse soil conditions, in contrast with the communities, which have developed mainly in the lowland and flat areas, with good soil. This means the buildings are generally far from the forested areas, with few cities and villages in the forest proximity, having then a reduced wildland-urban interface (WUI).

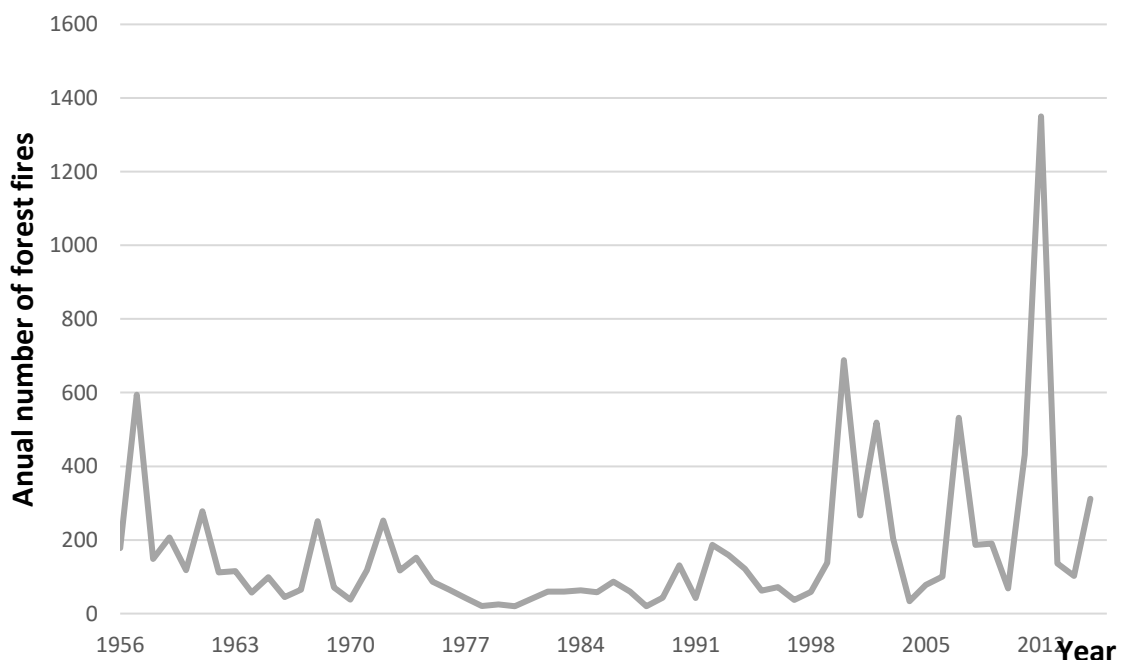
The forest fire occurs mostly during dry periods, especially in the forests from the hilly sub-Carpathian area. Regarding the time and location of fires, it has been found that most are recorded in the spring season (51%), followed by the summer seasons (25%), fall (18%) and winter (6%). The seasonality of the fires correlates with the dry periods and also with the agricultural practices of burning the vegetation waste for land clearing. The human presence and activity are the key drivers for the occurrence of forest fire events.

This assertion is also sustained by the intra-annual and spatial distribution of fire occurrence, which is more common in the hilly areas during the spring and autumn, when agricultural burnings for vegetation management are practiced. During the summer, most of wildfires occur in the plains when the stubble burnings are common and in the mountains due to an increased human activity in the non-inhabited areas.

Likelihood and Impact

The forest fires frequency has doubled up to 341 events/year in the last decade compared with an historical (1956-2005) average of 175, possible because of climate change issues. The average burned area has increased with 25%, from 5.2 to 6.5 ha in the same period. The trends of increase frequencies of forest fire and forest burned areas is consistent with the studies indicating that climate change corroborates with an increased fire danger.

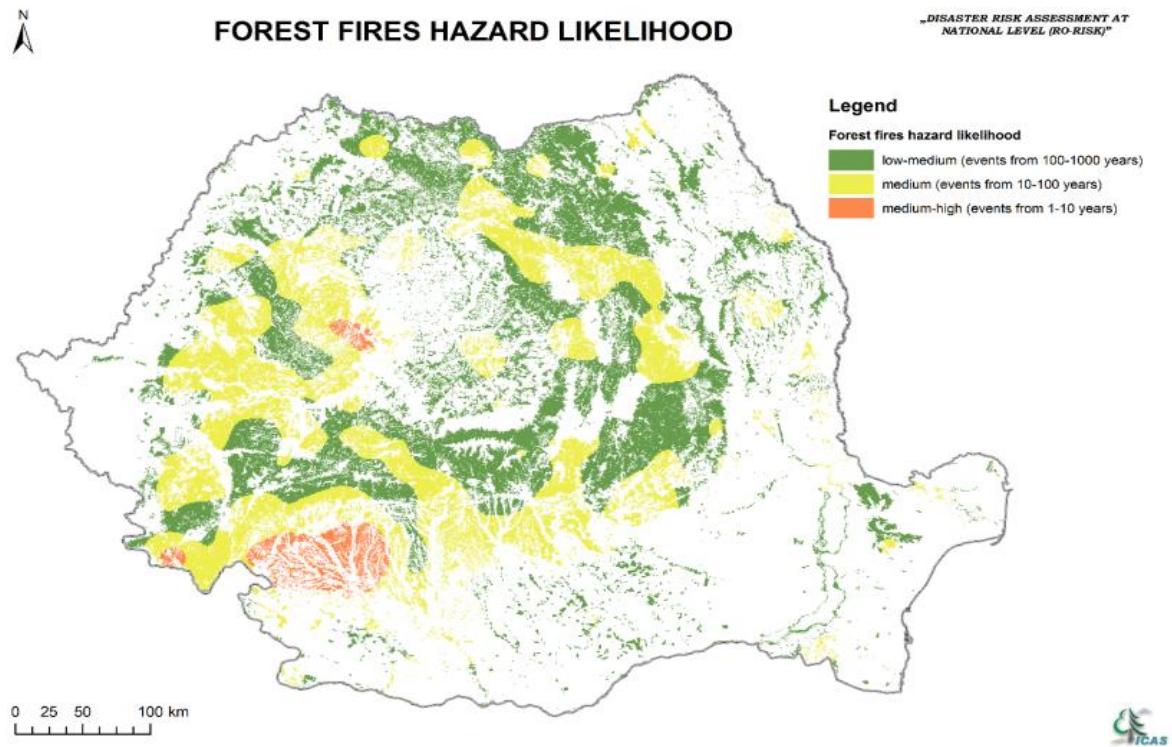
Graph 1. Number of forest fires between 1956-2015. *Source:* INCDS.



The map of forest fires hazard likelihood (derived from the forest fires records of the last decade) shows also an increased likelihood of wildfire in the forested areas close to inhabited zones, roads, grasslands or farmlands, remote and inaccessible areas having lower fire occurrence records. The

hazard likelihood ranks from low-medium to medium-high, with an average of medium likelihood for all Romanian forests (**Map 10**).

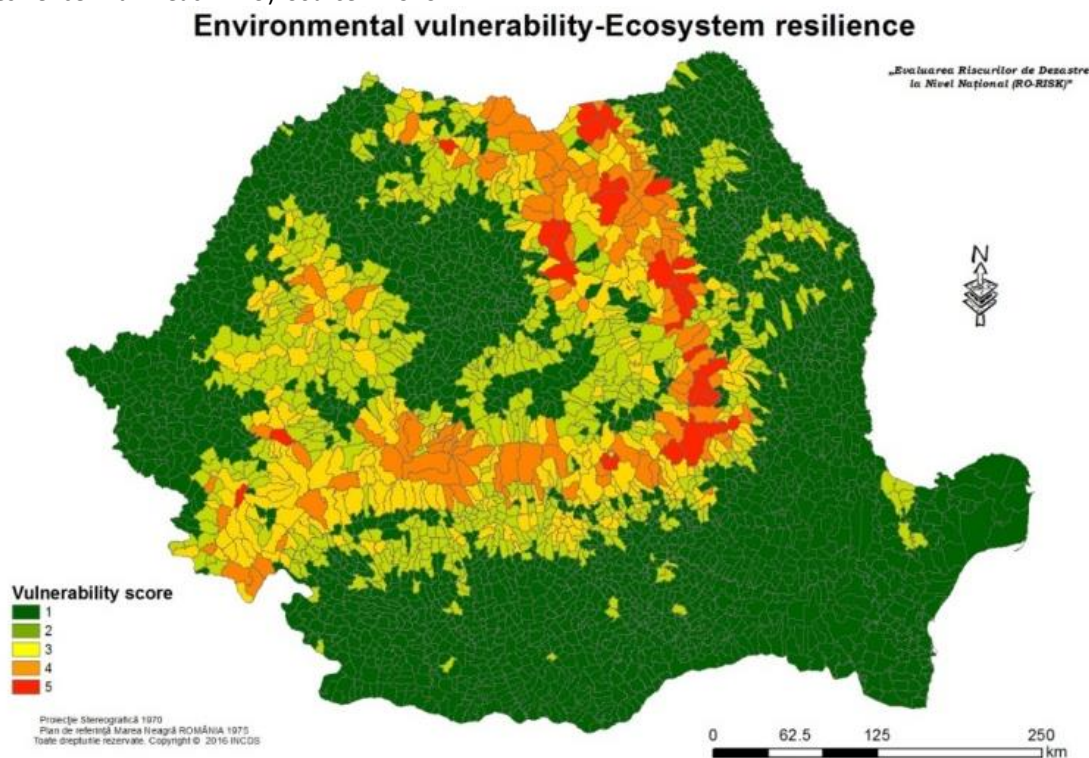
Map 10. National scale forest classification according to forest fires hazard likelihood. *Source:* INCDS.



With some exceptions, the specific of wildland-urban interface in Romania is that usually buildings are located away from the forest edge, meaning that in general the impact of forest fires on communities is indirect, driven mainly by the resulted smokescreen and less to direct combustion. The major exposed elements to forest fires risk, considered for impact calculation at national level, are population and forest ecosystems, with a special attention on protected areas.

A plausible local scale scenario is one described for the Gorj County, as a medium-high likelihood scenario with an excessive number of forest fires following an exceptional spring drought, similar to a situation from year 2012, an exceptional year regarding the forest fires (**Graph 1**).

Map 11: The classification of environmental vulnerability to forest fire at ATU level (based on ecosystem resilience within each ATU). *Source:* INCDS.

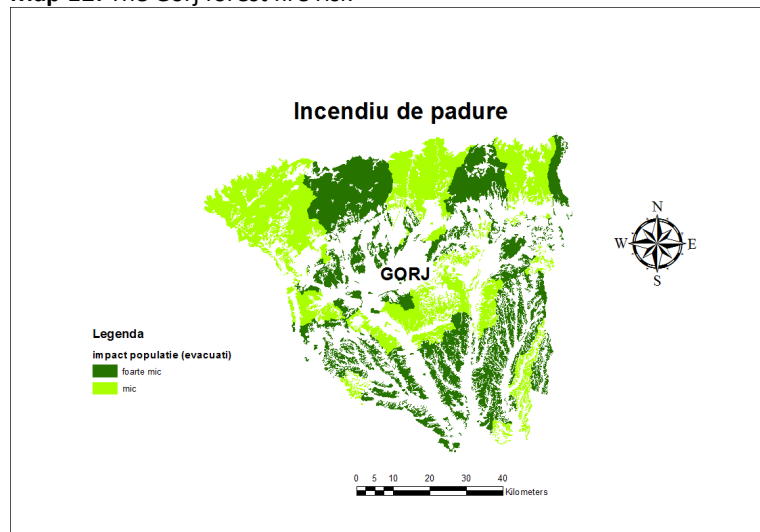


Gorj County is a hilly and mountain area from the South-West of Romania, with an altitude of 200-1700 m, with fragmented forests of hardwood and softwood ecosystems, pasture and farm land and a very diverse landscape configuration. Influencing factors (e.g. vegetation, topography, wind direction, proximity to urban areas and roads) have been taken into consideration in order to identify the fire prone areas and their prioritization in forest fire risk scenario mapping.

Position on the risk matrix

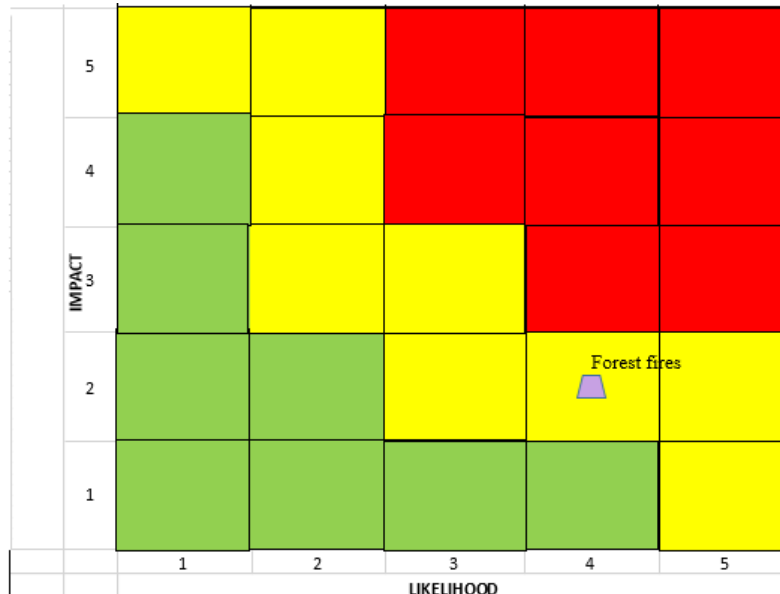
Forest fires remain one of the most frequent but rather low level of impact, compared with other types of risks. Judging by the area affected by a single fire event, effects on population, economic and social aftermath, the impact might be considered lower than other risks.

Map 12: The Gorj forest fire risk



On the other hand, their frequency and other impact indicators, such as environmental, socio-psychological, but also indirect costs, should be taken into consideration in the overall evaluation of risk (Figure 6.).

Figure 6. The position of forest fire on the risk matrix.



E. Landslides

Specific context

Landslides are among the potentially-endangering geomorphic hazards in Romania in terms of both space-temporal distribution and direct and indirect damages to the human and natural environment. A multitude of predisposing (lithology, geological structure, active neotectonic movements), preparing and triggering (precipitation, intense seismicity) factors are turning large areas into landslide-prone domains. Thus, the presence of a wide range of landslide types (shallow earth slides and flows, deep-seated rock slides, rock falls and rock topples, complex landslides) is placing Romania on Europe's map as a landslide hotspot. Among these, slide processes are those which pose the most serious problems in terms of damages in Romania, therefore this report will mainly focus on slide-associated issues.

Propitious factors are outlining several regions as being susceptible to (and highly affected by) slides: the Subcarpathian chain (especially throughout its Curvature sector, with slope and channel processes' dynamics enhanced by the active uplift and intense seismicity triggered mainly by Vrancea intermediate seismic area (Europe's most important region of such kind), the Transylvanian Plateau (hosting both active and relict landslides) or the Moldavian Plateau (where the typological distribution of landslides is strongly linked with agricultural practices or interrelates with active erosion processes). Long-termed and intense mining activities (mines, quarries, waste deposits and tailing dams), the development of a dense network of roads crossing the Carpathian chain (causing slope undercut), the construction of numerous dams and reservoirs (forming new slope base levels), or overloading of slopes are examples of human activities enhancing the natural conditioning/triggering framework of both shallow and deep-seated landslides.

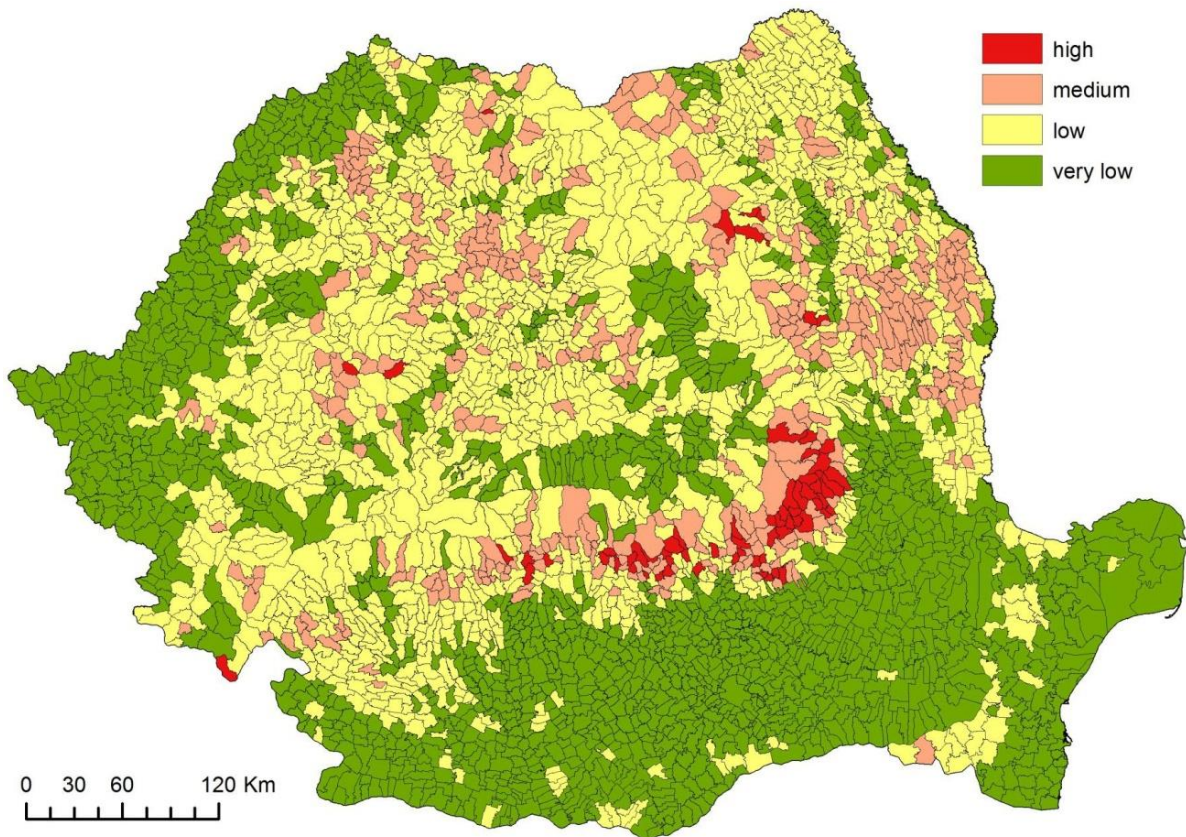
Likelihood and Impact

According to their complex typology, the landslides are either responding fast or delayed to natural triggers like precipitation (both long and short-term), earthquakes (either as *co-* or *post-*seismic

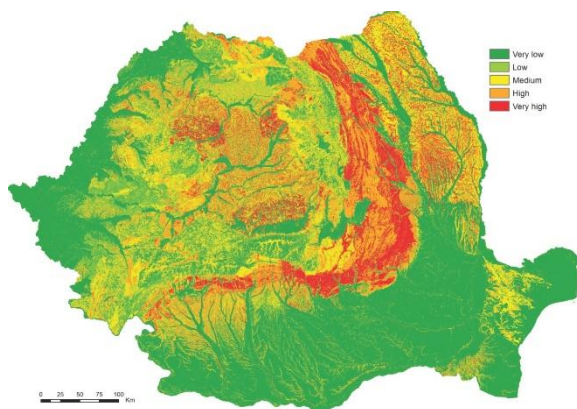
processes), fluvial erosion (by riverbanks' undercutting during flash-flood events) or human interventions in the environment (mining and quarrying). Their temporal distribution is therefore linked with the triggering factors' one, and several frameworks might be outlined: *shallow earth slides* (high frequency and low magnitude, regularly displacing 0-5 m thick deposits) are showing a high likelihood of occurrence, being triggered on an yearly basis, while *deep-seated* (usually complex) *landslides* (low frequency, high magnitude, affecting deposits thicker than 10-20 m) features a medium-to-high occurrence probability, being triggered every 10-100 years. This pattern could be encountered all throughout Romania's major landslide-prone areas, while local conditions could enhance their frequency (spring showers overlapping snowmelt in the Subcarpathians or in the outer flysch sector of the Eastern Carpathians) or magnitude (old, dormant landslides prone to large reactivations) (**Map 13.**).

Throughout the last 200 years, several events were responsible for an enhanced landslide activity: the large earthquakes of 1809 and 1838 (M=7.5-7.9), the modern-time earthquakes of 1940 (M 7.7) and 1977 (M 7.4), the rainy period of 1968-1974, the wet seasons of 2004, 2005, 2006 and 2010 etc.

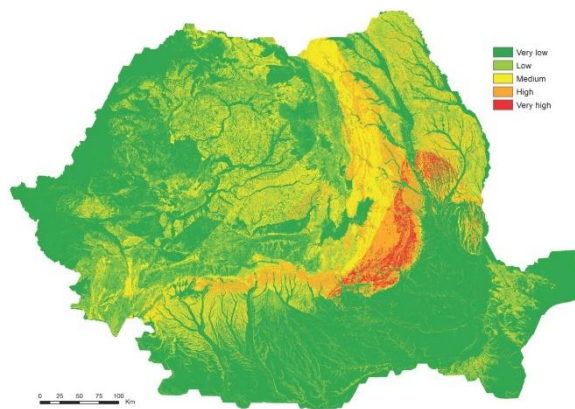
Map 13. Mean exposure to slides of built-up areas at municipality level.



The scenarios developed, considering 10, 100 and 1000 year-return periods show that landslide hazard could inflict large damages to extended areas, either as rain-triggered processes (**Map 14.**) or earthquake-induced ones (**Map 15.**).



Map 14. Landslide hazard scenario with a 100 year recurrence interval triggered by extreme seasonal precipitation (RO-RISK, 2016)



Map 15. Landslide hazard scenario with a 100 year recurrence interval triggered by Vrancea intermediate earthquake (Peak Ground Acceleration) (RO-RISK, 2016)

Position on the risk matrix

Large areas of Romania are relative high landslide risk. There are numerous economical losses associated to landslide occurrences, but not as many human victims (casualties and injured persons) when addressing landslides *stricto sensu* – (2 – on impact axis). Featuring a more punctual disposition if compared with other hazards (e.g. floods, earthquakes), landslides are compensating the extension through their number, high occurrence likelihood (3 – on likelihood axis) and extremely difficult prediction, unless a consistent dataset of well-documented events (and continuously populated with new cases through local or regional monitoring, thus imposing large pro-actively directed funds) exists.

This type of risk is significantly related to other risks, such as floods or earthquakes. According to the assessments, there are many locations on the Romanian territory affected by landslides. During 2005 - 2015, landslides events had the greatest spatial extent, especially during spring and summer. In certain parts of the country, significant amounts of precipitation and substantial positive deviations from the climatologically normal conditions (1981-2010) have been recorded. This led to a rise in the number of landslides, the total area affected by this risk being estimated at 900,000 hectares (34 municipalities, 78 small towns, 875 communities on 7 watercourses) (**Figure 7.**).

Map 16. Landslide Comarnic scenario

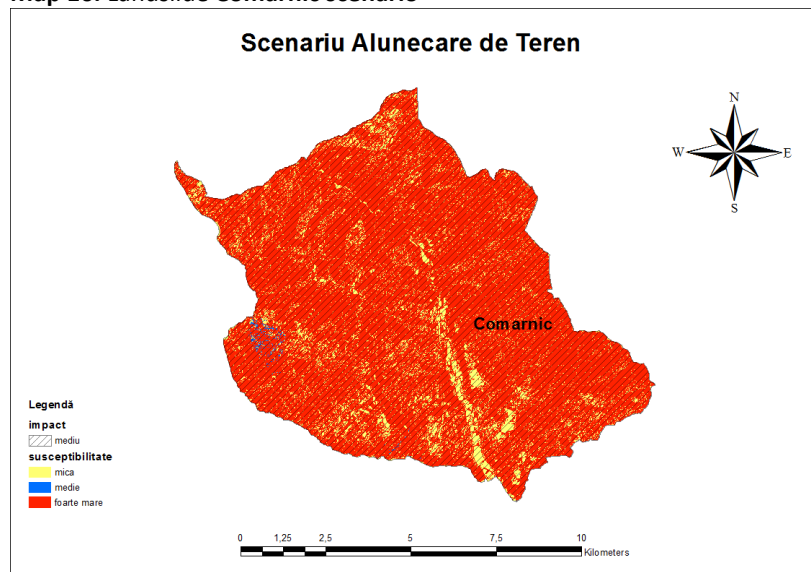
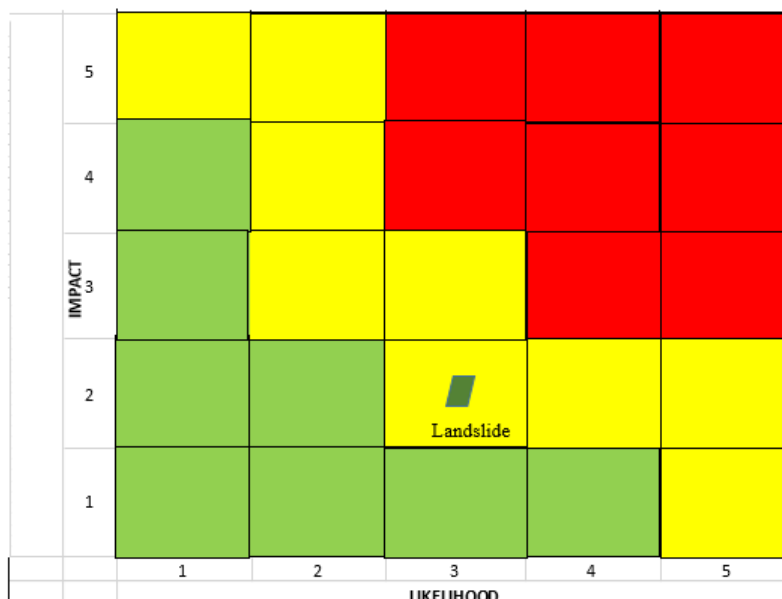


Figure 7. The position of landslides on the risk matrix.



II.2.2. Technological risks

F. The nuclear and radiological risk

Specific context

One of the most important event which affected the Romanian territory is the nuclear accident from Chernobyl, in 1986. Nuclear accidents are extremely unlikely to occur, as all nuclear reactors have prepared response plans, containing measures that minimize accidents in case of risks. There are several locations in Romania which can be associated with the source of nuclear accidents:

- a. The Cernavodă area due to CNE PROD Cernavodă. It is designed for five CANDU 660 enveloped reactors, which are considered to be highly reliable/secure in operation. A serious accident at CNE PROD Cernavodă, though highly unlikely due to special safety systems and envelope, would partially affect three counties and the Danube Delta.
- b. Bechet-Dolj area due to CNE Kozloduy in Bulgaria. According to the current dimensions of the emergency planning areas, the preparedness for a nuclear accident at CNE Kozloduy covers 7 counties from southern Romania. It is considered that a major nuclear accident could lead to the contamination of the Danube River, with severe consequences downstream, not excluding the manifestation of effects in the Danube Delta Nature Reserve.
- c. The Pitești – Mioveni area due to a TRIGA type research reactor of 14 MW, which was put into use in 1979, but with greatly diminished consequences in case of a nuclear accident, given its small strength and intrinsic security factors.

At this time, there are several buildings which use ionizing radiation. Such applications do not present an immediate danger to the population, but could affect its own staff in case of non-compliance to the procedures.

Likelihood and Impact

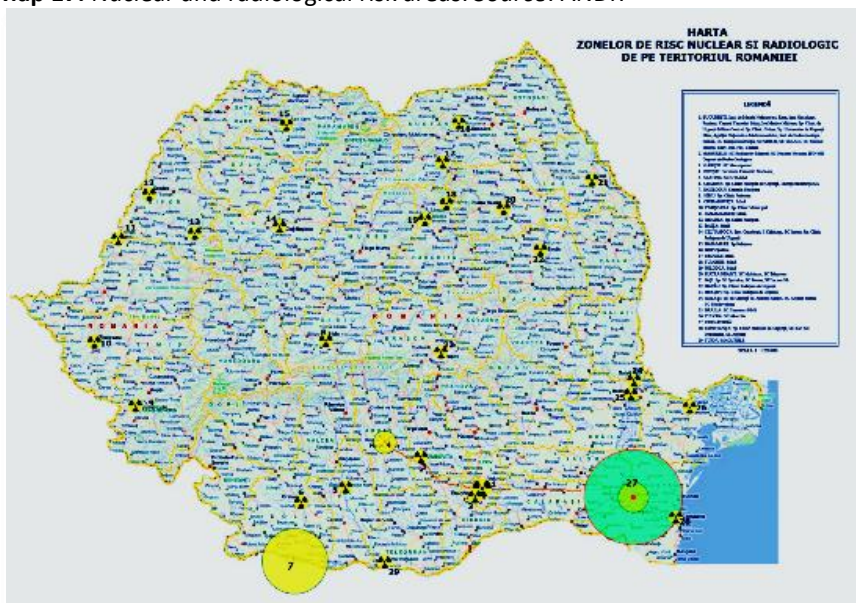
The impact of a nuclear or radiological accidents could have an extensive and most dangerous effects in case of occurrence. Depending on their level, these specific accidents could be the cause of a various types of impact. It may consist in partial contamination of the environment, namely:

- The atmosphere, through volatile fission products, such as ^{131}I , ^{133}Xe ;
- The water used as cooling agent;
- The soil in the vicinity, which becomes contaminated with fission products;
- A large amount of radioactive waste, whose evacuation poses a great problem, in order to avoid environmental contamination in the area where the evacuation was done.

The implication and the impact on the health of the population, but also the evolution of socio-psychological impact, indicates that this type of hazard has one of the greatest impact from all risks. Even though no major accident took place on the Romanian territory, the dimension of losses in case of occurrence provides the basis for an in-depth analysis and criteria for measures to be undertaken, in order to increase safety and reduce the risk of occurrence.

According with the assessment developed, there are several sources of possible accidents on Romanian territory. As presented above, the most important ones are located in the southern part of the country (Cernavodă). In Bulgaria, close to Romanian border, at Kozloduy, a possible accident at the nuclear power station could have an important impact on the Romanian territory as well (see **Map 17**).

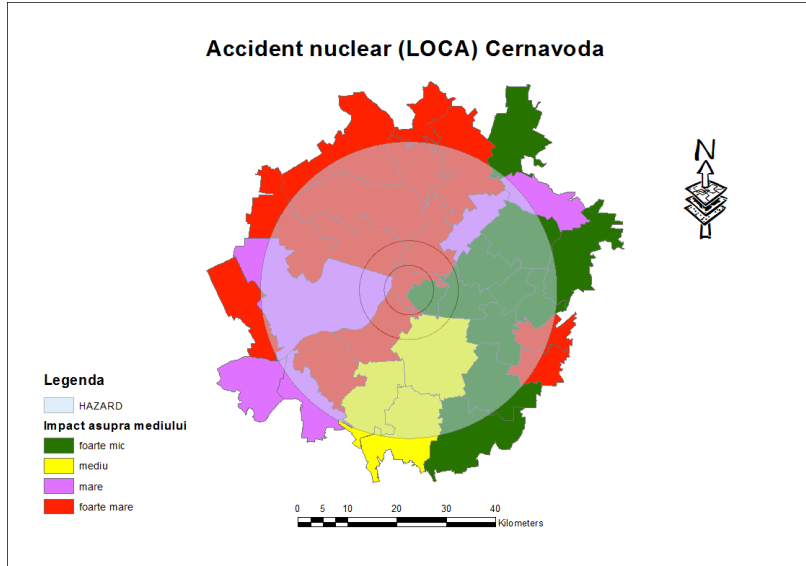
Map 17. Nuclear and radiological risk areas. *Source:* ANDR



One of the scenarios developed and analyzed for nuclear accident on Nuclear Power Plant (NPP) was Loss of coolant (LOCA - Loss of coolant accident). LOCA is a catastrophic accident to the nuclear reactor, production facilities and their immediate vicinity. Each NPP has a second, emergency cooling system of the reactor core (Emergency Core Cooling System - ECCS), intended to intervene in case of LOCA accident. Nuclear reactors generate internal heat. To convert heat into useful energy it uses a cooling system. If coolant is lost, the Nuclear Reactor heat generation can continue until the temperature reaches the point of destruction of the reactor. Events that affect a single fuel channel resulting in a small break in the heat transport system are assessed separately. These events are: spontaneous pressure tube rupture, channel blockage leading to channel failure, complete failure of a channel.

For this region preparations are made to promptly implement urgent protective measures based on environmental monitoring (size 10 km). 31.000 people are living within a 10 km radius around the NPP. Most of them (ca. 20.000) live in the town of Cernavodă, where evacuation of population in a short time on a safe way is hard, because there are only two way out of the town. In the distance of 10 to 20 km around the plant reside approximately 65.000 people. In a 30 km radius from the NPP live 90.000 people.

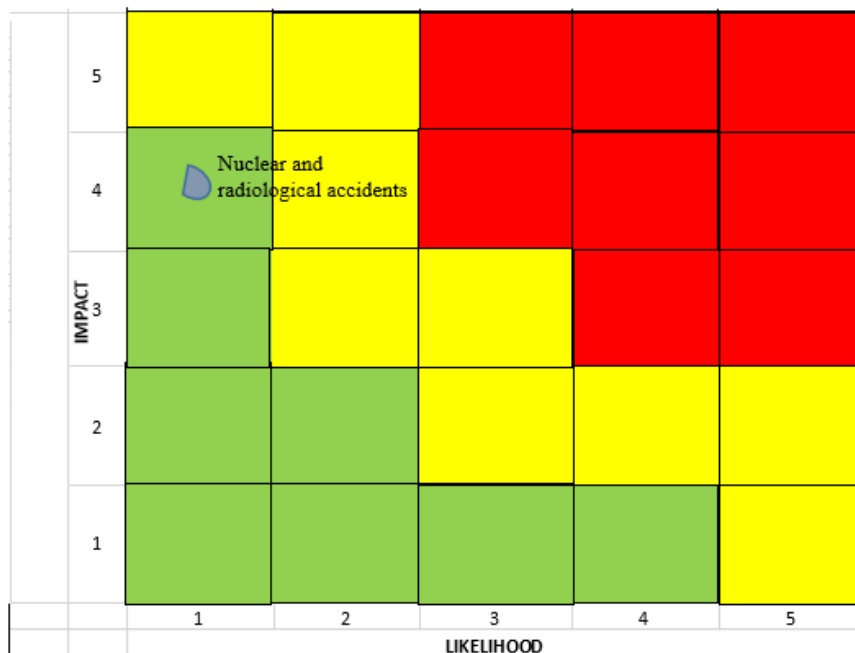
Map 18. Nuclear accident at Cernavoda NPP scenario



Position on the risk matrix

With its low rate of occurrence (1 – on likelihood axis), but with one of the most important impact in case of occurrence, the risk of nuclear and radiological accident has its remote place on the risk matrix. This position, even though in the “green” area, indicates the need for further action to be taken regarding the prevention and response to this type of risk (Figure 8.).

Figure 8. The position of nuclear and radiological accidents on the risk matrix.



G. The risk of major industrial accidents involving dangerous substances (SEVESO Accidents)

Specific context

Another technological risk active on Romania's territory is represented by possible major accidents involving dangerous substances. This risk is determined by the existence in Romania of 300 industrial establishments subject to the provisions of *Directive 2012/18/EU (SEVESO III) of The European Parliament and of the Council on the control of major-accident hazards involving dangerous substances*²³.

A "major accident" means an occurrence such as a major emission, fire or explosion resulting from uncontrolled developments in the course of the operation of any establishment covered by Directive 2012/18/EU, and leading to serious danger to human health and/or the environment, immediate or delayed, inside or outside the establishment, and involving one or more dangerous substances.

Likelihood and Impact

Major accidents can occur inside the classified establishments with a relatively low likelihood, but with potential severe consequences on population and/or environment in the surroundings, when the accident is producing effects outside the limits of the establishments.

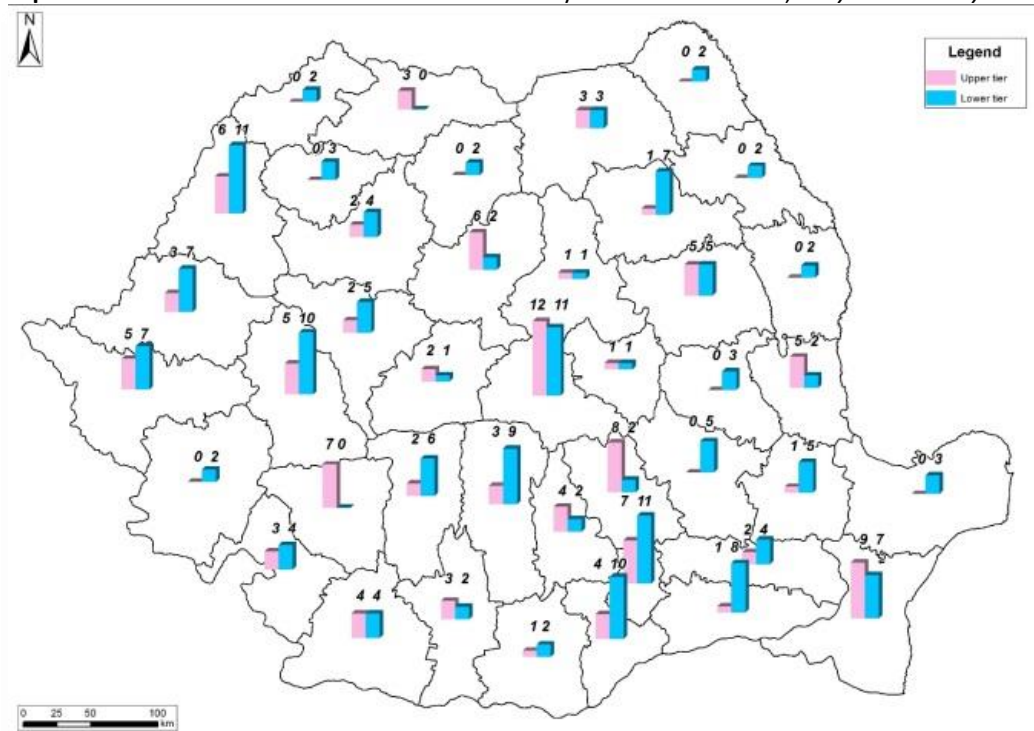
The number of lower and upper-tier Seveso establishments (according to SEVESO III Directive) on county level in Romania are represented in **Map 19**.

The number of operational Seveso establishments in Romania was 300 in 2015, but due to economical constrains or development this number is subject to changes in the future. Totally a number of 179 lower-tier and 121 upper-tier establishments were identified.

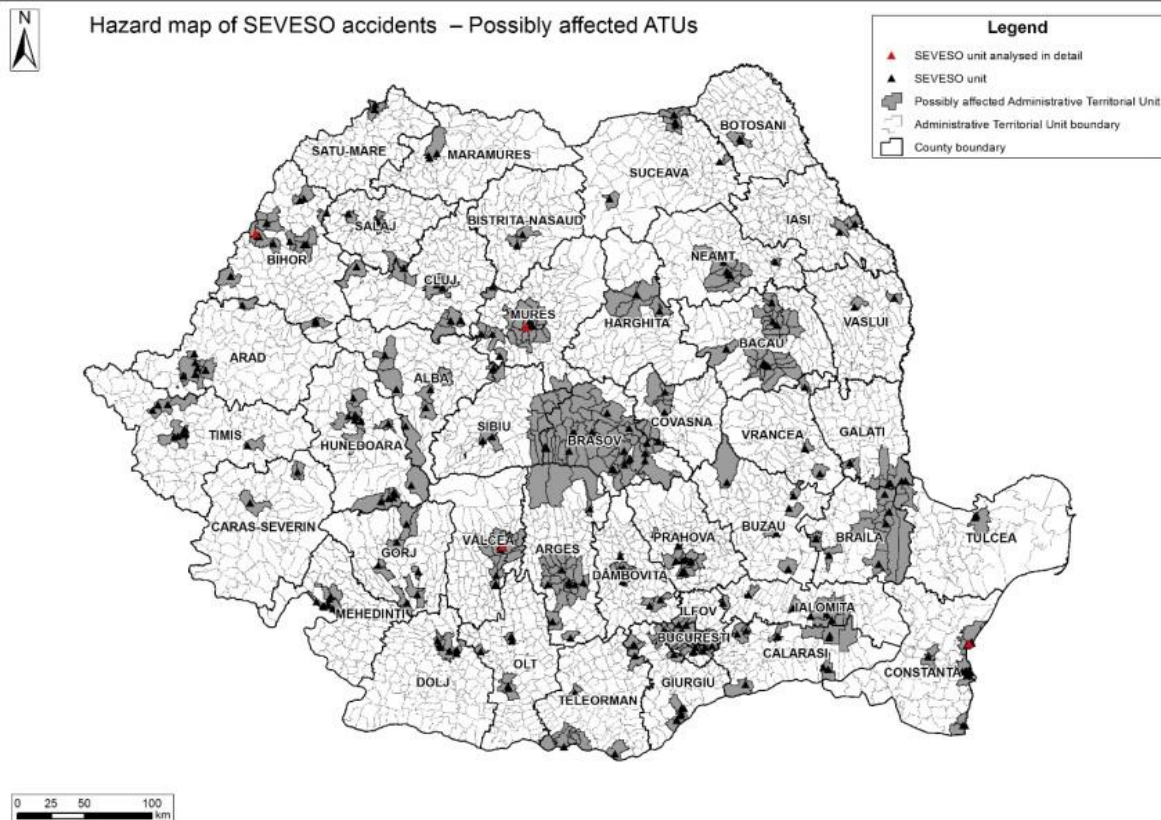
The most important Seveso hazards are:

- toxic dispersions involving ammonia, chlorine, etc.,
- explosions involving ammonium nitrate, flammable vapors/gases, explosive materials, etc.,

Map 19: Seveso establishments in Romania at county level. *Source: Babeş-Bolyai University.*



Map 20. Seveso hazard map of Romania – Possible affected ATUs. *Source: Babeş-Bolyai University.*



- fires involving combustible liquids, such as petroleum products, flammable vapors/gases, etc.
- BLEVE (Boiling Liquid Exploding Vapor Explosion) involving flammable liquefied gases such as LPG, propylene, etc.

The Seveso hazard map with possibly affected Administrative Territorial Units is represented in **Map 20**. Approximately 431 from the total number of 3186 Administrative Territorial Units (ATU) can be threatened by Seveso-type hazards.

30% of Romania's territory may be subject to technological disasters - Seveso accidents, about 8.000.000 people living in the risk areas. Among the toxic substances that could affect them, are Ammonia, Chlorine, Hydrochloric acid, Hydrogen sulfide, or Carbon sulfide. In terms of the risk type of Seveso sites, there are Toxic risk (57%) or Risk of fire/explosion (86%).

Historical Seveso type accidents in Romania:

Among other accidents, one of the most relevant occurred in Baia Mare (2000), in the Northern part of the country, on a Tailings Management Facility (TMF) depositing residues from the gold mining extraction process using cyanides. The accident was triggered by heavy rainfall and melting of the snow on the surface of the TMF and led to the partial collapse of the dam. A release of approx. 100,000 m³ of sludge containing cyanide and heavy metals into the Sasaş river occurred, which led to the pollution of the Lapuş, Someş, Tisza, and Danube rivers. Among the consequences, the most important were the interruption of water supplies along the river network, and pollution of approx. 2,000 km of river basin. No human casualties were registered.

Another Seveso-type accident occurred in Constanta at Oil Terminal S.A. (2003). There was an explosion at an oil tank containing 300 tons of petroleum products with a total storage capacity of 5,000 tons. The most likely cause leading to deflagration and the fire that followed was human error -

a spark or flame caused by a team of workers who were cleaning the tank. A major threat of the accident consisted in the spreading of fire to other storage tanks. Following the accident, a worker died and four others were injured. The material damage amounted to 1372 billion ROL.

Position on the risk matrix

Map 21. Seveso accident scenario – release of chlorine in the air

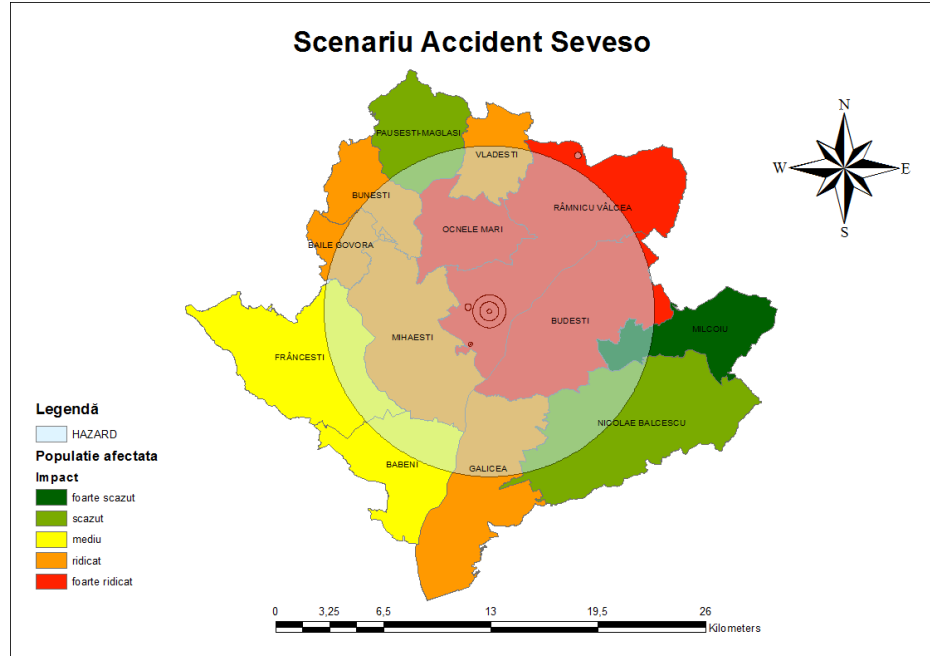
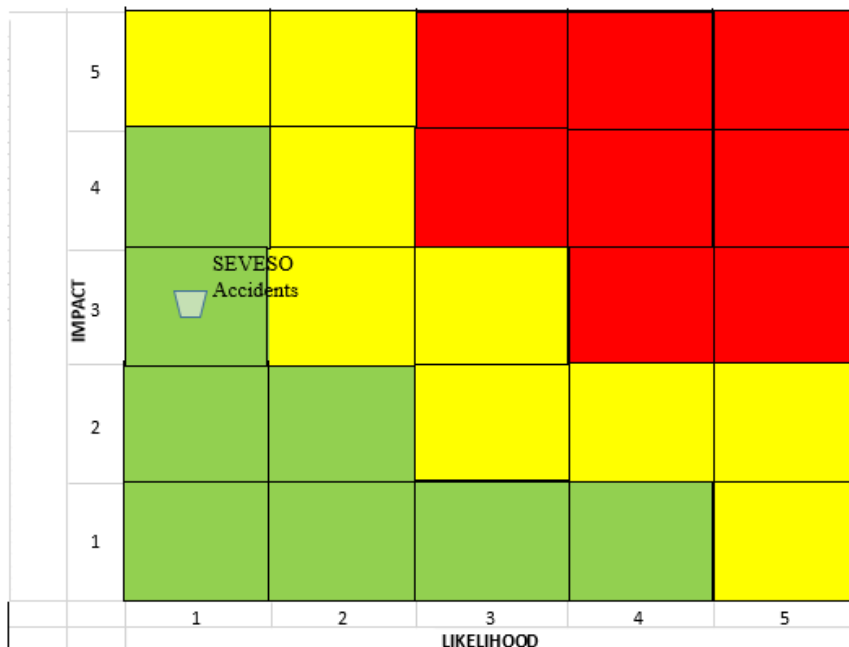


Figure 9. The position of Seveso accidents on the risk matrix.



The major Seveso accidents risks are characterized by low likelihood (with frequencies lower than 10^{-3} events/year) – 1 – on likelihood axis - and medium impact on a national level – 3 – on impact axis - placing the Seveso accident scenarios on the green area of the risk matrix. However, there are still necessary measures needed to be implemented in terms of reducing the impact of such accidents (Figure 9.).

H. The risk of major transportation accidents involving dangerous goods

Specific context

The transportation of dangerous goods is done in accordance with national and international legislation linked to the Directive 2008/68/EC of the European Parliament and of the Council on the Inland Transport of Dangerous Goods.

The transport of dangerous goods/wastes involves several stakeholders, such as shippers, transporters, manufacturers, beneficiaries, state and emergency response institutions, each with a specific role in the transport of dangerous goods safely, from their origins to their destinations.

Dangerous goods include:

- industrial chemicals (chemical substances and mixtures, gases, acids, bases, etc.);
- agricultural use related chemicals (pesticides, fertilizers);
- combustible materials (fuels, liquefied petroleum products, etc.);
- household products (paints, adhesives, batteries, cleaning solutions, etc.);
- hazardous wastes resulting from fabrication processes or from consumption.

The main categories of high consequence dangerous goods are: explosives, flammable and/or toxic gases, flammable liquids, oxidizing liquids, toxic substances, corrosive substances. Dangerous goods represent a large percentage of total freight transport because they include many substances and products widely used.

Gasoline and other petroleum products are estimated at about 40% of all transfers of dangerous goods and about three quarters of the tonnage carried in Romania. Excluding traffic by pipeline and ships more than two thirds of the tonnage of oil is shipped by truck, especially on short haul routes of distribution.

Likelihood and Impact

The transport of dangerous goods poses a risk because of the danger associated with accidental release of these materials. An incident involving a vehicle carrying dangerous goods may cause short and/or long-term consequences on human health and the environment, including severe illness, death, irreversible pollution, and the evacuation of people from the affected area.

Major transportation accidents can occur with a relatively low likelihood, but with potential severe consequences on population and/or environment in the surroundings. Certain routes have shorter lengths, but crossing areas with high population density; some routes avoid densely populated areas, but are longer, resulting in higher transport costs and accident possibilities; while other routes involve the use of highways as to minimize the travel time, but may be associated with higher rates of accidents.

According to existing national statistics most accidents occur on highways and in cities, where traffic is more crowded. Also, it can be seen in **Tables 3.** and **4.** that most accidents involve flammable liquids and gases, which are the most shipped types of cargo.

Table 3. Accidents involving transportation of dangerous goods by road – type of substance transported. *Source:* GIES.

The type of substance transported	No. of accidents	Deaths	Severely injured	Minor injuries
Flammable liquids	48	23	35	18
Gases	21	12	18	9

Oxidizing substances	11	8	8	4
Substances which generate flammable gases on contact with water	6	2	4	1
Organic peroxides	2	2	2	1
Flammable solids	2	3	1	1
Explosive substances	2	1	1	4
Substances subject to spontaneous ignition	2	1	1	0
Toxic substances	2	1	2	1
Auto - reactive substance	1	0	1	0
Corrosive substances	1	1	0	0
TOTAL	98	54	73	39

Table 4. Accidents involving transportation of dangerous goods by road – place of occurrence. *Source:* GIES

Occurrence place	No. of accidents	Deaths	Severely injured	Minor injuries
National road	52	37	39	31
Streets	34	10	26	7
County road	9	5	5	1
Other roads	2	2	2	0
Communal road	1	0	1	0
TOTAL	98	54	73	39

Even if the frequency of dangerous waste transportation is relatively high, due to the fact that most of the wastes are mixtures of non-dangerous and dangerous substances and the quantities transported are small, the potential impact in case of a transportation accident is very low.

The transportation routes analyzed and the maximum possible hazard areas are represented in **Map 22**. The most important transportation hazards are:

- Toxic dispersions involving ammonia, chlorine, sulphur dioxide, etc.
- Explosions involving ammonium nitrate, flammable vapors/gases, explosive materials, etc.
- Fires involving combustible liquids, such as petroleum products, flammable vapors/gases, etc.
- BLEVE (Boiling Liquid Exploding Vapour Explosion) involving liquefied gases such as LPG, propylene, etc.

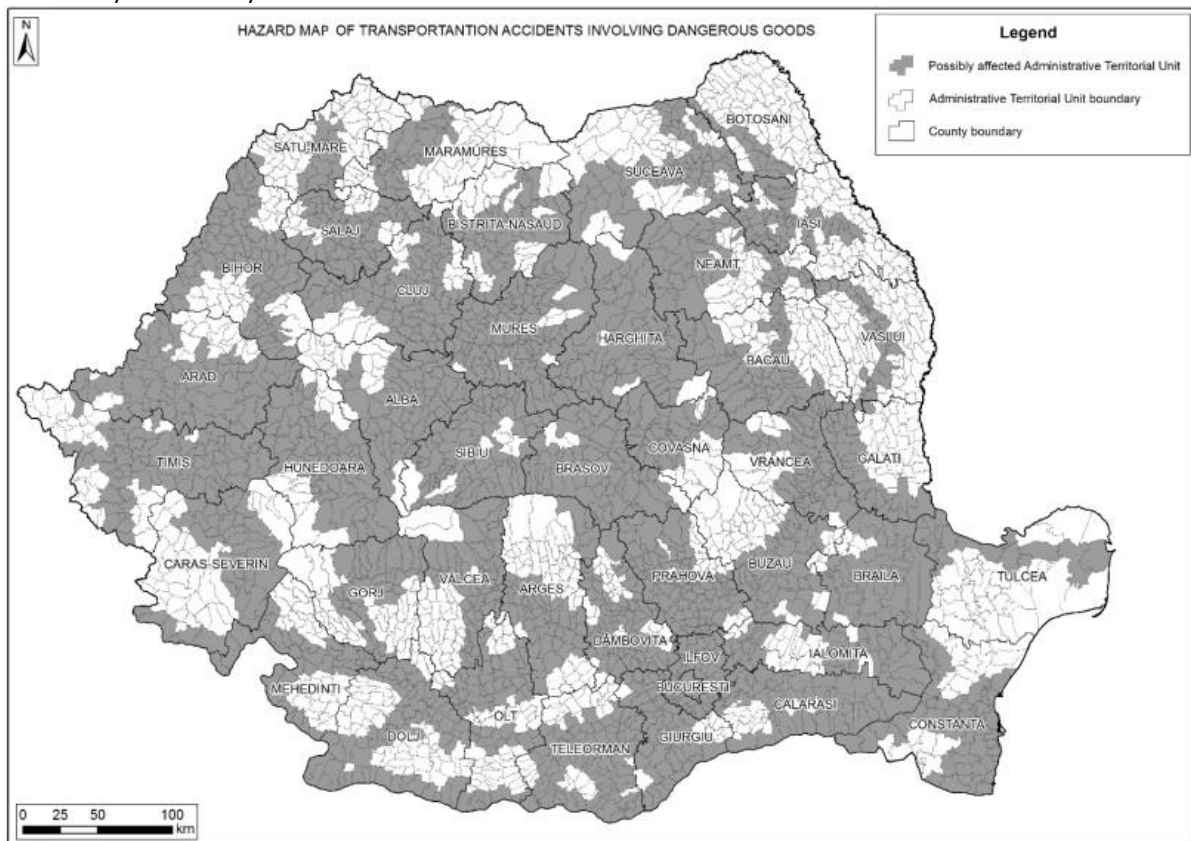
The dangerous goods transportation routes and related possibly affected ATUs are represented in **Map 22**.

Relevant transportation accidents involving dangerous goods in Romania:

In 1979 in a drugs factory in Bucharest a railway tank wagon containing liquefied ammonia and overloaded with 5 tons has exploded. 27 casualties and 175 severe intoxicated persons were registered and an area of 1.5 km² was contaminated.

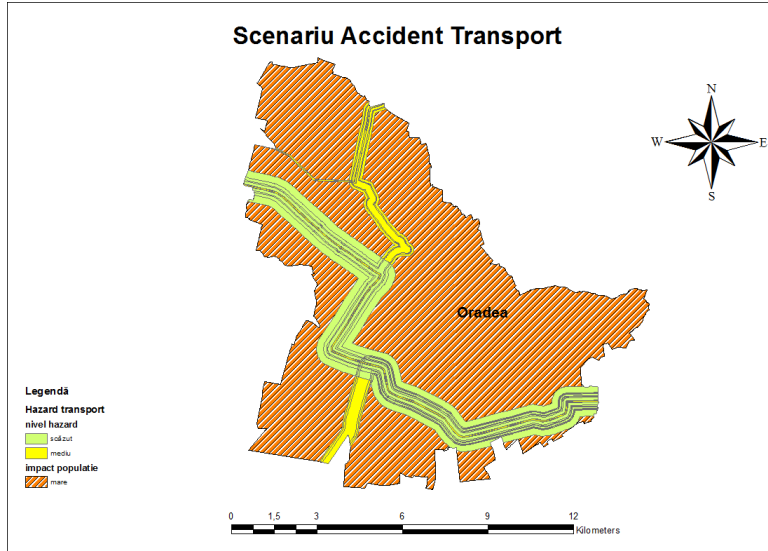
In 2004 on the European Road E85, at the entrance in Mihăilești village, Buzău county, a truck transporting 20 tons of ammonium nitrate in bags skidded off the road, overturned in the ditch and slipped several meters. The cabin of the truck caught fire in a few minutes after the impact and after one hour the entire quantity of ammonium nitrate exploded. The consequences of the accidents were catastrophic: 18 deaths, 11 injured, 16 houses damaged, 6 private cars and 2 fire-fighter trucks.

Map 22. Hazard map of transportation accidents involving dangerous goods – Possible affected TAUs. *Source:* Babes-Bolyai University.



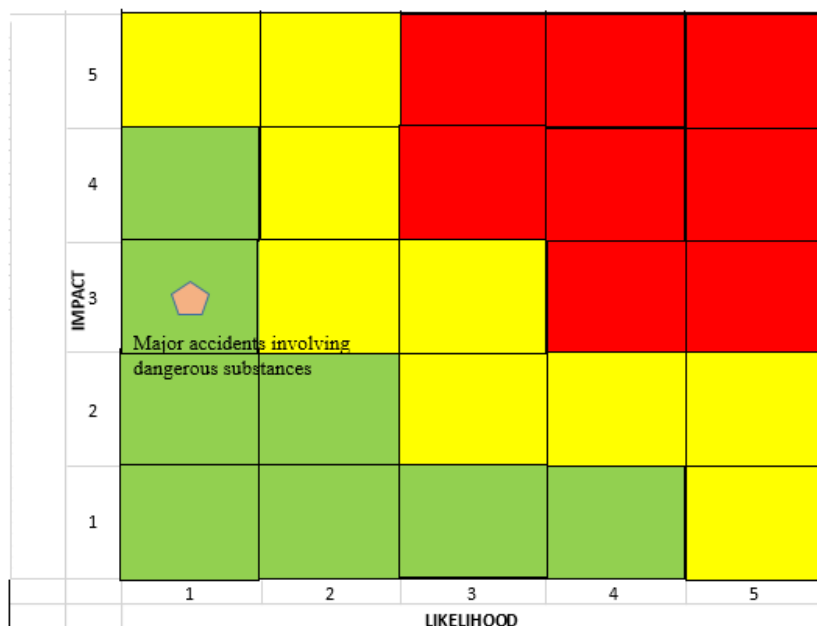
Position on the risk matrix

Map 23. Transport accident involving dangerous substances scenario in Oradea city



Based on the historical data and research on the possible impact, the risk of major transportation accident scenarios involving dangerous goods could be placed on the risk matrix on a position in the “green” area, with a low likelihood (1 – on the likelihood axis) (with frequencies lower than 4×10^{-3} events/year) and medium impact (3 – on the impact axis) (**Figure 10.**).

Figure 10. The position of major transportation accidents involving dangerous goods on the risk matrix.



The position of the selected transportation accident scenario involving dangerous substance is represented in the following risk matrix.

II.2.3. Biological risks

I. Epidemics

Specific context

Epidemics are favored not only by poverty, the lack of hygiene, water infestation, overcrowding of the household waste, but also the transport facilities and globalization that have allowed the contamination of some populations at great distance from the place of release.

The Ebola hemorrhagic virus, Zika and other viruses or pathogens with a high degree of contamination are possible and probable in Romania, even though it is at a great distance from the disease outbreak, edifying in this regard being the need for prophylactic measures and for response managed by the Ebola National Committee (turned into The National Committee for Highly Contagious Diseases).

Public health emergencies may take many forms - communicable disease epidemics, widespread incidents caused by contaminated food or water, extended periods of time without water and sewer services, exposure to biological agents, as well as infestations by vectors carriers of disease (insects or rodents). Public health emergencies may occur as primary events for themselves, or may be side events occurring as a result of another disaster or emergency, such as a flood or earthquake. The common characteristic of most public health emergencies is the fact that they have a negative impact on a large number of people. Depending on their magnitude, public health emergencies may be categorized as national, regional or local.

Likelihood and Impact

Over time, several outbreaks of communicable diseases or epidemics which have been classified as public health emergencies have occurred. One of the main dangers of communicable diseases dangers is the fact that they may quickly overwhelm the healthcare system.

The impact on the population – the main effects on public health involve the threat or presence of disease, contamination or sanitation problems. Epidemics or pandemics have the potential to cause high morbidity and mortality, the associated medical costs, as well as reduced productivity and quality

of life. The contamination may, at least temporarily, decrease the property value. The problem related to contamination and sanitation implies an effort and increased expenditures, as well as increasing the variety and the likelihood of occurrence of the disease. The facilities may be closed, as a means of preventing disease transmission or contamination, thereby causing a loss of services that are provided to the population (schools, for example). Medical resources may be overwhelmed and unable to cope with any additional needs. As traditional medical services become increasingly difficult to access (or if their quality decreases due to overexertion or lack of staff), a growing number of affected people may turn to alternative, less responsible and effective means and treatment (or abandon treatment altogether).

Acute respiratory infections (ARI), the flu and other cases compatible with the flu (ILI)

The supervision of these diseases is done at countrywide level, during the cold season (week 40 – week 20 of the next year), but also during summer, through the sentinel surveillance system, aiming to monitor the deaths caused by the flu and the circulation of flu viruses. In the last 8 seasons, ILI and ARI rates trend, as well as the number of flu cases was similar, excepting during May 2009 – May 2010, when these were markedly elevated, in the international context of the flu with the AH1N1 pandemic virus.

The A/H1N1 flu incidence with the pandemic virus in the country was of 32.7%; larger agglomeration of cases was in Bucharest Municipality and Botoşani and Dâmboviţa Counties.

The specific incidence by age has had the biggest value at the 5 – 14 age group, followed by the 15 – 29 age group; at the 70+ age group can be noticed the effect of residual immunity, materialized in the lowest-specific incidence.

Table 5. The distribution of the registered deaths of the confirmed cases of flu with the A/H1N1 pandemic virus by counties, in Romania, 24th March 2009 – 3rd April 2010. *Source:* NCSCCD.

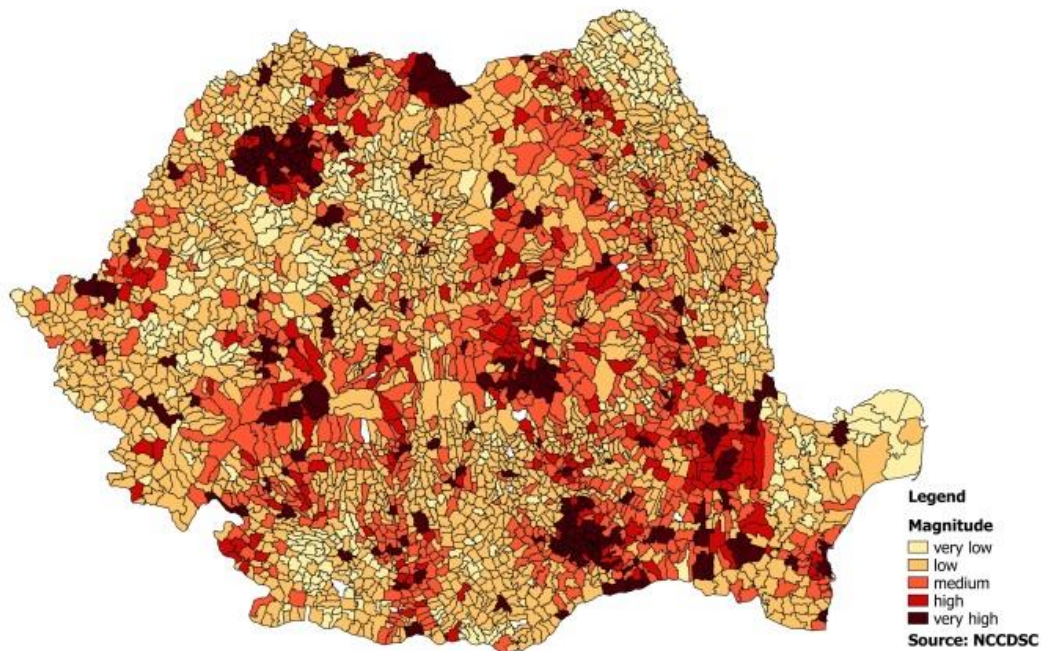
Age groups (years)	Number of confirmed cases	Number of deaths	Case-fatality rate
0 -4	295	0	0.0
5-14	1398	4	0.3
15-29	2695	18	0.7
30-44	1400	59	4.2
45-59	947	33	3.5
≥60	273	8	2.9
TOTAL	7008	122	1.7

Measles

The 2004-2005 measles epidemic reached almost 5,000 cases nationally, the age group most affected was the group under 1 year with an incidence of 554.57 cases per 100,000, followed by 1-4 years age group. In December 2005, the epidemic reached its peak, and measures were taken for intervention by vaccination. The hospitalization rate of the confirmed measles cases was 82.7% and the rate of complications with pneumonia were 40%. Also 13 deaths were registered. In some counties, the mode of transmission of measles was predominantly nosocomial in hospitals with paediatric profile, the vast majority of cases coming from hard to reach communities without provision of primary health care and prolonged hospitalization (**Map 24**).

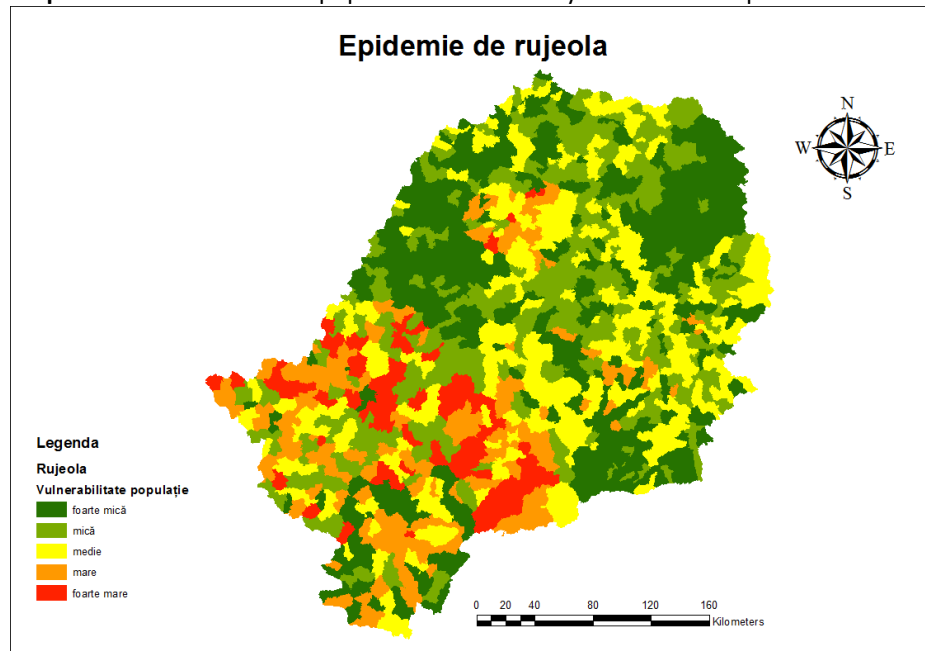
Map 24. Measles case distribution 2006-2015

Measles case distribution, Romania, 2006 - 2015



The 2010-2012 measles epidemic totalled a number of 12.427 cases, with 3 deaths. The most affected age group was under 1 year, ineligible to measles vaccination (incidence reaching 770.9 cases per 100,000), followed by the age group 1-4 years (incidence 333.2 cases per 100,000). The rate of complications reached 72.8% in case of pneumonia. The most important measure taken was an additional MMR vaccination campaign for the unvaccinated or incompletely vaccinated children, aged 7 months to 7 years.

Map 25. Measles scenario – population vulnerability in the western part of Romania



Viral hepatitis type A

In 2014, 6,667 cases of viral hepatitis type A cases were registered, the national incidence being 31.34%/ 1000 inhabitants, with 154.7% more elevated than in 2013. The incidence rate was higher starting from 2012.

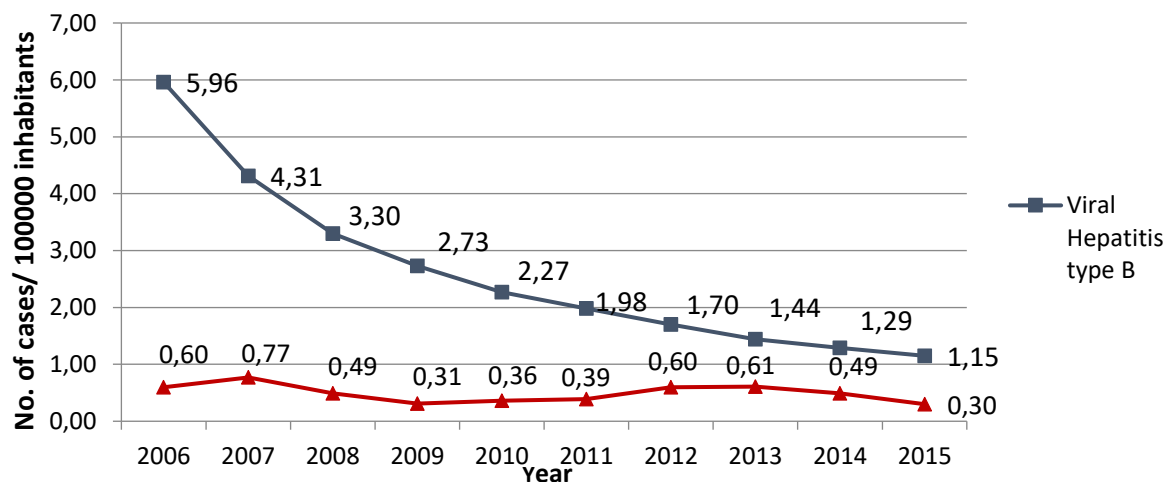
Viral hepatitis types B and C

The Surveillance Methodology for the viral hepatitis types B and C was introduced in 2012. The evolution of the incidence of the viral hepatitis types B and C, in Romania, during 2006 – 2015, is presented in the graph below (**Graph 2**). A descending trend for the reported incidence of the viral hepatitis type B, along with minor variations, from one year to another, for the viral hepatitis type C can be noticed.

In 2015, the most cases of the *acute viral hepatitis type B* (26%) were registered in the 25 – 34 age group. The maximum rates of specific incidence were recorded in this age group in males (2.5%), respectively in the 35 – 44 age group in females (1.7%). In almost all age groups, except the 0-4 year olds, the incidence rates were higher in males. The maximum values of the incidence rate for the acute stage occurred in young adults (25 – 34 age group, followed by 35 – 44 year olds), while for the chronic stage, the number of cases is too low for a relevant comparison.

The possible transmission categories for the acute viral hepatitis type B, those mentioned with the highest frequency, were the heterosexual one (20.8%), followed by the nosocomial one (12.8%).

Graph 2. The evolution of the incidence of the viral hepatitis types B and C, during 2006 – 2015. *Source:* NCSCCD



Regarding the possible nosocomial transmission of cases of acute viral hepatitis type B, dental maneuvers were mentioned in 2015 as well, with the highest frequency (6.2%), value comparable to that of year 2014 (5.6%). 5 deaths caused by the acute viral hepatitis type B were registered (the fatality rate 2.4%).

Referring to the *acute viral hepatitis type C*, in 2015 the maximum incidence rate was registered in the 55 – 64 age group for females (0.69%), respectively in the 45 – 54 age group for males (0.53%). The possible transmission category mentioned with the highest frequency was the nosocomial one (50%).

The impact on the population – the main effects on public health involve the threat or presence of disease, contamination or sanitation problems. Epidemics or pandemics have the potential to cause

high morbidity and mortality, the associated medical costs, as well as reduced productivity and quality of life. The contamination may, at least temporarily, decrease the property value. The problem related to contamination and sanitation imply an effort and increased expenditures, as well as increasing the variety and the likelihood of occurrence of the disease. The facilities may be closed, as a means of preventing disease transmission or contamination, thereby causing a loss of services that are provided to the population (schools, for example). Medical resources may be overwhelmed and unable to cope with any additional needs. As traditional medical services become increasingly difficult to access (or if their quality decreases due to overexertion or lack of staff), a growing number of affected people may turn to alternative, less responsible and effective means and treatment (or abandon treatment altogether).

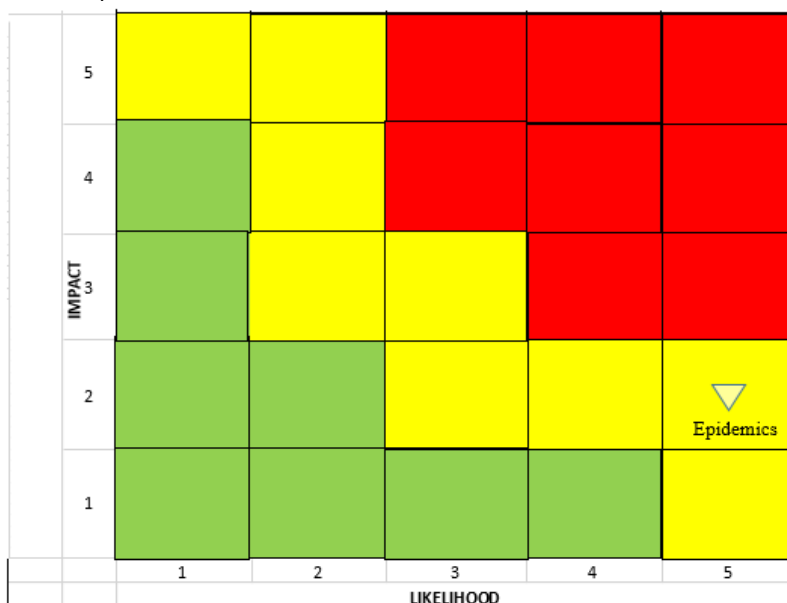
Position on the risk matrix

Epidemics have a low to medium impact (2 – on the impact scale) and a high occurrence likelihood (5 – on likelihood axis) and are placed in the “yellow” area of the risk matrix. Most of the epidemics were that of flu and different types of Hepatitis. However, the Ebola hemorrhagic virus, Zika and other viruses or pathogens with a high degree of contamination are possible and probable in Romania, even though it is at a great distance from the disease outbreaks. One of the most frequent types of epidemics in Romania is the flu, their circulation being similar to that of Europe (**Figure 11.**).

One of the most representative possible scenario is pandemic influenza projected over a period of 12 months, resulting a total number of over 2 milion cases, including over 44.000 deaths.

The highest exposure would initially be registered in the cities with high population density and in the cities with intense international circulation of people (where there are airports with increased air traffic). After approximately six weeks, illnesses spread across the country.

Figure 11. The position of epidemics on the risk matrix.



J. Epizootic diseases and zoonosis

Specific context

This risk is represented by mass dissemination of infectious and contagious diseases among animals, some of which are transmitted to humans through direct contact or through the consumption of contaminated animal products (H5N1, bluetongue, etc.). These risks may occur individually or

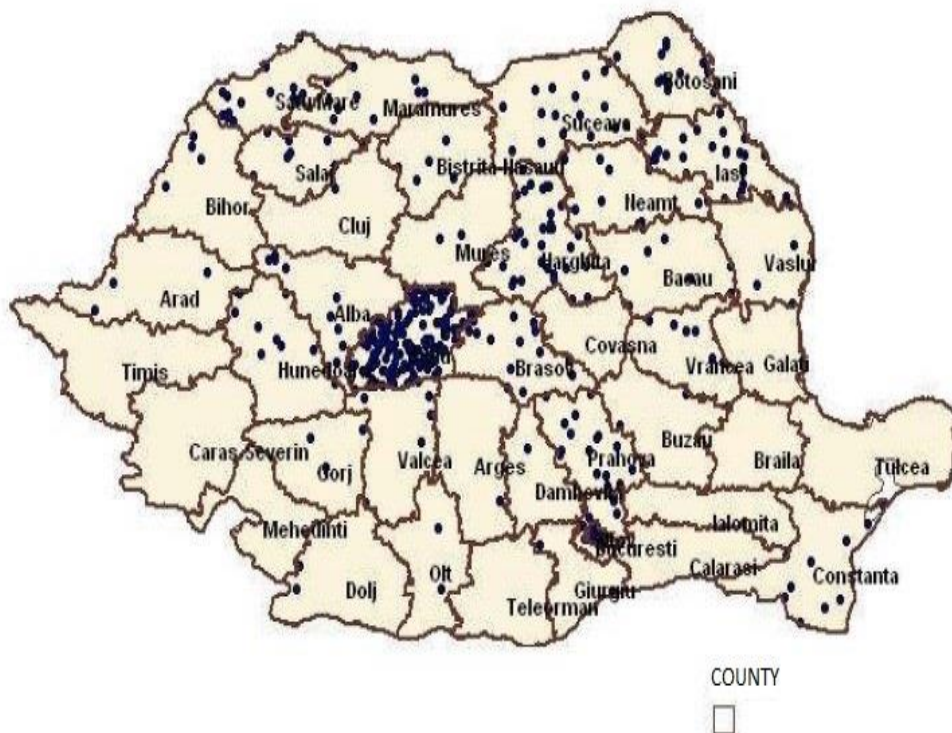
combined, two or more (multi-risk: for example – an earthquake followed by fire); due to this fact, an integrated approach based on multi-risk scenarios of emergency response is needed.

The human – animal – ecosystem interface (HAEI) encompasses all direct and indirect human exposure to animals and animal products and to the various environments and ecosystems we all share. Health threats at this interface include those existing and emerging pathogens transmitted through contact with animals, food, water, and contaminated environments. Examples include:

- Antimicrobial resistance in pathogens;
- Avian influenza H5N1 and H7N9;
- Bovine spongiform encephalopathy and Variant Creutzfeldt-Jacob disease;
- Food-borne E. coli and Salmonella infections
- Middle East respiratory syndrome coronavirus (MERS-CoV)
- Rabies¹⁸.

Map 26. Lyme disease in Romania, 2011. *Source:* ANSVSA.

Counties distribution of cases of Lyme disease, Romania, 2011 (N=429)



Likelihood and Impact

Cases of epizootic diseases and zoonosis occurred in Romania in the last years, with a rather moderate intensity. Lyme is one of the diseases with a rather limited area of impact. As shown in **Map 26**, the number of cases in Romania reached 429, most of them being registered in the central part of Romania. Reported cases of human *trichinellosis* increased by 12% in 2009 (n=748) compared to 2008 (n= 670)¹⁹. The distribution of reported cases was not homogeneous across EU Member States, as the

¹⁸ http://www.who.int/foodsafety/about/flyer_zoonoses.pdf?ua=1

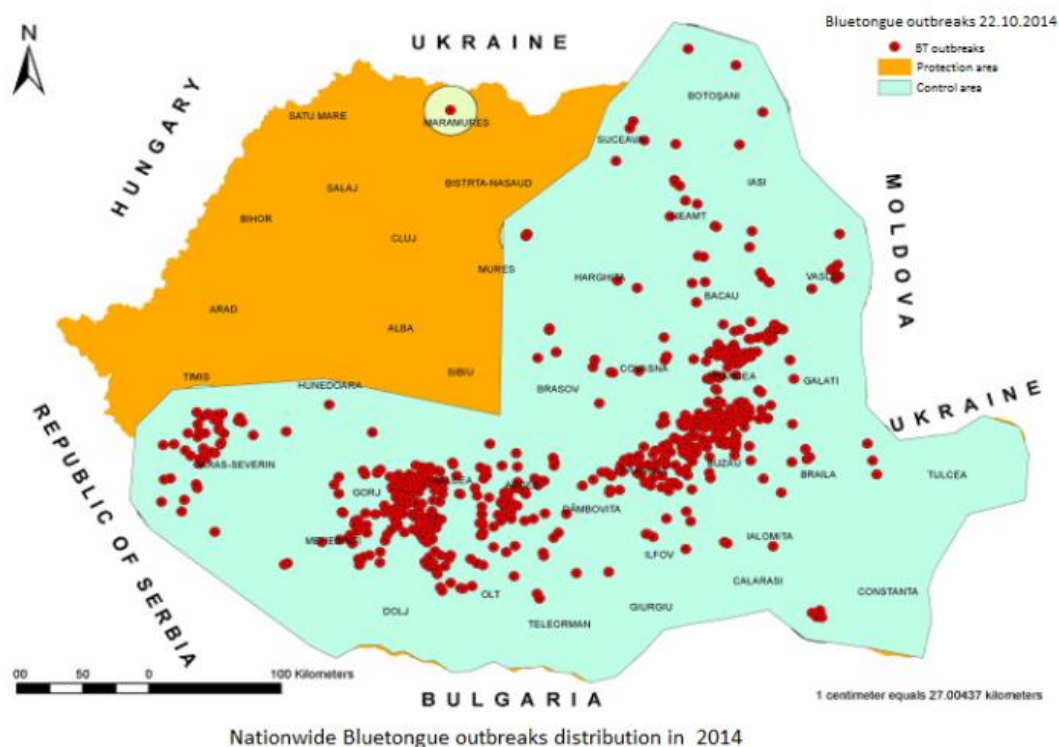
¹⁹ <http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=19832>

majority of cases (94%) was reported by four eastern European countries (Bulgaria, Romania, Poland and Lithuania).

The reason for this large proportion of human cases in these countries may be linked to particular regional habits, such as raising pigs in backyards for private consumption, for which official meat inspection for the presence of *Trichinella* spp. is not carried out.

Bluetongue is an infectious disease, specific to ruminants, with variable clinical severity, characterized by mucosal inflammation, hemorrhage and edema throughout the body (**Map 27**).

Map 27. The distribution of the outbreaks of Bluetongue nationwide in 2014. *Source:* ANSVSA.



A qualitative risk analysis²⁰ on "epizootic threats" for Romania, highlights the following:

- *Bluetongue* represents the greatest threat in the near future;
- *Classical swine* fever will continue to constitute a danger due to at least three factors: (a) Romania is the southeastern border of the European Union, (b) the limited control of populations of feral pigs and (c) pig farming in households lacking biosecurity conditions;
- *African swine fever, foot and mouth disease* and the other *vesicular diseases* continue to pose a major threat to all European countries;
- *Newcastle disease* appears to be the disease that will mark the field of avian pathology in the near future;
- *West Nile* will continue to evolve in Europe.

The increased number of cases of *trichinellosis* in eastern European countries (Bulgaria, Romania, Poland and Lithuania) is of major concern because the disease is easily preventable when appropriate veterinary meat inspection is carried out and preventive measures are taken²¹.

Position on the risk matrix

²⁰ http://www.ansvsa.ro/upload/admin/documente/ANALIZE_DE_RISC_CALITATIV.pdf (2011)

²¹ <http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=19832>

Epizootic diseases and zoonosis are placed on the risk matrix in the „green area”. This is due to the fact that their nationwide impact is low (1 – on the impact axis) and their likelihood is high. According to the assessment developed, in Romania, cases of Epizootic diseases and zoonosis were reported with a rather moderate intensity. Some of the more frequent cases were that of the flu epidemics (AH1N1) and Lyme disease, of human trichinellosis. Other diseases to be taken into consideration are Bluetongue, Classical swine fever, African swine fever, foot and mouth disease, Newcastle or West Nile.

Map 28. The hazard associated to AH1N1 zoonosis incidence (100 years return period)

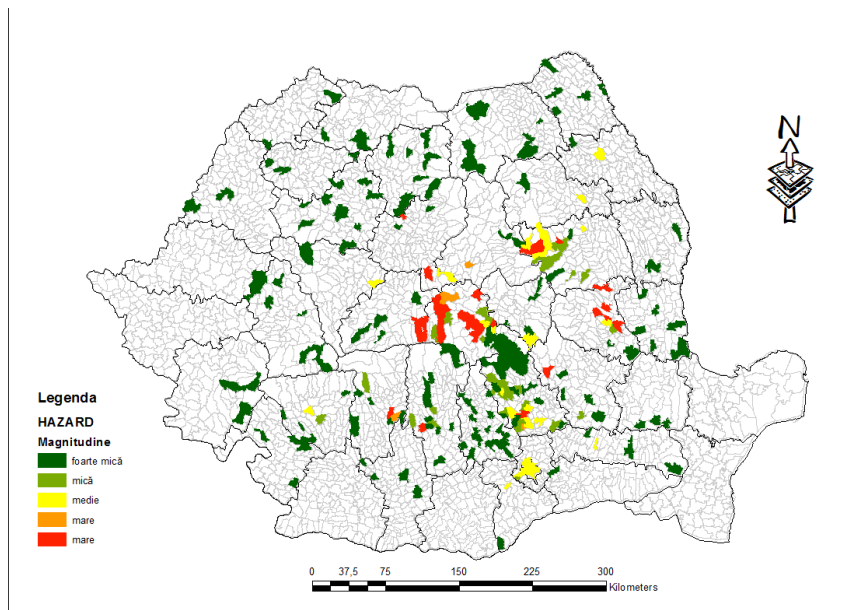
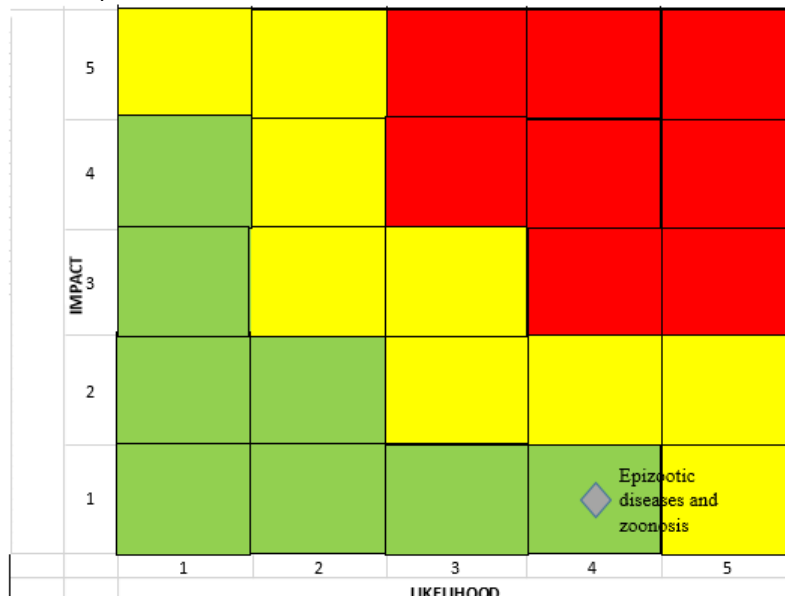


Figure 12. The position of epizootic diseases and zoonosis on the risk matrix.



II.2.4. Risk Matrix

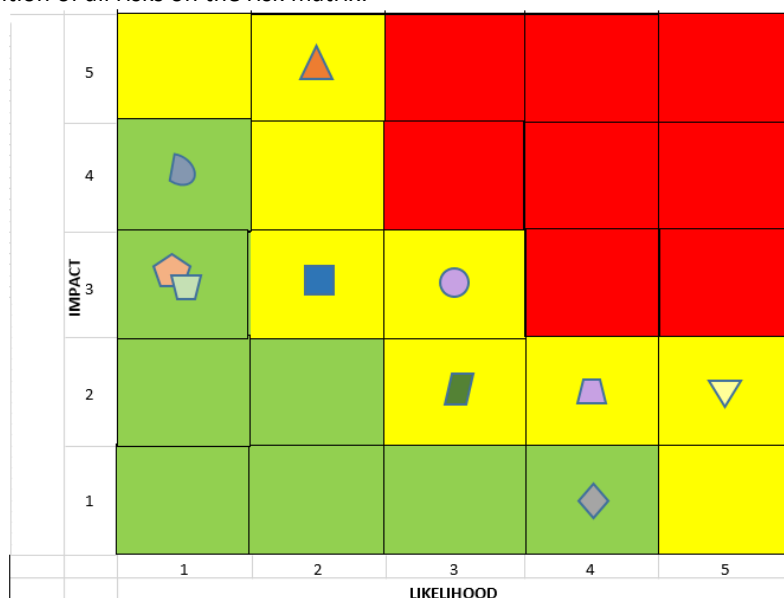
As one can see in **Figure 13.**, according to statistical frequency, historical data and the assessment developed, the risks with the medium to high likelihood to occur in Romania are floods and landslides (3), forest fires, epizootic disease and zoonosis (4) and epidemics (5). Differences in the level of impact place these risks in the “green” and “yellow” area of the matrix. Floods have a level 3 impact, which means a rather medium level. Landslides, forest fire and epidemics register a rather low level of impact (2). With a level 1 on impact axis, epizootic diseases and zoonosis are placed on the “green” area of the matrix.

On the other area of the risk matrix, having a rather medium to high level of impact are risks such as: earthquakes (5), nuclear and radiological accidents (4), Seveso accidents, major accidents involving dangerous substances and drought (3). These risks have various level of likelihood as follows: earthquakes (2) – “yellow” area, nuclear and radiological accidents (1) which places this risk in the “green” area, Seveso accidents and major accidents involving dangerous substances (1) which place these risks in the green area as well. The drought has a level 2 on the likelihood axis which place this risk in the “yellow” area.

The position of each hazard on the risk matrix provide a valuable information for the further prioritization of the action in order to diminish the possible vulnerabilities and to improve the response capacity, as well as prevention capacities in case of occurrence of these risks. The matrix provides a rough estimation and cannot be considered as an infallible national risk assessment in Romania.

Being based on historical data, statistics and estimation of possible impacts, the risk assessment is nevertheless an important step in setting priorities and improving the emergency services in the most important aspects, such as infrastructure, institutional framework and human resources. They are assessed in the following chapter which is mainly focused on possible discrepancies between the status quo of capabilities and the prospected one, in which each of the risks is diminished as far as impact, as well as rate of frequency are concerned.

Figure 13. The position of all risks on the risk matrix.



Legend:

- Floods
- ▱ SEVESO Accidents
- Drought
- ▱ Forest fires
- ▲ Earthquakes
- ▱ Landslides
- ▽ Epidemics
- ▱ Major accidents involving dangerous substances
- ◆ Epizootic diseases and zoonosis
- Nuclear and radiological accidents

III. Needs assessment

The frequencies, diversity and the impact of disasters requires a constant, efficient management and a solid administrative capacity of responsible institutions involved in preventing, analyzing and managing emergency situations. A proper analysis of possible problems and inconsistencies in the management system should focus on the distinction between the level of these capacities and the needs, correlated with the nature of risks and the adequate response in case of the occurrence of a certain hazard.

In order to identify the main vulnerabilities and needs of the emergency management system, one should follow several aspects influencing the quality, number and level of performance of risk management related activities. The types of needs listed below were identified following also the existing action plans, regulation or strategies developed by different institutions with a relevant role in developing risk management related activities²². (see **Annex 1**.) These aspects are the following:

- **Institutional framework** of risk management system – needs related with this topic are referring to various regulations, procedures, laws, government decisions or ordinances, action plans, organizational arrangements, guidelines, budget allocation framework and other regulation specific to risk management activities falling under the responsibility of various institutions;
- **Human resources** – it refers both to needs related with the preparation of population in case of emergency (information, training, raise awareness activities etc.) as well as the quality of human resources involved in various risk management related activities (prevention, preparedness, response and post-event assessment);
- **Infrastructure and logistics** – includes references to various types of investments including constructions aiming at diminishing the impact of various hazards. This also includes the logistics needed for improving the performance of risk management related activities.

These categories of needs were further cross-checked with the main components of risk management. These are the following²³:

- **Prevention** - all the actions carried out by the authorities responsible for identifying, evaluating and mitigate the risks of emergency situations in order to protect life, property and the environment against the adverse effects thereof;

²² The following documents were consulted during the elaboration of this chapter and the following one, containing the road map. For *nuclear accidents*: “National Strategy for Nuclear Safety” <http://www.cncan.ro/assets/Informatii-Publice/Strategii-Planuri-Programe/Strategia-de-securitate-nucleara/HG-Strategie-2014.pdf>, for *floods*: “National Strategy for Risk Management in case of Floods” http://www.mmediu.ro/app/webroot/uploads/files/2012-01-10_risc_inundatii_hg846din2010aprobarenmri.pdf, for *drought*: “National Strategy for Reducing the Effects of Drought, preventing and combating land degradation and desertification in the short, medium and long” http://old.madr.ro/pages/strategie/strategie_antiseceta_update_09.05.2008.pdf, for *floods, drought, landslides* “Romania’s National Strategy on Climate Change 2013 – 2020” http://www.mmediu.ro/beta/wp-content/uploads/2012/10/2012-10-05-Strategia_NR-SC.pdf, for *epidemics, zoonosis*: Government Decision no. 320/2013 on The approval of the “National Intervention Plan to prevent mass illness outbreaks in the general population and pandemics”. http://www.ms.ro/documente/HG%20aprobare%20Plan%20national%20si%20SIEG_768_1514.pdf; for *all types of risks*: Strategy for Consolidation and Development of General Inspectorate for Emergency Situations 2016-2025, <http://www.mai.gov.ro/documente/transparenta/SIGSU%202016-2025%2004%20august.pdf>

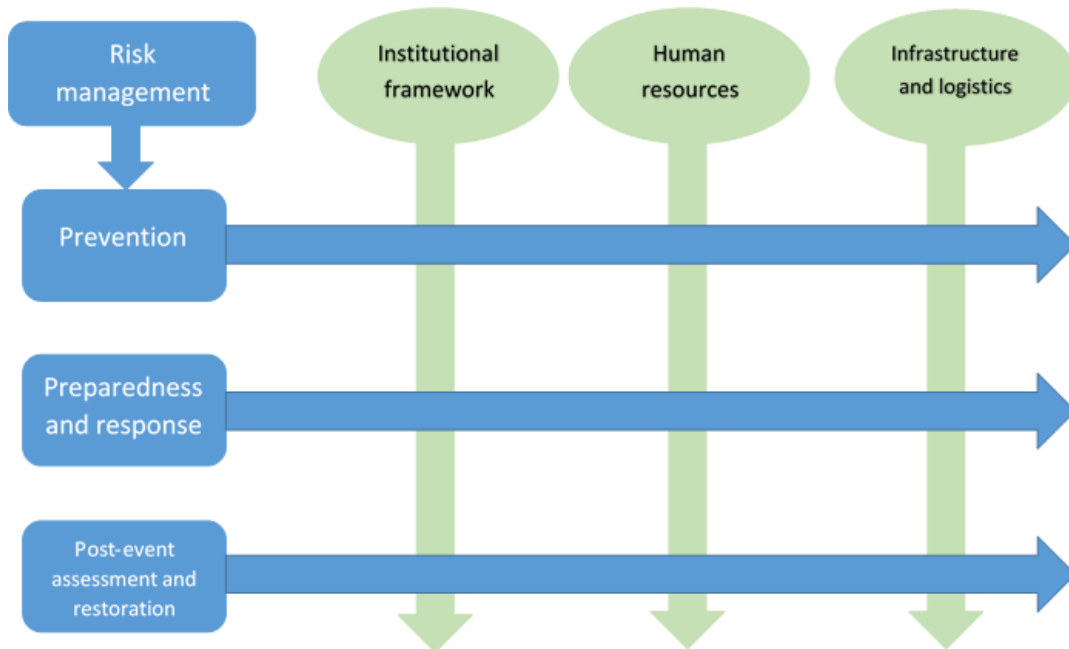
²³ The components of risk management were identified based on the provisions of G.D. no. 557 from 3 August 2016 – referring to risk management. According with this regulation there are several types of activities falling under 4 categories: prevention, preparedness, response, post-event assessment, restoration. These types of activities are covering the process of risk management and are developed under the responsibilities of various institutions from central and local public administrations.

- **Preparedness and response** - all the prior measures and actions, subsumed to the prevention and response activities, permanently carried out by the responsible authorities, as well as the actions carried out by the authorities responsible for planning, organizing, coordinating, and operational directing of the capabilities involved in the operative intervention in order to mitigate and eliminate the negative effects of the emergency situation, until the restoration of the normality provisional status;
- **Post event assessment and restoration** - all the actions carried out by the authorities responsible for identifying and quantifying the effects, causes and circumstances that resulted in an emergency or its associated events, as well as the measures and actions planned, prioritized and carried out further to the investigation/post-event assessment process, in order to restore the normality state.

This chapter explores the possible vulnerabilities and corresponding needs through analyzing the existing data correlated with the aspects listed above. They are organized in three categories: institutional framework, human resources, infrastructure and logistics. Each of these categories is further assessed for each of the main components of the risk management – prevention, preparedness and response and post-event assessment and restoration.

The last component can be associated with prevention, therefore, for the purpose of this report, is considered as being part of it, even though a separate assessment of the possible post-event capabilities could be developed. The reason for such an approach is the cyclical nature of risk management process. The results of the post-event activities have the purpose of reducing the risk of occurrence of a future hazard. For example, consolidation of buildings after an earthquake could be considered as being both a prevention and/or a post-event assessment and restoration type of activity.

Figure 14. Needs assessment matrix



Based on this approach and taking into consideration the information provided by the risk matrix, a synopsis of the most important vulnerabilities and needs is provided. These problems are an input for identification of corresponding measures, as they are further described in the Roadmap.

III.1. Institutional framework

The quality of institutional framework is one of the key aspects in decreasing the level of impact of a certain hazard. There are several needs identified based on the sectoral risk assessments developed, as well as on the existing action plans, strategies or other programmatic documents developed by various institutions at central level of public administration.

On both prevention, preparedness and response sides, the assessment revealed a set of vulnerabilities that were identified as being related with the institutional framework. These were referring to deficits in regulation, guidelines and management issues developed in order to reduce the impact of various hazards. This type of vulnerabilities was identified mainly for the risks placed in “the yellow area” from the risk matrix. These are the following: earthquakes, drought, floods, landslides, forest fires and epidemics. However, measures referring to other risks were also presented.

These measures are envisaging both the GIES’s capacity, as the focal institutions covering the intervention stage of the risk management and the institutions part of the National System of Emergency Situations Management. The corresponding needs were identified based on the implications of the evolution of a very important and relevant indicator, even though is referring to response type of activities: *number of interventions*.

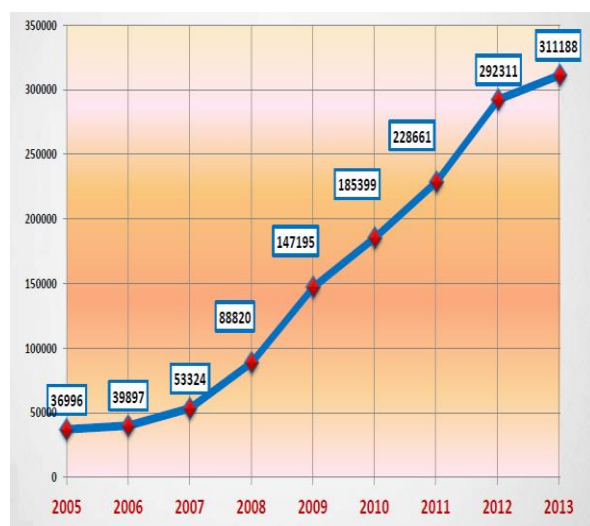
This indicator, mainly related with GIES’s activities, provides useful information which may have an impact on the institutional framework for risk management, as well as human resources or infrastructure and logistics. For this reason, a short overview of its evolution, as well as a comparison with other indicators (e.g. budget allocation), was considered relevant for assessing the efficiency of risk management related activities.

According to **Graph 3.**, the number of interventions has significantly increased from 2005 – 36,996 interventions up to 311,288 in 2013. In a rather short time, the increase in the number of interventions should be correlated to a similar increase in the level of capacity of the relevant institutions.

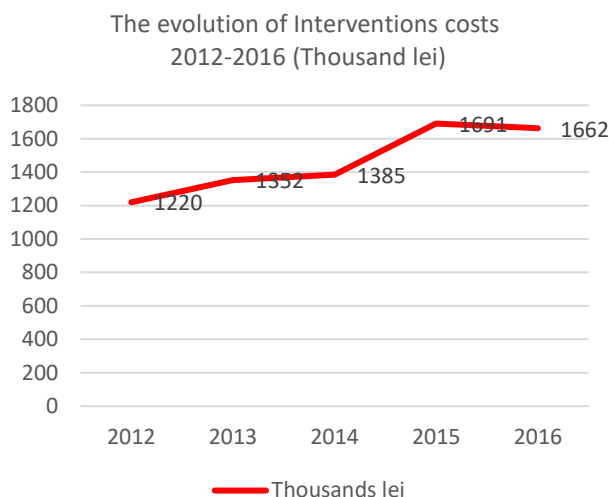
The increasing trend of the number of interventions can also be noticed in the following years. In 2015, 342,161 requests of medical interventions and extrications were made and have been answered, an increase of 11% compared to 2014 and 7312 interventions to assist people, up by 12% compared to the 2014 number of interventions. Summing up, there were up to 965,162 hours allocated to the consumption of human resources.

An increased number of interventions would influence the profile of the management solution able to coordinate the emergency situation at the quality level expected by the citizens. As it is further documented, the higher number of interventions was not constantly followed by initiatives to modify the management framework or to implement a coherent plan for increasing the quality and/or quality of resources allocated (logistics, equipment or human resources).

Graph 3. Increase in the number of interventions 2005-2013. *Source: GIES.*



Graph 4. The Evolution of Funds Allocation for the Purchase of Protective Equipment (thousands lei). *Source: GIES.*



An important element contributing to the quality of the emergency services is indirectly related to the level of fund allocation for purchases or other current activities of the relevant institutions

According to **Graph 4.**, only a slight increase in the allocation of funds for purchasing protective equipment can be noticed (for GIES, as a focal point of risk management related activities). From 1220 thousand lei allocated in 2012, to only 1.662 thousand were allocated in 2016. This evolution indicates a high degree of wear and tear of equipment in service, value which can be correlated to the number of incidents requiring specific equipment.

This situation indicates an overall need for implementation of a performance based budget allocation framework for the resources necessary to support especially the response activities. However, the same type of needs was identified for prevention component in the cases of risks, such as: earthquake, drought, floods, landslides, forest fire and epidemics. The list of needs referring to the institutional framework for risk management related activities is listed below:

Prevention, post event assessment and restoration:

- Lack of systematic periodical updating of the risk management plans (e.g. droughts, floods, epidemics, zoonosis, landslides), taking into account the possible climate change effects as well as other events that may influence risk management capacity;
- Lack of a functional and updated communication system of best practice in management of various types of risks (e.g. droughts, floods, nuclear accidents);
- Lack of priority based approach system in supplying the population and animals with water/prioritizing water supply, restrictions plans during the deficit periods;
- Insufficient developed national monitoring and warning services regarding decreasing debits/drought;
- The insufficient increase of the operational and response capacity, compared to the society's requirements and the citizens' demands;

- Financial debts and the overdue investment process (GIES, but also other relevant institutions involved in the prevention stage of the risk management process);
- Lack of a sound monitoring system developed based on the collaboration of various institutions involved in public health, regarding the early detection of the strains with epidemic potential/pandemic potential and of the outbreaks;
- Unsystematic collaboration with the international organizations within the system of epidemiological surveillance, as well as the early warning and rapid response and participation in the information exchange and within the European Network for the communicable diseases epidemiological surveillance.

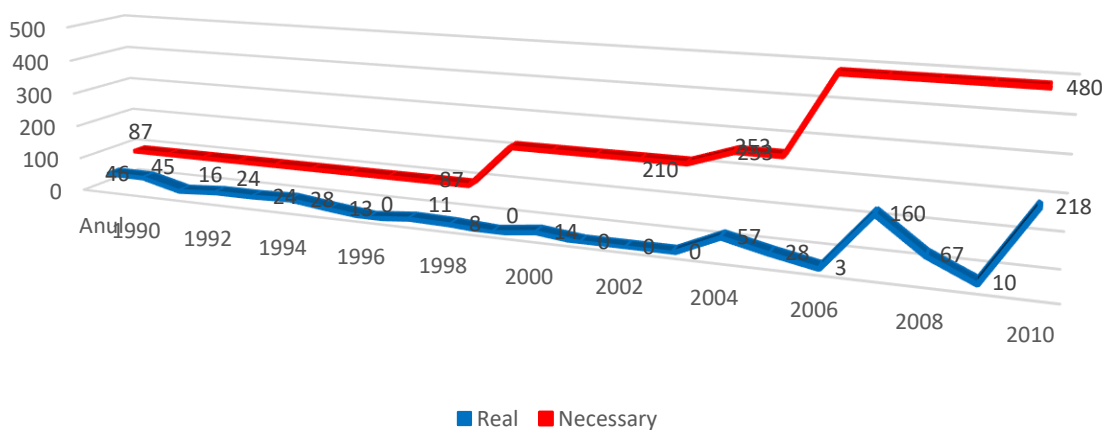
Preparedness and response:

- Insufficient correlation between resource allocation and priorities based on ex-ante impact analysis of various risk management related initiatives;
- Delays in promoting a performance management into the GIES’s operations;
- Insufficient coverage of methodologies, guidelines and of an updating system for identification of drought thresholds and drought mapping, as well as methodologies, guidelines for early detection and characterization of the epidemic/pandemic infectious agents;
- Inconsistency between implementation of research activity results and scientific progress in the field of prevention of communicable diseases;
- The reduced intervention capacity of the Voluntary Services for Emergency Situations.

III.2. Infrastructure & logistics

The response time and the efficiency of the prevention, preparedness and response activities are depending on the quality of the infrastructure and equipment used. Even in cases when apparently, the equipment is sufficient in number, its quality or level of usage could be an important factor in insuring the quality of the emergency service provided.

Graph 5. The needs and procurement dynamics during 1990-2011. *Source:* Socio economic analysis developed at the level of the Consultative Committee for Administration and Governance (2014)



NOTE:

- 2008 - 160 trucks from the Ministry of Health;
- 2009 - 30 intervention vehicles through ROP;
37 ambulances by the Ministry of Health;
- 2010 - 10 intervention vehicles ROP;
- 157 intervention vehicles ROP.
- 2011 - 61 ambulances in 2011 from the Ministry of Health

In spite of a considerable increase in the number of interventions, from a technical point of view, there is still a considerable lack of modern equipment available for providing the expected level of efficiency of emergency services. 40% of vehicles still have more than 10 years in service - 20% have between 5-10 years and only 60% are under 5 years.

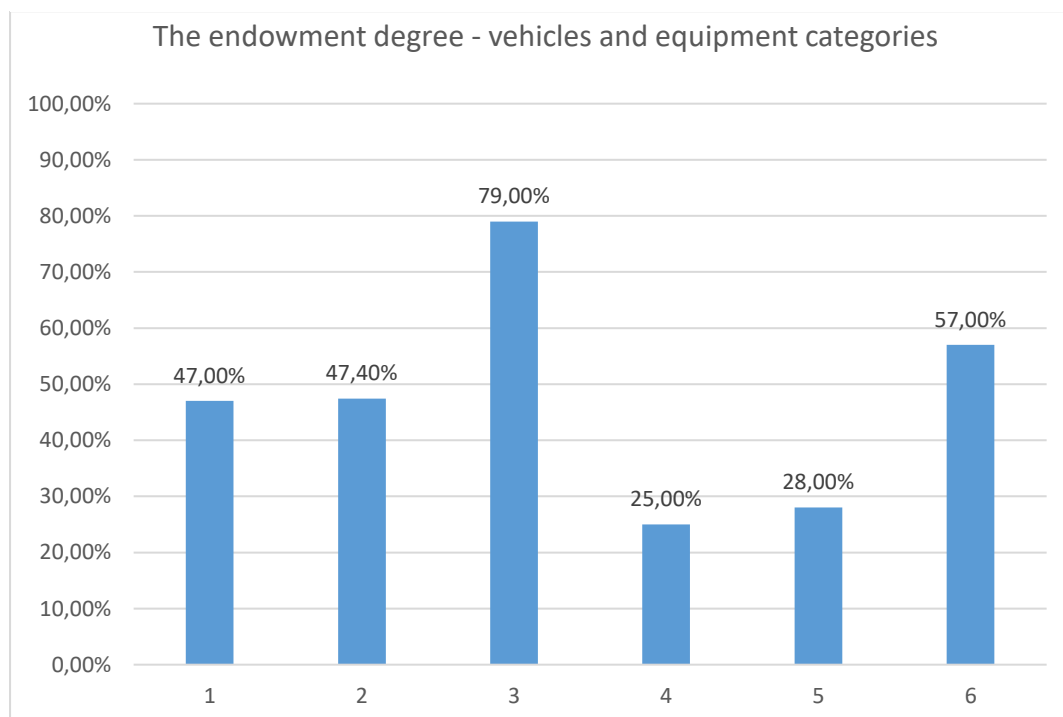
Relevant information is provided in **Graph 5.**, where a comparison between the real and necessary equipment is presented. As one can notice, there is a considerable gap between the necessities of GIES and the actual allocation of funds for procurement. Even with a slight increase in 2010, the difference between what the procurement needs are for a proper response and the actual allocation of funds, budget adjustments are needed in order to close the gap.

The length of service of the fire-fighting special vehicles is as follows: 50% have between 0 – 10 years of service, 10% between 10 – 20 years, 20% have between 20 – 30 years of service and 20% have more than 30 years of service. As regarding the MESREE ambulances, 60% have between 0 – 5 years of service and 40% have 5 – 10 years.

The endowment level for special intervention vehicles goes up to 60% and 55% of those for firefighting have exceeded the normal use at least twice. The engineer special vehicles length of service is: 78% have between 0 – 10 years in service, 14.53% have between 10 – 20 years, 5% 20 – 30 years in service and 5% have more than 30 years of service. As regarding the CBRN special vehicles, 72% have between 0 – 10 years in service, 2% have 10 – 20 years, 25% have between 20 – 30 years and 1% have more than 30 years of service.

At GIES's level, as a leading provider of public protection in emergency situations, the annual rate of fleet completion and refresh, as about 82% of the means of land transportation are over 10 years old, and only about 17% of the fire trucks have up to five years in service (due to the fire trucks purchased through the Regional Operation Programme 2007-2013) (**Graph 6.**).

Graph 6: The endowment degree – means and equipment. *Source:* GIES.



LEGEND:

- 1. Auto, naval, air, petrol and other liquid equipment/vehicles;
- 2. Equipment for communication, informatics and notice-alarm;

3. Equipment for fire prevention and fighting fire;
4. Engineering equipment, mines, explosives and specific technical means;
5. Nuclear, biological and chemical protection equipment;
6. Equipment and installations for diagnosis, investigation and treatments.

The infrastructure having a significant impact on the prevention, preparedness and response activities face a similar situation in case of most of the risks assessed. There is a lack of proper systematization of investments in infrastructure for various types of risks. A prioritization of these investments is necessary in case of drought or floods (e.g. developing plans for efficient use of resources for investments) but also earthquakes (consolidation of buildings in urban areas close to the epicenter), epidemics or zoonosis (proper equipment and prevention related infrastructure) etc.

The prioritization of investments in infrastructure and logistics (e.g. equipment) is closely related with the elements of a performance based approach to activities corresponding with various stages of the risk management (prevention and preparedness response).

Prevention:

- Lack of a strategic approach in developing saving measures and efficient use of water: irrigation, industry;
- Lack of strategic approach in selection of flood protection work (e.g. to be done locally, rather than extensive, large infrastructure);
- A cost-effective approach in identification of proper investments in infrastructure for prevention of floods, drought, landslides, earthquakes, epidemics, zoonosis, SEVESO accidents, nuclear accidents, forest fires;
- Insufficiently developed monitoring and diagnosis and early warning network (epidemics, zoonosis);
- Insufficient infrastructure developed in order to prevent mass illness generated by epidemics and pandemics;
- Insufficient infrastructure for implementation of the pre-pandemic phases preventive measures;
- Lack of prioritization and proper methods and techniques for the rehabilitation/construction of dams and the execution of protection work in conjunction with urban construction territorial plans;
- A high level of leaks in the water distribution networks.

Preparedness and response:

- Obsolete equipment for response;
- Lack of facilities and of an appropriate training enabling an effective response to the following types of risk missions: earthquakes, floods, CBRN accidents (chemical, biological, radiological, nuclear), situations requiring emergency intervention in an integrated system in territorial waters (fire, search and rescue, etc.);
- The low degree of endowment with prevention and firefighting accessories and extinguishing substances;
- GIES headquarters is presenting high seismic risk;
- Insufficient and old intervention technology.
- Lack of proper infrastructure for fast production of a pandemic vaccine;
- Lack of proper preparation of therapeutic and prophylactic biological products in case of an epidemic or pandemic;
- Insufficient infrastructure for rapid response in case of microbiological emergency situations;
- Lack of capacity of local authorities with responsibilities in the management of emergency situations caused by various types of risks (floods, droughts, etc.);
- Improper infrastructure for ensuring the water quality during the drought.

III.3. Human resources

Last but not least, one of the most important elements contributing to an effective risk management system is the quality and level of preparedness of human resources in case a risk occurs. In this chapter, we are referring to human resources as being represented both by the personnel of various response and prevention responsible institutions from central and local level of public administration and, in general, to the people exposed to various risks. The needs identified accordingly are referring, on one hand, to the capacity level in terms of quality and number of specialized personnel of the public institution and, on the other hand, to the level of preparedness of general public in case of emergency (prevention and response).

For example, from the point of view of the response institutional capacity, according to the last report of activities (2015)²⁴ there is an acute problem of aging of human resources in GIES.

In 2013 the level of Human Resources was 97%, which translates into 27,884 positions filled. In 2006 42,636 employees went through a process of professionalization. During 2010 – 2011, 3,595 positions were removed, and in 2011, 2,273 were dismissed as a result of a reorganization process. During 2011 – 2013 there were 378 system departures.

In 2015 the level of employment in GIES was around 95.5% with 28,441 positions and 27,162 occupied positions. Compared to the beginning of 2015 there is a decrease of the level of human resources by 70 persons.

In addition to the decreasing number of human resources, another situation looks like it will become a problem in the following years: aging of the existing personnel, judging on the number of new entries in the system in the last years (an average of 100/year). At the end of 2015, over 24% of the operational personnel was aged between 30 and 34 years old and over 25% between 35 and 39 years old. If the same path will be followed in the following years, 10 years from now on, GIES will face a real human resource problem. In this period, 61% of the personnel will be over 45 years, and only 15% will be less than 39 years old.

Taking these aspects into consideration, the problems regarding the quality and the number of human resources involved in risk management related activities are the following:

Prevention:

- Lack of human resources management strategy developed in order to increase the capacity of risk management related activities;
- The need for new skills emergency situations developed;
- Insufficient or lack of skills, training tailored to the institution's specific multidisciplinary;
- Poor human resource management and recruitment policies;

Preparedness and response:

- Improvement of the specialized personnel training in order to implement actions under the National Intervention Plan for Human Resources;
- Decreased level of public awareness and preparedness regarding the response in case of emergency.

²⁴ http://www.igsu.ro/documente/informare_publica/evaluari/Evaluare-IGSU-2015.pdf

IV. Roadmap

This chapter summarizes the main aspects which have to be taken in consideration in order to increase the level of risk management performance. The measures were identified based on information taken from several sources. The main sources are the results of the research developed in the sectoral risk assessments. Other important and relevant sources are the strategies, action plans and other relevant programmatic documents available at the level of central public administration institutions with responsibilities regarding risk management related activities. A list of documents consulted is presented in the Annex 1 of this report.

The Road map is organized following the most relevant types of needs as they were identified in a previous chapter. For each category of needs a set of measures is identified and associated with the needs of GIES, as the focal point of the risk management system and the institutions members of the National System of Emergency Situations Management. In both cases, the measures are referring to corresponding institutional objectives:

- **Institutional framework** - measures in this category are referring to development or improving existing regulations, guidelines, legislation or other type of rules (ordinances, decisions etc.) related to risk management;
- **Infrastructure and logistics** – measures in this category are referring to improvement of existing or investments in new infrastructure in a prioritized and evidence-based manner. The objective corresponding to this category of measures envisage both prevention, preparedness and response stages of the risk management;
- **Human resources** – measures in this category envisages initiatives referring to both improvement of the quality of human resources from institutions involved in risk management activities and those referring to level of preparedness of people in case of emergency situation.

IV.1. Improving the institutional framework for risk management

One of the main **general objectives** assumed in the Roadmap is **the improvement of the institutional framework for risk management**. This is highly important for risk management because it provides the general conditions for activities to be developed at the level of responsible institutions related to prevention, as well as preparedness and response. As already mentioned in a previous chapter, initiatives in these areas have been already undertaken and the new institutional framework allows for an increased flexibility and operability in delivering emergency services by public authorities, in collaboration with other relevant institutions from the central and local administration.

The measures listed below have as common feature the reference to modification or initiation of a new regulation, guideline, rule, legislation, strategy or specific public policy which has an impact on the performance of risk management related activities. These measures were organized according with the objectives envisaged as a response to the needs identified in the previous chapter and follows the main components of the risk management process: prevention, preparedness and response, as well as post-event assessment and restoration. According with these objectives a set of indicative measures are presented for **General Inspectorate for Emergency Situations** and the other institutions

member of the **National System of Emergency Situations Management**. These measures can be updated periodically.

The **specific objectives** regarding the improvement of institutional framework are the following:

- Improvement of the legislation in the risk management area (prevention, preparedness and response);
- Development of a strategic approach in allocation of resources, following an evidence-based decision making process in improving the prevention, preparedness and response capacities;
- Improving the communication system for early warning in case of emergency;
- Improving the soft legislation tools in order to increase the efficiency of risk management related activities;
- Increase the capacity of integrated response in medical emergencies, fire and civil protection.

Indicative Measures:

General Inspectorate for Emergency Situations:

- Reducing the financial debts and the overdue investment process (response institution – GIES, but also other relevant institutions involved in the prevention stage of the risk management process);
- Multiplying the actions for public information and preparedness of population and economic environment for action in case of disasters;
- Improvement of the primary, secondary and tertiary legislation in the fields of firefighting and civil protection;
- Compliance and enforcement by citizens, institutions and the private sector of legal requirements in the field;
- Updating the approval and authorization procedures by eliminating unnecessary links;
- Improving the correlation between resource allocation and priorities based on ex-ante impact analysis of various risk management related initiatives;
- Promoting a performance management into the GIES's operations;

National System of Emergency Situations Management institutions:

- Development of a periodical updating system of the risk management plans (e.g. droughts, floods, epidemics, zoonosis, landslides), taking into account the possible climate change effects as well as other events that may influence risk management capacity;
- Operationalizing National Platform for Disaster Risk Reduction in order to develop strategies for risk reduction;
- Updating the communication system of best practice in management of various types of risks (e.g. droughts, floods, drought);
- Introduction of a priority based approach system in supplying the population and animals with water/prioritizing water supply, restrictions plans during the deficit periods;
- Improvement of national monitoring and warning services regarding decreasing debits/drought;
- Developing a monitoring system based on the collaboration of various institutions involved in public health, regarding the early detection of the strains with epidemic potential/pandemic potential and of the outbreaks;
- Improving the legal framework in order to run efficiently the annual program for reducing the seismic risk to multi-store buildings which are vulnerable to earthquakes;
- Promoting a national program for building houses for temporary relocation of people during consolidation works;
- Improving the collaboration with the international organizations within the system of epidemiological surveillance, as well as the early warning and rapid response and participation

in the information exchange and within the European Network for the communicable diseases epidemiological surveillance;

- Improving of monitoring and diagnosis and early warning network (e.g. epidemics, zoonosis).
- Improving and development of methodologies, guidelines and of an updating system for identification of drought thresholds and drought mapping, as well as methodologies, guidelines for early detection and characterization of the epidemic/pandemic infectious agents;
- Improving the system of implementation of research activity results and scientific progress in the field of prevention of communicable diseases;

IV.2. Strengthen and develop the infrastructure and logistics for prevention, operational and response capacity

An important number of needs identified in the previous chapter, based on the risk assessment results, indicates a rather poor infrastructure for prevention, as well as a rather insufficient operational and response capacity (logistics) of the public institutions and authorities dealing with risk management related activities. The objectives and indicative measures identified for this general objective envisage an increased quality and efficiency in providing these activities.

Specific Objectives:

- Improving the infrastructure for better capacity of preparedness and response to risks (especially those placed in “the yellow area” of the risk matrix) in order to increase the efficiency of risk management related activities;
- Increasing the quality of logistics for operational and response capacity, compared to the society’s requirements and the citizens’ demands (all risks, especially those in “the yellow area”).

Indicative measures:

General Inspectorate for Emergency Situations:

- Development of the strategy for endowment and supplies for response actions;
- Implementing a strategic approach in selection of flood protection work (e.g. to be done locally, rather than extensive, large infrastructure);
- Updating the equipment for response (all risks, especially those in “the yellow area”);
- Improving the degree of endowment with prevention and firefighting accessories and extinguishing substances;
- Improving the infrastructure for rapid response in case of microbiological emergency situations;
- Improving the equipment and technical means, material assets and protective equipment adapted for all categories of mission;

National System of Emergency Situations Management institutions:

- Implementing a strategic approach in developing saving measures and efficient use of water: irrigation, industry;
- Identification, based on a cost-effective approach, of proper investments in infrastructure for prevention of all risks (especially those in “the yellow area”);
- Improving the infrastructure developed in order to prevent mass illness generated by epidemics and pandemics;
- Expanding the real estate, improvement of working conditions, upgrading existing facilities and renovation of the buildings with a high seismic risk;

- Improving the infrastructure for implementation of the pre-pandemic phases preventive measures;
- Implementation of priority based approach and proper methods and techniques for the rehabilitation/construction of dams and the execution of protection work in conjunction with urban construction territorial plans;
- Restoration of water distribution networks.
- Improving the infrastructure for fast production of a pandemic vaccine;
- Improving the infrastructure for preparation of therapeutic and prophylactic biological products in case of an epidemic or pandemic;
- Increasing the capacity of local authorities with responsibilities in the management of emergency situations caused by various types of risks (all risks, especially those in “the yellow area”);
- Improving the infrastructure for ensuring the water quality during the drought;

IV.3. Improving the quality of human resources involved in risk management related activities and the level of preparedness of population.

Improving the quality of human resources, as well as the level of preparedness of population in case of emergency represents one of the most important component of the Roadmap. According to the needs assessment presented above, this objective would focus on developing better training for human resources from the institutions involved in risk management related activities, but also on the level of awareness among population regarding a proper reaction in case of emergency.

Specific Objectives:

- Increasing the quality and frequency of specialized training activities for personnel involved in risk management related activities (from all institutions involved in risk management related activities);
- Increasing the level of awareness among population regarding proper response in case of emergency situation.

Indicative measures:

General Inspectorate for Emergency Situations:

- Developing new skills for emergency situations prevention and response activities;
- Development of multidisciplinary training tailored to the attributions of the institutions regarding the risk management related activities;
- Improving the personnel policy for recruitment, selection, training and ensuring a consistent and predictable career development;
- Strengthening and adapting the system of initial and continuous professional training to international standards;
- Promotion and application of the performance based management framework for personnel involved in risk management related activities;
- Developing communication and public information;
- Decreasing the human resource deficit compared to the allocated positions from the organizational chart (less than 5% for each category) and correct the imbalance in the age structure of the staff (GIES);
- Improving of training and specialization, based on competences (continuous and upgraded training system);
- Improving the performance communication and public information (communications and information technology system upgraded in line with developments in the field);

- ISO 9001 and Common Assessment Framework implemented at GIES and the subordinated units level;
- Increasing volunteer participation in the GIES intervention teams;
- Improving the quality and frequency of training and education activities for the population in the emergency situations field.

National System of Emergency Situations Management institutions:

- Developing an integrated training strategy (for personnel from all institutions involved in risk management related activities) based on human resources management strategies;
- Improving the facilities and of an appropriate training enabling an effective response to the following types of risk missions: earthquakes, floods, CBRN accidents (chemical, biological, radiological, nuclear), situations requiring emergency intervention in an integrated system in territorial waters (e.g. fire, search and rescue, etc.);
- Develop NTCIQMES (National Training Center for Increasing the Quality of the Management of Emergency Situations) and regional training centers as well as develop new ones, depending on the needs and performance of training;
- Development of the specialized personnel training in order to implement actions under the National Intervention Plan for Human Resources;
- Providing training for the institutions and public and local public administration decision – makers regarding the responsibilities, how to act in emergency situations and optimizing the capacity self-protection;
- Increase the preparedness of public emergency services and the intervention capacity of the Voluntary Services for Emergency Situations;
- Improve the voluntary and private emergency staff by providing training and personnel assessment, as well as endorsement of the expertise sector, equipment and related logistic base;
- The introduction of new technological elements for detecting and signaling fires in every public and private building.

Bibliography:

National Administration „Romanian Waters” Management Plan (2016). Available at:

<http://www.rowater.ro/dadobrogea/SCAR/Planul%20de%20management.aspx>, accessed on 19 Sept. 2016;

The National Authority for Sanitary, Veterinary and Food Safety (2011), Qualitative risk analysis in terms of major animal diseases. Available at:

http://www.ansvsa.ro/upload/admin/documente/ANALIZE_DE_RISC_CALITATIV.pdf, accessed on 19 Sept. 2016;

Chiriac, D., Geicu, A., Humă, C. and Bleahu, A. (2005), Socio-economic effects of the drought on the quality of life of human communities in Romania,

<http://www.revistacalitateavietii.ro/2005/CV-3-4-05/8.pdf> CALITATEA VIETII, XVI, nr.3–4, 2005, p. 313–331;

Commission Staff Working Paper Risk Assessment and Mapping Guidelines for Disaster Management (2010). Available at:

http://ec.europa.eu/echo/files/about/COMM_PDF_SEC_2010_1626_F_staff_working_document_en.pdf accessed on 19 Sept. 2016;

Emergency Ordinance no. 1/2014 on certain measures in the area of emergency management and amending and supplementing Government Emergency Ordinance no. 21/2004 on the National Management System for Emergency Situations;

Eurosurveillance (2011) Zoonoses in the European Union: Origin, Distribution and Dynamics - the EFSA-ECDC Summary Report 2009. Available at: <http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=19832>, accessed on 19 Sept. 2016;

General Inspectorate of Emergency Situations (2014) Institutional Strategic Plan of the Ministry of Internal Affairs, http://www.igsu.ro/documente/informare_publica/Programe-strategii/PSI_2014-2016_anexa_OMAI_159din2014.pdf, accessed on 19 Sept. 2016;

Government Decision no. 94/2014 on the organization, functioning and composition on the National Committee for Special Emergency Situations;

Government Decision no. 121/ 2014 on the organization, functioning and composition on the National Committee for Weatherproof and Calamity. The coordination is at the National Committee for Weatherproof and Calamity;

Government Decision no. 2288/2004 on the approval of distribution of main support functions ensured by ministries, other central organizations and NGOs on emergency situations prevention and management;

Government Decision no. 762/2008 on the approval of National Strategy of Prevention of Emergency Situations;

National Intervention Plan to prevent mass illness outbreaks in the general population and pandemics, Government Decision no.320/2013, http://www.ms.ro/documente/HG%20aprobare%20Plan%20national%20si%20SIEG_768_1514.pdf;

National Safety and Security Strategy of the Netherlands (2009);

National Strategy for Nuclear Safety, <http://www.cncan.ro/assets/Informatii-Publice/Strategii-Planuri-Programe/Strategia-de-securitate-nucleara/HG-Strategie-2014.pdf>;

National Strategy for Risk Management in case of Floods, http://www.mmediu.ro/app/webroot/uploads/files/2012-01-10_risc_inundatii_hg846din2010aprobarenmri.pdf;

National Strategy for Reducing the Effects of Drought, preventing and combating land degradation and desertification in the short, medium and long, http://old.madr.ro/pages/strategie/strategie_antiseceata_update_09.05.2008.pdf;

ROMPLUS catalogues. Available at: <http://www1.infp.ro/catalog-seismic>, accessed on 19 Sept. 2016;

SEVESO risk, What to do in case of an industrial accident? Available at: <http://www.seveso.be/seveso-risk>, accessed on 19 Sept. 2016;

Romania's National Strategy on Climate Change 2013 – 2020. Available at: http://www.mmediu.ro/beta/wp-content/uploads/2012/10/2012-10-05-Strategia_NR-SC.pdf, accessed on 19 Sept. 2016;

Strategy for Consolidation and Development of General Inspectorate for Emergency Situations 2016-2025, <http://www.mai.gov.ro/documente/transparenta/SIGSU%202016-2025%2004%20august.pdf>;

Studies and Communications (2010) Magazine sponsored by Romanian Committee for History and Philosophy of Science and Technology, under the aegis of the Romanian Academy;

The United Nations Office for Disaster Risk Reduction (2009) Terminology. Available at: <https://www.unisdr.org/we/inform/terminology#letter-r>, accessed on 19 Sept. 2016;

Vacareanu, R.; Sercaianu, M.; Ionescu, C. and Pavel, F. (2016) Investigation of the variability of strong ground motions from Vrancea earthquakes;

World Health Organization, Managing zoonotic public health risks at the human–animal–ecosystem interface. Available at: http://www.who.int/foodsafety/about/flyer_zoonoses.pdf?ua=1, accessed on 19 Sept. 2016;

Annex 1. List of normative acts, strategies and action plans referring to risk management and emergency situation services

- Law no. 307 from 12th July 2006 on fire protection, as amended and supplemented;
- Law no. 481 from 8th November 2014, on civil protection, republished;
- Emergency Ordinance no. 21 from 15th April 2004 on the National System of Emergency Situations Management (SNMSU), as amended and supplemented;
- Emergency Ordinance no. 88 from 30th August 2001 on the establishment, organization and functioning of public services for emergency situations;
- Government Decision no. 94 from 12th February 2014 on the organization, functioning and composition of the National Committee for Special Emergency Situations.
- Government Decision no. 1490 from 9th September 2014 on the approval of GIES's Regulation on organization and functioning and the organizational chart, as amended and supplemented;
- Government Decision no. 2288/2004 on the approval of distribution of main support functions ensured by ministries, other central organizations and NGOs on emergency situations prevention and management;
- Government Decision no. 1492 from 9th September 2004 on the Approval of the principles of organization, functioning and attributions of the professional emergency services;

Annex 2. List of institutions involved in the consultation and research phases

- ABN research;
- Ministry of Regional Development and Public Administration;
- Ministry of Environment and Climate Change;
- Department of Waters, Forests and Fishery, Ministry of Agriculture and Rural Development;
- Ministry of Health;
- Ministry of Economy;
- Ministry of Transport;
- The National Veterinary Sanitary and Food Safety;
- National Commission for Nuclear Activities Control;
- National Institute of Hydrology and Water Management;
- National Agency for Land Development;
- The National Administration (of) "Romanian Waters";
- The Directorate General National Anti-Hail and Increasing Rainfall System;
- General Inspectorate for Emergency Situations representatives;
- The National Meteorological Administration;
- Ministry of Energy.

Annex 3. List of institutions, partners of GIES involved in elaboration of sectoral risk assessments

- Nuclear and Radioactive Waste Agency;
- The National Sanitary Veterinary and Food Safety Authority;
- Institute for Economic Forecasting;
- Institute of Geography of the Romanian Academy;
- The Institute of Sociology;
- National Institute of Research and Development for Physics of the Earth;
- National Institute of Research and Development Urban Planning and Sustainable Territorial Development "URBAN INCERC";
- National Institute of Research and Development in Forestry "Marin Dracea";
- National Institute of Research and Development in Pedology, Agrochemistry and the Environment – ICPA Bucharest;
- National Institute of Public Health;
- Ministry of Environment and Climate Change;
- Babeş-Bolyai University;
- Technical University of Civil Engineering of Bucharest.

Annex 4. Types of impact, Criteria and impact thresholds

C1.1. Deceased (Number of people)	<10	10-50	51-100	101-1.000	> 1.000	
C1.2. Injured people (Number of medical records)	<50	50-250	251-500	501- 5,000	> 5000	
C1.3. Evacuated people (Number of individual entries in shelters * number of days)	<100	>100-1,000	>1.000-10,000	>10,000-20.000	> 20,000	
C1.4. People with no access to basic services (Number of people * number of days)	<500	500-1,000	1,001-10,000	10,001-500,000	> 500,000	
C1.5. Civil and industrial constructions	Affected constructions (%)	<0.01	0.01 – 0.05	0.06 – 0.5	0.6 – 1.5	> 1.5
	Destroyed constructions (%)	<0.01	0.01 – 0.05	0.06 – 0.5	0.6 – 1.5	> 1.5
C1.6. Transport infrastructure (%)	< 0.01	0.01 - 0.1	0.1 - 0.5	0.5 - 2	> 2	
C1.7. Utilities (%)	< 0.01	0.01 - 0.05	0.05 - 0.3	0.3 - 1.3	> 1.3	
C1.8. Means of intervention (No of machinery, equipment)	< 580	581 - 750	751 - 1080	1081 - 1250	> 1250	
C1.9. Affected area (Sq. km.)	Local (<30)	Regional (30-300)	Provincial (301-3,000)	National (>3,000)	-	
C1.10. Environment (the protected area affected) (Ha* Number of days)	≤ 1,000	100 - 400	400 – 1,000	1,000 – 10,000	≥ 10,000	

C2.1. Costs associated with human loss (deceased/ injured/ evacuated/ people with no access to basic services) (EURO)	<5 mil	5 - 50 mil	51 - 250 mil	251 mil- 1 mld	> 1 mld
C2.2. Cost associated to direct material loss (EURO)	<10 mil.	10-100 mil	101-500 mil	501 mil- 2 BN	> 2 BN
C2.3. Cost associated to environmental loss (EURO)	<5 mil.	5-50 mil	51-250 mil	251 mil- 1 mld	>1 mld
C2.4. Cost of the intervention of task forces	<100.000	100.001 – 1 mil.	1 mil. – 10 mil.	10 mil. – 100 mil.	> 100 mil.
C2.5. Indirect costs (EURO)	<20 mil	20-200 mil	101-1 mil	1 mil- 4 mld	>4 mld
C3.1. Disruption to everyday life (Units = no. of people with no access * no. of services * no. of days with no access)	<10,000	10,001 – 100,000	100,001-1 mil	1-5 mil	> 5 mil
C3.2. Psychological impact (Index of psychological impact on society - IP) – a detailed description of the calculation algorithm of this indicator can be further consulted in the methodology for risk assessment.	Very low	Low	Medium	High	Very high

Annex 5. Needs and objectives matrix

	<p style="text-align: center;"><u>Objectives and indicative measures</u></p> <p><u>Vulnerability /needs</u></p>	<p>GO1. Improving the institutional framework for risk management</p>	<p>GO2. Strengthen and develop the infrastructure and logistics for prevention, operational and response capacity</p>	<p>GO3. Improving the quality of human resources involved in risk management related activities and the level of preparedness of population.</p>
<p style="text-align: center;"><u>Institutional framework</u></p>	<p><u>Prevention</u> (post-assessment and restoration):</p> <ul style="list-style-type: none"> - Lack of a strategic approach in developing saving measures and efficient use of water: irrigation, industry; - Insufficient water storage capacity; - Lack of strategic approach in selection of flood protection work (e.g. to be done locally, rather than extensive, large infrastructure); - A cost-effective approach in identification of proper investments in infrastructure for prevention of floods, drought, landslides, earthquakes, epidemics, zoonosis, SEVESO accidents, nuclear accidents, forest fires; - Insufficiently developed monitoring and diagnosis and early warning network (epidemics, zoonosis); - Insufficient infrastructure developed in order to prevent mass illness generated by epidemics and pandemics; - Insufficient infrastructure for implementation of the pre-pandemic phases preventive measures; - Lack of prioritization and proper methods and techniques for the rehabilitation/construction of dams and the execution of protection work in conjunction with urban construction territorial plans; - A high level of leaks in the water distribution networks. <p><u>Preparedness and response:</u></p> <ul style="list-style-type: none"> - Insufficient correlation between resource allocation and priorities based on ex-ante impact analysis of various risk management related initiatives; - Delays in promoting a performance management into the GIES's operations; - Insufficient methodologies, guidelines and of an updating system for identification of drought thresholds and 	<p><u>General Inspectorate for Emergency Situations:</u></p> <ul style="list-style-type: none"> - Reducing the financial debts and the overdue investment process (response institution – GIES, but also other relevant institutions involved in the prevention stage of the risk management process); - Multiplying the actions for public information and preparedness of population and economic environment for action in case of disasters; - Improvement of the primary, secondary and tertiary legislation in the fields of firefighting and civil protection; - Compliance and enforcement by citizens, institutions and the private sector of legal requirements in the field; - Updating the approval and authorization procedures by eliminating unnecessary links; - Improving the correlation between resource allocation and priorities based on ex-ante impact analysis of various 	<p><u>General Inspectorate for Emergency Situations:</u></p> <ul style="list-style-type: none"> - Development of the strategy for endowment and supplies for response actions; - Implementing a strategic approach in selection of flood protection work (e.g. to be done locally, rather than extensive, large infrastructure); - Updating the equipment for response (all risks, especially those in “the yellow area”); - Improving the degree of endowment with prevention and firefighting accessories and extinguishing substances; - Improving the infrastructure for rapid response in case of microbiological emergency situations; - Improving the equipment and technical means, material assets and protective equipment adapted for all categories of mission; <p><u>National System of Emergency Situations Management institutions:</u></p> <ul style="list-style-type: none"> - Implementing a strategic approach in developing saving measures and efficient use of water: irrigation, industry; 	<p><u>General Inspectorate for Emergency Situations:</u></p> <ul style="list-style-type: none"> - Developing new skills for emergency situations prevention and response activities; - Development of multidisciplinary training tailored to the attributions of the institutions regarding the risk management related activities; - Improving the personnel policy for recruitment, selection, training and ensuring a consistent and predictable career development; - Strengthening and adapting the system of initial and continuous professional training to international standards; - Promotion and application of the performance based management framework for personnel involved in risk management related activities; - Developing communication and public information; - Decreasing the human resource deficit compared to the allocated positions from the organizational chart (less than 5% for each category) and correct the imbalance in the age structure of the staff (GIES); - Improving of training and specialization, based on competences (continuous and upgraded training system);

	<p>drought mapping, as well as methodologies, guidelines for early detection and characterization of the epidemic/pandemic infectious agents;</p> <ul style="list-style-type: none"> - Underdeveloped system of implementation of research activity results and scientific progress in the field of prevention of communicable diseases; - The reduced intervention capacity of the Voluntary Services for Emergency Situations. 	<p>risk management related initiatives;</p> <ul style="list-style-type: none"> - Promoting a performance management into the GIES's operations; <p><u>National System of Emergency Situations Management institutions:</u></p> <ul style="list-style-type: none"> - Development of a periodical updating system of the risk management plans (e.g. droughts, floods, epidemics, zoonosis, landslides), taking into account the possible climate change effects as well as other events that may influence risk management capacity; - Operationalizing National Platform for Disaster Risk Reduction in order to develop strategies for risk reduction; - Updating the communication system of best practice in management of various types of risks (e.g. droughts, floods, drought); 	<ul style="list-style-type: none"> - Identification, based on a cost-effective approach, of proper investments in infrastructure for prevention of all risks (especially those in "the yellow area"); - Improving the infrastructure developed in order to prevent mass illness generated by epidemics and pandemics; - Expanding the real estate, improvement of working conditions, upgrading existing facilities and renovation of the buildings with a high seismic risk; - Improving the infrastructure for implementation of the pre-pandemic phases preventive measures; - Implementation of priority based approach and proper methods and techniques for the rehabilitation/construction of dams and the execution of protection work in conjunction with urban construction territorial plans; - Restoration of water distribution networks. - Improving the infrastructure for fast production of a pandemic vaccine; - Improving the infrastructure for preparation of therapeutic and 	<ul style="list-style-type: none"> - Improving the performance communication and public information (communications and information technology system upgraded in line with developments in the field); - ISO 9001 and Common Assessment Framework implemented at GIES and the subordinated units level; - Increasing volunteer participation in the GIES intervention teams. - Improving the quality and frequency of training and education activities for the population in the emergency situations field. <p><u>National System of Emergency Situations Management institutions:</u></p> <ul style="list-style-type: none"> - Developing an integrated training strategy (for personnel from all institutions involved in risk management related activities) based on human resources management strategies; - Improving the facilities and of an appropriate training enabling an effective response to the following types of risk missions: earthquakes, floods, CBRN accidents (chemical,
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<p><u>Infrastructure and logistics</u></p>	<p><u>Prevention</u> (post event assessment and restoration):</p> <ul style="list-style-type: none"> - Lack of a strategic approach in developing saving measures and efficient use of water: irrigation, industry; - Insufficient water storage capacity; - Lack of strategic approach in selection of flood protection work (e.g. to be done locally, rather than extensive, large infrastructure); - A cost-effective approach in identification of proper investments in infrastructure for prevention of floods, drought, landslides, earthquakes, epidemics, zoonosis, SEVESO accidents, nuclear accidents, forest fires; - Insufficiently developed monitoring and diagnosis and early warning network (epidemics, zoonosis); - Insufficient infrastructure developed in order to prevent mass illness generated by epidemics and pandemics; - Insufficient infrastructure for implementation of the pre-pandemic phases preventive measures; - Lack of prioritization and proper methods and techniques for the rehabilitation/construction of dams and the execution of protection work in conjunction with urban construction territorial plans; - A high level of leaks in the water distribution networks. <p>- <u>Preparedness and response:</u></p> <ul style="list-style-type: none"> - Obsolete equipment for response; - Lack of facilities and of an appropriate training enabling an effective response to the following types of risk missions: earthquakes, floods, CBRN accidents (chemical, biological, radiological, nuclear), situations requiring emergency intervention in an integrated system in territorial waters (fire, search and rescue, etc.); - The low degree of endowment with prevention and firefighting accessories and extinguishing substances; - GIES headquarters is presenting high seismic risk; - Insufficient and old intervention technology. - Lack of proper infrastructure for fast production of a pandemic vaccine; 	<ul style="list-style-type: none"> - Introduction of a priority based approach system in supplying the population and animals with water/prioritizing water supply, restrictions plans during the deficit periods; - Improvement of national monitoring and warning services regarding decreasing debits/drought; - Developing a monitoring system based on the collaboration of various institutions involved in public health, regarding the early detection of the strains with epidemic potential/pandemic potential and of the outbreaks; - Improving the legal framework in order to run efficiently the annual program for reducing the seismic risk to multi-store buildings which are vulnerable to earthquakes; - Promoting a national program for building houses for temporary relocation of people during consolidation works; - Improving the collaboration with the international organizations within the system of epidemiological surveillance, as well as the early warning and rapid response and participation in the information exchange and within the European Network for the communicable diseases epidemiological surveillance; - Improving of monitoring and diagnosis and early warning 	<p>prophylactic biological products in case of an epidemic or pandemic;</p> <ul style="list-style-type: none"> - Increasing the capacity of local authorities with responsibilities in the management of emergency situations caused by various types of risks (all risks, especially those in “the yellow area”); - Improving the infrastructure for ensuring the water quality during the drought. 	<p>biological, radiological, nuclear), situations requiring emergency intervention in an integrated system in territorial waters (e.g. fire, search and rescue, etc.);</p> <ul style="list-style-type: none"> - Develop CNPPMSU (National Training Center for Increasing the Quality of the Management of Emergency Situations) and regional training centers as well as develop new ones, depending on the needs and performance of training. - Development of the specialized personnel training in order to implement actions under the National Intervention Plan for Human Resources; - Providing training for the institutions and public and local public administration decision – makers regarding the responsibilities, how to act in emergency situations and optimizing the capacity self-protection; - Increase the preparedness of public emergency services and the intervention capacity of the Voluntary Services for Emergency Situations. - Improve the voluntary and private emergency staff by providing training and personnel assessment, as well as endorsement of the expertise sector, equipment and related logistic base; - The introduction of new technological elements for detecting and signaling fires in every public and private building.
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<p><u>Human resources</u></p>	<p><u>Prevention</u> (post event assessment and restoration):</p> <ul style="list-style-type: none"> - Lack of human resources management strategy developed in order to increase the capacity of risk management related activities; - The need for new skills emergency situations developed; - Insufficient or lack of skills, training tailored to the institution's specific multidisciplinary; - Poor human resource management and recruitment policies; <p><u>Preparedness and response:</u></p> <ul style="list-style-type: none"> - Improvement of the specialized personnel training in order to implement actions under the National Intervention Plan for Human Resources; - Decreased level of public awareness and preparedness regarding the response in case of emergency. 			